Bridge Project Development Manual

Texas Department of Transportation

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Manual Notice 2016-1

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Manual: Bridge Project Development Manual

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Purpose

This manual provides guidance and outlines uniform procedures and policies for administering and developing projects involving bridges.

Contents

This revision constitutes a complete rewrite of the manual. The overall language was refined and condensed for clarification and better flow. Specific manual information still remains to help the user locate the correct manual for further information. All duplicate information in this manual was removed so as not to conflict with the Office of Primary Responsibilities' manuals.

The following sections have been specifically modified to reflect changes in TxDOT's organizational structure and to reflect updates to The Bridge Division Project Development Section's policies, practices, and procedures:

- Chapter 1 – Organizational Overview
  - Section 1 – "This Manual" updated the overviews in Chapters 5 and 6.
  - Section 2 – "Coordinating with Other Divisions and Sections" updated organizational information.
- Chapter 2 -- Bridge Programming and Funding
  - Section 1 – "Bridge Division's Role" was updated with the federal definition of a bridge from the Highway Bridge Program section; the new transportation bill FAST Act, and information regarding the UTP's Category 6 funding and its subprograms.
  - Section 2 – "Category 6 Funding" is a new section containing general information about the UTP's Category 6 Structure Replacement and Rehabilitation funding such as: eligibility, programming, and change orders. Definitions from the Highway Bridge Program section were moved to this section if they were more general to the overall funding UTP category. Information was provided about Category 6 Developmental Authority.
  - Section 3 – "Highway Bridge Program" was condensed and cleaned up to clearly illustrate the program's eligibility, programming, and prioritization methods. Table 2-1 was added to elaborate on the funding program's annual selection process. Information was added to

the off-system HBP project section pertaining to the Participation Waived/Equivalent-Match Project Program.

- Section 4 – “Bridge Maintenance and Improvement Program” is a new section containing specific information about the funding program’s eligibility, prioritization and programming. Table 2-2 was included to elaborate on the funding program’s annual selection process.
- Section 5 – “Railroad Grade Separation Program” was condensed and streamlined to clearly illustrate the specific program's eligibility, programming, and prioritization methods. The railroad underpass project attribute weights were revised for the priority rating score. Table 2-3 was included to elaborate on the funding program’s annual selection process. The railroad agreement process for Exhibit A and B was further developed.
- Section 6 – “Rail Replacement Program” is a new section containing specific information about the funding program’s eligibility, prioritization and programming. Table 2-4 was included to elaborate on the funding program’s annual selection process.

◆ Chapter 3 -- Preliminary Design Features

- Section 1 – “General Features” was updated with: the revised information about span lengths, new bridge railing, bridge beginnings and ends, excavation protection requirements, and staged construction procedures; the clarifications on horizontal alignments, sidewalks, bike paths, and illuminations; the complete rewrite of the design exceptions process to remove any non-bridge related design exceptions; the new preferred corrosion protection systems; and the removal of out-of-date detailed bridge joint information.
- Section 2 – “Features Based on Bridge Location” was revised with minor clarifications in the following subsections: highway grade separation, structures over streams, railroad overpasses and underpasses, and pedestrian bridges.

◆ Chapter 4 -- Advanced Planning

- Section 1 – “General Considerations” was updated with clarifications to the subsections: New Bridges, and Modifications of Existing Structures, specifically removing extraneous language about condition surveys and stage construction. Further information was provided in detour/temporary crossing structures and economic comparisons and alternate designs subsections. Major revisions and clarifications were provided in the environmental concerns subsection pertaining to lead-based paint and asbestos.
- Section 2 – “Considerations Based on Bridge Location” was revised with minor clarifications in the following subsections: Highway Grade Separations, Structures over Streams, Highway-Railroad Grade Separations, Federally Funded Off-system Bridges, and Interchanges. Table 4-1 was updated with the two off-system bridges spanning Texas and Oklahoma. This subsection, bridges with adjacent states, was rewritten to include the required procedures for their project development from the formation of the agreement to post construction.

- Section 3 – “Agreements and Permits” has minor clarifications to the subsections: U.S. Army Corps of Engineers, Environmental Protection Agency, Railroad, and Local Government Agencies.
- Section 4 – “Utility Attachments” is revised to state that the Bridge Division is the Office of Primary Responsibility for all bridge utility attachments. All agreements will be stored in the Bridge Inspection Database. Information about temporary/saltwater pipelines was added to this section. The subsection concerning USGS gauging stations was rewritten to include the required procedures for developing and executing a USGS agreement.

◆ Chapter 5 – Bridge Plan Review Processes

- Section 1 – “Preliminary Bridge Layout Review” was updated with revisions and clarifications to how PBLRs are submitted and the required submittal documentation for Bridge Division, federal, and railroad project review.
- Section 2 – “Bridge PS&E Review” was rewritten to explain the Department’s new policy on Bridge Division’s role in the PS&E review process.
- Section 3 – “Bridge Cost Information Review” is a new section pertaining to the Department’s federal requirement to provide the average unit cost data for all bridge class structures. Information provided assists the Districts with obtaining and entering the correct data for the Bridge Division’s annual unit cost calculations.

◆ Chapter 6 – Bridge Project Development Reference Information

- Section 1 – “Bridge Project Development Submission Schedules” provides Table 6-1 for information about a typical bridge project’s schedule to assist with timely project development. Table 6-2 is a specific submission schedule for geotechnical work.
- Section 2 – “Requests for Development of Bridge and Geotechnical Work” was revised to add specific information needed for bridge and geotechnical design detail requests.
- Section 3 – “Other Relevant Information” provides a description of the National Bridge Inventory number and the P3B screen in Design Construction Information System (DCIS).

Contact

For more information about any portion of this manual, please contact the TxDOT Bridge Division.

Archives

Past manual notices are available in a pdf archive.

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Chapter 1 — Organizational Overview

Contents:

Section 1 — This Manual

Section 2 — Coordinating with Other Divisions and Sections

Section 1 — This Manual

Overview

This manual was developed to provide bridge project developers and designers with the policies and guidelines set forth by the Texas Department of Transportation (TxDOT) regarding the following:

- bridge programming and funding
- preliminary planning of bridge structures
- preparation and review of bridge layouts
- preparation and review of plans, specifications, and estimates (PS&E) for bridge projects

This manual is subject to revision as conditions, experience, or research data warrant.

Table 1-1: Manual Revision History

Version	Publication Date	Summary of Changes
2001-1	October 2001	New manual; replaced Bridge Division's *Operations and Procedures Manual*.
2002-1	April 2002	Revision clarifying information on curbs, adding information on overhead sign supports, correcting minor errors, and adding hyperlinks to recently published TxDOT online manuals.
2003-1	June 2003	Revision updating terminology related to Unified Transportation Program (UTP) categories, clarifying approach-roadway eligibility requirements for HBRRP, expanding structure design criteria to include Load Resistance Factor Design (LRFD) recommendations, expanding and clarifying preliminary layout requirements, and correcting minor editorial errors.
2005-1	January 2005	Revision updating departmental organization information and correcting minor editorial errors.
2006-1	February 2006	Revision changing the name of the federally funded Highway Bridge Replacement and Rehabilitation Program to Highway Bridge Program, adding information on load and resistance factor design (LRFD), updating a procedure for appraising an existing structure, and adding an index to the manual.
2007-1	July 2007	Revision updating departmental organization information in Chapter 1. Revising Chapter 3 to include the membership of the Roadway Design Exception Committee, the Bridge Design Exception Committee and a joint subcommittee, the Roadway/Bridge Design Exception Committee. Updating Chapter 4 to include the mandate by the Federal Highway Administration that Load Resistance Factor Design be used on all bridges for which preliminary engineering is initiated after October 2007. Correcting errors in the Chapter 5, Section 4 table on submission schedules and also correcting other minor editorial errors.

Table 1-1: Manual Revision History

Version	Publication Date	Summary of Changes
2008-1	April 2008	Revision deleting references to the TxDOT Bridge Design Manual and inserting references to Load Resistance Factor Design bridge design.
2012-1	October 2012	Revision updating departmental organization information in Chapter 1. Revising Highway Bridge Program selection process in Chapter 2. Revising bicycle and pedestrian policy, as well as updating the design exception process in Chapter 3. Updating policies on required condition surveys for bridge rehabilitations, asbestos abatement and state funded historic bridge projects in Chapter 4. Revising bridge layout submission requirements in Chapter 5. Revising PS & E submissions to include the Bridge Cost Information screen requirements for DCIS in Chapter 6. Correcting other minor editorial errors throughout.
2016-1	September 2016	Chapter 1: Updated departmental organization information. Chapter 2: Added new Category 6 section and new BMIP and RRP funding program sections; revised HBP and RGS program prioritizations; added annual program funding timetables for Calls. Chapter 3: Updated the design exception process and added references to other manuals. Chapter 4: Updated policies on required condition surveys for bridge rehabilitations, asbestos abatement, state-funded historic bridge projects, and agreement processes. Chapter 5: Completely updated the Plan Review process. Chapter 6: Revised the submission schedule for bridge projects and added the geotechnical submission schedule; added design request information including pertinent forms; moved and added reference information for general bridge project development. General: Corrected minor editorial errors throughout the manual.

The manual is not a substitute for engineering experience, knowledge, or judgment. Special situations may call for variation from these policy requirements.

Manual Organization

The manual is organized to reflect the chronology of a bridge project from bridge funding to PS&E:

- Chapter 1 identifies departmental organizations that may be involved in bridge project development.
- Chapter 2 presents bridge programming and funding policies, focusing on the factors involved with the funding and prioritizing, or programming, of bridge projects.
- Chapter 3 identifies basic considerations during advanced planning of bridge projects, including general and location specific planning considerations.
- Chapter 4 presents preliminary design features required during early design development for general practice and location-specific requirements to aid planners/designers in preparing an appropriate preliminary design.
- Chapter 5 describes bridge plan review processes.

- Chapter 6 provides reference material, timelines, and submittal information for bridge project development.

Feedback

You may direct any questions or comments on the content of this manual to the Director of the Bridge Division, Texas Department of Transportation.

Section 2 — Coordinating with Other Divisions and Sections

Overview

The development and design of a bridge project may involve several divisions within TxDOT:

- Bridge Division (BRG)
- Contracts and Purchasing Division (CPD)
- Construction Division (CST)
- Design Division (DES)
- Environmental Affairs Division (ENV)
- Financial Management Division (FIN)
- Maintenance Division (MNT)
- Professional Engineering Procurement Services Division (PEPS)
- Right of Way Division (ROW)
- Traffic Operations Division (TRF)
- Transportation Planning and Programming Division (TPP)

Bridge Division(BRG)

The Bridge Division provides in-house expertise and assistance to the districts, divisions, and offices in all aspects of structural project development, design, construction, maintenance, and inspection. The division is involved in research, value engineering studies, partnering with contractors, and general support to TxDOT districts and other divisions. The division assists the districts with the implementation of innovative methods and materials to reduce the impact of construction on the public, improve long-term performance and durability, and develop aesthetically attractive structures.

Bridges are the most visible elements of the transportation system, and they create an emotional impact on the user. The Bridge Division develops aesthetically appropriate bridges as requested by the districts, creating custom designs that consider site, local architecture, span length, structural safety, durability, and maintenance on a case-by-case basis.

The Bridge Division manages the Unified Transportation Program (UTP) Category 6 funds. These funds are divided into three subcategories: the Bridge Maintenance and Improvement Program (includes the Rail Replacement Program), the Highway Bridge Program, and the Railroad Grade Separation Program. The Bridge Division uses these funds to facilitate maintenance and safety improvements to the State's on-system bridges, and rehabilitation and/or replacement of structur-

ally deficient or functionally obsolete bridges on public highways, roads, and streets both on and off the state system; and to replace highway-railroad at-grade intersections with a new grade-separation structure, or replace deficient existing highway-railroad underpasses. The division achieves this by making optimal use of federal, state, and local funding; and by helping local governments create a safer roadway system by reducing the number of deficient bridges.

The Bridge Division also reduces design and construction time and cost by standardizing bridge elements and by using standard design drawings for bridge construction where possible. These standard drawings are available to the public, including cities and counties, and can be accessed from the Bridge Division page of the TxDOT website.

Historic bridges are also a priority for the Bridge Division. The division works with the districts, the Texas Historical Commission (THC), the Federal Highway Administration (FHWA), the Environmental Affairs Division (ENV), and local entities to preserve this valuable heritage.

The division strongly supports and is represented on many state, national, and international engineering organizations including the American Association of State Highway and Transportation Officials (AASHTO), National Cooperative Highway Research Program (NCHRP), Transportation Research Board (TRB), American Concrete Institute (ACI), American Society of Civil Engineers (ASCE), Prestressed Concrete Institute (PCI), American Segmental Bridge Institute (ASBI), American Railway Engineers and Maintenance of Way Association (AREMA), National Steel Bridge Alliance (NSBA), Highway Innovative Technology Evaluation Center (HITEC), American Welding Society (AWS), and American Institute of Steel Construction (AISC).

The Bridge Division is composed of four sections: Project Development, Field Operations, Design, and Administration.

Project Development Section

- Serves as the primary contact with the district on all bridge project development issues.
- Determines critical bridge replacement and rehabilitation needs.
- Programs work based on funding and eligibility.
- Administers the Highway Bridge Program.
- Administers the Railroad Grade Separation Program.
- Administers the Bridge Maintenance and Improvement Program and its subset, the Rail Replacement Program.
- Performs preliminary planning of structures.
- Determines average bridge cost.
- Coordinates plans, specifications, and estimates (PS&E); bridge plan preparation; and review of final PS&E.

- Coordinates federal discretionary bridge applications.
- Negotiates and drafts various types of agreements.
- Manages design work by the statewide indefinite deliverable bridge design consultant pool.
- Maintains the Historic Bridge Manual.
- Maintains the Bridge Project Development Manual.
- Provides content for the Bridge Division's internal and external Project Development web pages.

Field Operations Section

- Inspects bridges during construction.
- Inspects bridges after construction.
- Consults with districts on bridge construction/maintenance problems.
- Reviews PS&E for construction-related issues.
- Performs bridge load rating and condition surveys prior to widening or rehabilitation.
- Inspects structures damaged by impact, flood, fire, or failures and makes remediation recommendations.
- Designs emergency shoring to prevent collapse of a damaged structure.
- Reviews form, falsework, and erection plans.
- Reviews structural field welding and bolted splice construction.
- Instructs maintenance forces in welding practices.
- Certifies field welders for structural welding.
- Coordinates and makes recommendations on change orders involving bridge items.
- Develops, reviews, and maintains the standard construction specifications and special provisions.
- Acts as a liaison with the Construction Division's Materials and Pavements Section, Maintenance Division, and Federal Highway Administration.
- Provides inspection and training for post-tensioning operations.
- Reviews shop drawings.
- Conducts structural reviews for fabrication issues.
- Prepares designs and details or checks designs submitted for structural foundations and retaining walls.
- Designs geotechnical structures.
- Oversees geotechnical construction and maintenance support operations.

- Performs subsurface soil exploration.
- Collects, analyzes, and reports bridge data.
- Prioritizes the selection of the Bridge Maintenance and Improvement Program projects.
- Manages contracts for inspection, field investigation, and remedial design work by consultants.

Design Section

- Reviews preliminary bridge layouts.
- Consults with bridge project managers in the preliminary phase to determine the proper bridge type.
- Prepares designs and details for all types of bridges and culverts used on the highway system.
- Prepares designs and sketches for widening, repairing, and reconstructing bridges for detailing by the districts.
- Assists the districts by reviewing and monitoring consultant bridge designs.
- Manages design work by the statewide indefinite deliverable bridge design consultant pool.
- Studies major bridges for best and most economical construction.
- Recommends to the Construction Division and the Maintenance Division needed repairs for damaged structures.
- Reviews PS&E for bridge design issues.
- Prepares designs for historic, railroad, and unique structures.
- Issues all bridge standard drawings and maintains up-to-date electronic standard drawing sheets.
- Prepares designs and details or checks alternate designs submitted for sign support structures, light poles, traffic signal supports, and other traffic structures.
- Provides technical oversight of computer-aided design and drafting (CADD) software needs.
- Reviews large proposed overloads on bridges.
- Provides expertise on bridge rail technology.

Administration Section

- Administers personnel activities including those related to payroll, benefits, training, records management, service awards, leave accounting, and classification.
- Coordinates and monitors the division's budget, travel requests, equipment inventory, records retention, legislation, and public information requests concerning bridges.
- Supports information resource users with equipment, software, and automation services.

- Maintains the division web pages and provides editorial support.
- Coordinates technical training.
- Coordinates with the Texas Transportation Commission and TxDOT administration.
- Coordinates and maintains all manuals concerning bridges.

Construction Division (CST), Materials and Pavements Section

The Bridge Division coordinates with CST's Materials and Pavements Section when reviewing material selections and analyzing the materials of an existing structure.

- Provides assistance in the development and review of structural material specifications.
- Analyzes concrete core and powder samples taken from bridge components for chloride content for condition survey purposes.
- Provides mill test reports to the Field Operations Section for load rating analysis.
- Analyzes paint samples from existing bridges to determine lead content so that appropriate general notes and special provisions can be included in the PS&E for bridge rehabilitation projects.

Contracts and Purchasing Division

The Bridge Division's Project Development Section coordinates with the Contract Services Office in the development and review of Advanced Funding Agreements/Amendments for bridge projects.

Design Division (DES)

The Design Division guides development of all highway projects through preliminary engineering stages on interstate, state, rural, and urban highway systems.

The Field Sections of the Design Division:

- Act as the receiving point for PS&E from the districts.
- Coordinate with the Bridge Division's Project Development Section and the districts during the preliminary and planning stages.
- Ensure proper documentation is provided with PS&E.
- Identify and resolve discrepancies and make necessary changes to PS&E.

The Hydraulics Branch of the Design Division:

- Provides hydrologic and hydraulic review and consultation for environmental issues and drainage complaint resolution and litigation.

- Prepares and checks designs submitted for hydrologic and hydraulic studies.

The Plan Development Section of the Design Division:

- Provides roadway design and full PS&E development for district projects.
- Coordinates with the Bridge Division's Project Development Section and the districts when developing PS&E for a bridge project.

Environmental Affairs Division (ENV)

The Bridge Division's Project Development Section and districts coordinate with ENV to ensure all bridge projects comply with applicable federal, state, and local environmental laws. ENV acts as consultant to the districts, offering expertise on likely impacts caused by a bridge project and required considerations and permits. Projects that require involvement from the Environmental Division include:

- Projects that must comply with applicable federal, state, and local environmental laws
- Work over navigable waters
- Dredge-and-fill operations
- Lead-based paint removal
- Asbestos removal

For additional information, refer to the Environmental Management System Manual and the Hazardous Materials in Project Development Manual. For assistance accessing the Environmental Management System Manual, which is internal to TxDOT, please contact the District office with which you are working or the Bridge Division project manager.

The Bridge Division's Project Development Section coordinates with the Environmental Affairs Division's Cultural Resources Section. The coordination includes but is not limited to ensuring historic bridge projects comply with applicable federal, state, and local environmental laws. For more information, see the Historic Bridge Manual.

Financial Management Division (FIN)

The Bridge Division's Project Development Section coordinates with the Financial Management Division's Letting Management Section. The coordination includes, but is not limited to, the development and monitoring of the 12-month and two-year letting schedules as they pertain to the projects using the Category 6 funds, as well as the submission of Federal Project Authorization Agreements (FPAA).

Maintenance Division (MNT), Maintenance Operations Section

Routine maintenance by the districts often uncovers problems such as deterioration, cracking, warping, and accidental damage due to vehicle collision. These problems are relayed through the Maintenance Division -- Maintenance Operations Section to the Bridge Division's Project Development Section, or directly to the Project Development Section from the District. The severity of the problem dictates whether the Field Operations Section will perform an inspection or condition survey.

MNT is the Office of Primary Responsibility (OPR) when there is an emergency with an existing bridge or a bridge under construction. BRG can provide inspections for structures damaged by vehicular impact, flood, fire, or failures and make remediation recommendations. MNT will help coordinate the State and/or Federal funding and any necessary contracts for the bridge repair or replacement for emergency projects.

Traffic Operations Division (TRF)

The Traffic Operations Division's Rail Safety Section (TRF-RSS) responsibilities, as they pertain to bridge projects, include the following:

- Coordinates with the railroad company and the bridge project managers during the bridge project.
- Prepares railroad agreements for highway-railroad grade separations.
- Reviews project plans involving highway-railroad grade separations.

The Bridge Division's Project Development Section coordinates with Traffic Operations Division's Rail Safety Section to obtain information and data on highway-railroad grade crossings in order to identify and prioritize projects for the Railroad Grade Separation Program discussed in Chapter 2.

Transportation Planning and Programming Division (TPP)

The Bridge Division's Project Development Section coordinates with the Transportation Planning and Programming (TPP) Division's Statewide Planning and Program Management Section and Traffic Analysis Section. The coordination includes, but is not limited to, providing and/or verifying Category 6 projects and project rankings for the UTP as needed by TPP's Statewide Planning and Program Management Section and obtaining the average daily traffic (ADT) data reported by the TPP's Traffic Analysis Section.

Chapter 2 — Bridge Programming and Funding

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Section 2 — Category 6 Funding

Section 3 — Highway Bridge Program

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Section 5 — Railroad Grade Separation Program

Section 6 — Rail Replacement Program

Section 1 — Bridge Division's Role

Overview

Bridge work administered by Texas Department of Transportation (TxDOT) includes projects for construction of new bridges and replacement, rehabilitation, repair, and maintenance of existing bridges on the public highways, roads, and streets.

TxDOT operates under the definition of "bridge" as provided in Title 23, Code of Federal Regulations (CFR), Section 650.403(a). The CFR definition of a bridge is:

> ... a structure including supports erected over a depression or an obstruction, such as water, high-way or railway, and having a track or passageway for carrying traffic or other moving loads, and having an opening measured along the center of the roadway of more than 20 feet between undercopings of abutments or spring lines of arches, or extreme ends of openings for multiple boxes; it may also include multiple pipes where the clear distance between openings is less than half of the smaller contiguous opening.

The CFR definition of a bridge includes multiple pipe structures. However, because multiple pipe structures are usually subject only to gradual and very localized collapse, TxDOT normally does not inventory or include such structures in the Bridge Inspection Database or address them under the Highway Bridge Program (HBP) unless the multiple pipes are 60 inches or more in diameter and where the clear distance between openings is less than half the smallest pipe diameter.

The public highways, roads, and streets may either be on- or off-system. On-system routes are on the designated state highway system, while off-system routes are not part of the designated state highway system and are under the direct jurisdiction of a local government. A local government may be a county, city, other political subdivision of the state, or special district that has the authority to finance a highway improvement project.

On-system bridge projects are typically funded with a combination of federal-state funds or 100% state funds, while off-system bridge projects administered by TxDOT are typically funded with a combination of federal-state-local, federal-state, and federal-local funds.

The Texas Transportation Commission (Commission) and TxDOT use the Unified Transportation Program (UTP) as TxDOT's ten-year plan for transportation project development and construction. The UTP is updated annually in accordance with the Texas Administrative Code (TAC §16.105) and is approved by the Commission annually prior to August 31. The UTP authorizes projects for construction, development and planning activities and includes projects involving highways, aviation, public transportation, and state and coastal waterways. The UTP provides a listing of projects and programs that may be delivered from available forecasted funding over the next 10 years. Categories in the UTP incorporate the various programs outlined by the current federal highway bill

and the state general appropriations act. TxDOT's Bridge Program, reflected in the UTP as Category 6, Structures Replacement and Rehabilitation, addresses the specific purpose of replacing or rehabilitating structurally deficient or functionally obsolete bridges. The Category 6 funds are distributed based on eligibility criteria and on a statewide basis; therefore, the individual Category 6 projects listed in the UTP may vary. Reasons for this variation include, but are not limited to, changes in a project's eligibility status or plan development.

Under the new federal highway bill introduced in October 2015, The Fixing America's Surface Transportation (FAST) Act, TxDOT's Bridge Program is supported by the National Highway Performance Program (NHPP) and the Surface Transportation Program (STP). However, for all TxDOT-administered construction projects that include bridges, regardless of the UTP funding category, matters of bridge planning, structural design, plan development, and plans, specifications, and estimates (PS&E) review are under the purview of the Bridge Division. Additional information on the UTP and funding categories is available at http://www.txdot.gov/inside-txdot/division/transportation-planning/utp.html and in the Transportation Planning Manual and the Transportation Programming and Scheduling Manual.

The Bridge Division is responsible for the management of Category 6: Structure Replacement and Rehabilitation. Category 6 consists of three funding programs: Highway Bridge Program (HBP), Bridge Maintenance and Improvement Program (BMIP), and Railroad Grade Separation (RGS) Program.

- Highway Bridge Program (HBP or Category 6 ON/OFF) is for the rehabilitation or replacement of structurally deficient or functionally obsolete bridges (see Chapter 2, Section 3).
- Bridge Maintenance and Improvement Program (BMIP or Category 6 BMN) is to improve physical conditions, not functionality, of on-system bridges by addressing issues affecting structural conditions before deterioration becomes irreversible. The Rail Replacement Program (RRP) is a subprogram to Category 6 BMN, and is used for improving the traffic safety features on bridges and bridge-class culverts (See Chapter 2, Section 4 and 6, respectively).
- Railroad Grade Separation Program (RGS or Category 6 RGS) is for the construction of new on-system highway-railroad grade separation structures at existing highway-railroad at-grade crossings or for replacing existing deficient on-system highway underpasses with railroads (see Chapter 2, Section 5).

Section 2 — Category 6 Funding

Overview

Bridges to be maintained, rehabilitated, or replaced either on or off the federal-aid highways should, as a minimum, conform to the Design Standards for Federal-Aid Highways contained in the Code of Federal Regulations, Title 23, Part 625.

Effective as of October 1, 2016, the CFR 23 U.S.C. 150(e) requires State DOTs to submit a biennial report on bridge condition and performance, including progress toward achieving performance targets and the effectiveness of the investment strategy document in the State asset management plan for the National Highway System (NHS). TxDOT's Bridge Asset Management plan is designed to keep good bridges in good condition, and move fair bridges back to good condition. The intent of the plan is to invest in more cost-effective cyclic/routine maintenance, repair, and minor rehabilitation work in order to correct minor condition defects before they progress to more severe problems requiring far more expensive and disruptive major rehabilitation or replacement.

Bridge rehabilitation refers to performing the necessary work of restoring the structural integrity of and/or correcting major safety defects of a bridge. The rehabilitated structure should meet the current geometric, construction, and structural standards required for the type and volume of the traffic expected on the facility. Applicable American Association of State Highway and Transportation Officials (AASHTO) design standards should be used.

Bridge replacement means total replacement of a bridge with a facility constructed in the same general traffic corridor. The replacement structure should meet the current geometric, construction, and structural standards required for the type and volume of traffic expected on the facility over its design life. Applicable AASHTO design standards should be used.

Eligibility Requirements

Each Category 6 funding program has specific eligibility criteria for prioritizing and selecting projects, which will be discussed in detail in Sections 3-6. In general, the majority of the eligibility criteria are captured within the Bridge Inspection Database; therefore, a bridge must be in the Bridge Inspection Database to be considered for funding with the exception of Railroad Grade Separation (RGS) funded projects. These projects consist of highway-railroad at-grade crossings and railroad underpasses. Railroad underpasses are in the Bridge Inspection Database for documented vertical clearances over public roadways.

The following are definitions for some of the common terms used when discussing eligibility throughout most of the Category 6 funding programs.

Development Authority. Authorizes the development of projects consistent with the fiscal resources. (See the Transportation Programming and Scheduling Manual for more information).

Deficiency Classification. A federal criterion that classifies a bridge as structurally deficient or functionally obsolete. (See the Bridge Inspection Manual for specific definition).

Functionally Obsolete. A functionally obsolete bridge is one in which the deck width, vertical clearance, or hydraulics is not adequate to accommodate the traffic demand on the bridge or the volume of water under the bridge. (See the Bridge Inspection Manual for specific definition).

Structurally Deficient. A structurally deficient bridge is one with routine maintenance concerns that does not pose a safety risk or one that is frequently flooded. (See the Bridge Inspection Manual for specific definition).

Sufficiency Rating. A single numerical rating ranging from 0 to 100 that is based on federal criteria and takes into consideration a bridge's structural adequacy and safety, serviceability and functional obsolescence, and essentiality of traffic service. (See the Bridge Inspection Manual for specific definition).

Five-Year Rule. Section 144 of Title 23 USC states that any bridge considered not significant, closed for five or more consecutive years with no corrective action taken, is not eligible for Category 6 funding. In addition, an FHWA memorandum dated November 16, 2001 states that any insignificant bridge should be removed from the NBI. This memorandum can be found at the following link: http://www.fhwa.dot.gov/bridge/nbi/011116.cfm.

Ten-Year Rule. Bridges need to be in the Bridge Inspection Database and inspected for a minimum of 10 years to be eligible for the HBP, BMIP, or RRP funding programs.

Toll Bridges or Bridges on Toll Roads. If they meet all other eligibility requirements, existing bridges on toll highways may be eligible for Category 6 funding under certain conditions. These conditions include the following:

- The highway is publicly owned.
- Tolls are being collected to finance necessary maintenance of the facility and to pay off construction bonds (that is, tolls are not being collected in any part for profit).

Programming

The Bridge Division conducts annual program calls for each of the funding programs. The annual calls consist of validating the current fiscal year's projects plus revisiting the programming of the four future plan development years. The projects programmed within the first two years are included in the department's 12-month and 24-month letting schedules. The following three years are considered to be in the plan development stage. All projects are authorized for construction letting for their respective years, and all project letting dates are subject to change based on changing

conditions, including the funding of emergency projects, fiscal funding constraints, and overall project development concerns/needs.

The Bridge Division coordinates with the Financial Management Division and the Transportation Planning and Programming Division to ensure the Category 6 approved projects are placed into their respective work programs; fiscal funding levels are met; project work type and descriptions are aligned with the appropriate funding program; and project UTP priorities and rankings are consistent across the entire category of funds.

Development Authority for Category 6 (6DA) allows projects that are eligible Category 6 projects but not on the current UTP Category 6 program's five year plan, to be authorized for plan development. These projects must be approved by the Bridge Division to be added to 6DA. Once they are ready to let (RTL), 6DA projects can be used to fill funding gaps within the current fiscal year. For more information about RTL, see the memorandum dated on March 7, 2016, titled "Ready to Let (RTL) Definition for Construction Projects," located on the Department's internal-only shared-documents web page, http://crossroads/org/ce/shared.html. If you are outside the agency and need assistance accessing this web page, please contact a Bridge Division project manager.

Category 6 Funded Change Orders

All bridge projects funded by Category 6 with change orders must be reviewed by the Bridge Division for funding approval. Please submit the Site Manager documentation and any other pertinent information via email to the Project Development Section Director. If the project does not receive the Bridge Division's funding approval, the District may be required to use a separate non-Category 6 funding source for the change order. Contact your Bridge Division project manager with questions about the process or change order negotiations.

Section 3 — Highway Bridge Program

Overview

The Highway Bridge Program (HBP or Category 6 ON/OFF) is a safety program and is one of the fiscally constrained funding programs outlined in the UTP under Category 6: Structure Replacement and Rehabilitation. The purpose of the Highway Bridge Program is to replace or rehabilitate existing on- and off-system structurally deficient or functionally obsolete bridges located on public highways, roads, and streets.

Eligibility Requirements

To be eligible for the Highway Bridge Program, (HBP or Category 6 ON/OFF), a proposed project must be consistent with the intent and purpose of the program as covered in the overview of this section. Existing bridges to be remedied under the program must be classified as deficient (structurally deficient or functionally obsolete). Collectively, bridges that are classified as structurally deficient or functionally obsolete are simply referred to as being "deficient." For a deficient-classified bridge, a sufficiency rating then determines if a bridge is eligible for rehabilitation or replacement. The interval of time, generally 10 years, since a structure's construction, reconstruction, or rehabilitation, and the type of structure also aid in determining a structure's eligibility. The following points further discuss eligibility requirements as well as work considered to be ineligible.

Bridges eligible for HBP funds must meet the following requirements:

- Bridge must be considered either functionally obsolete or structurally deficient as defined in Section 2; and
- Bridge must have a sufficiency rating (SR) equal to or below 80:
  - SR < = 80 eligible for rehabilitation
  - SR < 50 eligible for replacement

Allowable funding for HBP bridge replacement and rehabilitation projects is limited to the following Bridge Division directives:

- Eligible structure costs that are broken out separately for bridges in the project estimate. Bridge costs are the structural items (mostly Texas Standard Specifications 400 Items) listed separately for bridges in the project estimate. The approach roadway is the actual approach roadway called for in the plans.
- The entire project funding is approved, excluding items not eligible for federal funding, for bridges with 150-ft.-or-less average approach roadways (300 ft. total) or if the ratio of roadway to bridge costs is no more than 25% using the following equation.

- The following formula applies to bridges with more than 150-ft. approach roadways (300 ft. total): {[(Bridge Costs + Detour Costs) x 1.25] + (Mobilization + SW3P + Traffic Handling and Barricades + Removal of the Old Structure + Approach Rail + Bridge Approach Slabs)}, not to exceed [(Bridge Costs) x 2].
  - On-System projects with approach roadway costs greater than 300 ft. are limited to no more than 25% of bridge costs plus detour costs, but not greater than 2 times the bridge cost. A secondary funding source will be needed to cover the additional ineligible costs.
  - Off-System projects with approach roadway costs greater than 300 ft. are generally limited to no more that 25% of the bridge costs plus detour costs. Projects that exceed this 25% cost **must** be accompanied by a written justification, which must be approved by Bridge Division prior to the project letting. The owner of the bridge (i.e., the local governmental entity) may be responsible for funding 100% of the costs exceeding the allowable 25% bridge costs plus detour costs.
- Detour costs used in this formula may be based on either actual or theoretical costs. If a bridge is built on an alternate alignment to facilitate phased construction, then a theoretical cost for a detour that would have otherwise been required may be included in the calculation. The Bridge Division **must** approve the design and extent of any actual or theoretical detour for Category 6 ON/OFF funding before acquisition of right-of-way or other expenditure contingent on detour approval.
- At least 50% of the funds are dedicated to bridge costs alone.
- Funding limitations are based on the project estimate submitted with the final PS&E package sent to the Bridge Division before letting. Any funding over the eligible Category 6 ON/OFF funding limit required for the project must come from other available funding categories.

In special circumstances, roadway costs over the eligible Category 6 ON/OFF funding limit required for the project are considered for Category 6 ON/OFF funding if they have no other category of funding available. Funding justifications must be submitted and approved by the Bridge Division.

Outcome of Project. Replacement or rehabilitation projects under the HBP should result in the removal of the bridge's deficiency classification. Exceptions to this requirement are off-system historic structures that meet the guidelines of the Historic Bridge Manual, or projects with approved design exceptions. See the Chapter 3 of this manual for more information about design exceptions.

Disposition/Use of Existing Bridge. Whenever a deficient bridge is replaced or its deficiency otherwise alleviated through the use of HBP funds, the bridge should either be dismantled or demolished or its use limited to the type and volume of traffic that the structure can safely service over its remaining life.

Bridges replaced with federal funds that are identified as historically significant may be preserved for adaptive reuse with federal fund participation up to the estimated demolition cost. See the Historic Bridge Manual for additional information.

Ineligible Work. The costs of long approach fills, causeways, connecting roadways, interchanges, ramps, and other extensive earth structures, when constructed beyond the attainable touchdown point, are not eligible under the HBP.

Statewide Prioritization and Programming

Safety is TxDOT's main focus in prioritizing projects, including bridge projects being considered for replacement or rehabilitation using HBP funds. Structurally deficient and functionally obsolete bridges are prioritized for the program in order of lowest to highest sufficiency rating.

Each year, the Bridge Division reviews the list of programmed bridges using HBP funds and coordinates with Districts and the Financial Management Division to verify the projects are programmed within the 24-month letting schedule as well as the projects in plan development. The Bridge Division also develops a list of eligible bridges for the districts to review and submit for consideration for HBP funds. The Bridge Division prioritizes the newly submitted bridges and ranks them according to their deficiency status: from lowest to highest sufficiency rating, favoring SD over FO deficiencies. Bridges are selected in this order until funding is exhausted within the year(s) that have available funding. Bridges not selected for a requested fiscal year due to funding limits being reached, are added to the following year for consideration and prioritized until funds are exhausted. This process is repeated for each year of the five-year HBP program listing until funds for all fiscal programming years have been exhausted.

Districts are given the opportunity to request special-consideration projects for any of the project development years. Due to the funding constraints, however, Districts should be prepared to delay one or more of their previously approved projects in that fiscal year.

Funding not used in the current fiscal year is rolled over to the next fiscal year (subject to Transportation Commission approval), however, the goal is to use all of the available funding to ensure deficient bridges are replaced as soon as possible and to assist the department in meeting its goals and priorities. To accomplish this, the Bridge Division encourages bridge projects selected within the first four years be developed and RTL within the first two years of the program. This allows projects to be moved into the current fiscal year and be let for construction should another project be delayed. The Bridge Division's goals are to use all of the funding for each year of the program and to reduce the number of deficient structures in the state.

Table 2-1: Highway Bridge Program Selection Process Schedule

Program Time	Month	Time Frame	Action Items
List Development	August	1 month	BRG develops lists of all eligible HBP projects.
Program Call	September	1 month	Districts select new candidates and update current estimates and lettings.
Project Selection	October	1 month	BRG develops list of District candidate projects in order of Sufficiency Ratings.
Selection Comments and Special Considerations	November	2 weeks	Districts comment on selections and propose special considerations.
Special Consideration Administration Approval	November	2 weeks	BRG selects special considerations and sends to Admin for approval.
Program Call Finalized	December - January	1.5 months	BRG prepares final call list with special considerations and submits to Admin for approval.
Final list sent to FIN	January	End of month	BRG sends final HBP list to FIN.
DCIS Updates	February	1 month	Districts submit DCIS changes and build new CSJs.
Develop PS&E	Submit package 3 months pre-letting	9-24 months	District begins survey, permitting, and layout development. BRG review required.
Bridge Plans	Begin design no later than 6 months pre-letting.	Minimum 3 months	Bridge plans developed by District, Consultant, or BRG. BRG review required.

Administration of Off-System Highway Bridge Program Projects

When planning involves an off-system bridge project, particularly those under the Highway Bridge Program, coordination with the local government is essential.

- Prior to a project gaining CONSTRUCT authorization, the appropriate local government should be contacted, and its interest in participating in the project established.

- If the local government expresses interest in the project and the project has CONSTRUCT authorization, an appropriate Advance Funding Agreement (AFA) must be executed between the state and local government before any work, either preliminary engineering or construction, can be performed. In addition to specifying the responsibilities of the parties in the performance and funding of the work, the agreement defines the contributions of the local government for its share of the project funding responsibilities. Local government contributions must be defined in the AFA, and may be in the form of advance payments (escrow payments) or work performed under the Participation Waived/Equivalent-Match Project Program (PWP/EMP). The PWP/EMP is described in more detail at the end of this section. Questions about the standard agreement form should be directed to the appropriate Bridge Division project manager.
- Funding is typically 80-10-10, federal-state-local, with the local match fund participation requirement based on the estimate of project costs made at the time of the agreement's or its amendment's execution.
- For Category 6 OFF projects that are not yet CONSTRUCT-authorized, exercise judgment in communicating with the local government. Avoid expectations of imminent project construction. A project must be CONSTRUCT-authorized to be let for construction. A project cannot be let until a local government either remits escrow payments for its required participation in the project or provides a written agreement on how it will meet its participation requirement.
- The usual 10% participation of the local government may be adjusted where the project is located within a county that meets the statutory definition of being an "economically disadvantaged county" (EDC). Such adjustments of local government participation due to EDC classification are based on applications submitted by the local government through the district office, to the Transportation Planning and Programming Division (TPP). Information on the newest EDC program list is located on TPP's web page, http://txdot.gov/inside-txdot/forms-publications/publications/transportation-planning.html.
- The local match requirement for off-system bridge program projects may be waived by participation in the PWP/EMP. For participation in the program to be considered, the local government must agree to use local funds to perform structural or other safety improvement work on other load-carrying deficient bridges or cross-drainage structures in its jurisdiction. Such work must have a dollar value at least equivalent to the required local match participation or local participation as adjusted under the EDC provision.

The PWP/EMP requirements defined in 43 TAC Section 15.55(d) must be fully met in initiating and processing such a waiver. Adhere to the following sequence of events for inviting, reviewing and approving the waiver on an authorized federal off-system bridge program project:

- The District notifies the Local Government of the availability of waivers subject to specified conditions and invites submittal of requests.
- The Local Government makes such a request.

- The District receives and considers the completed request for waiver from the Local Government according to requirements of 43 TAC Section 15.55(d).
- If the request for waiver meets all requirements and approval is appropriate, the District advises the Local Government in writing of approval.
- If the request for waiver does not meet all requirements of 43 TAC Section 15.55(d) or approval is otherwise not appropriate, the district informs the Local Government, stating the reason(s) for disapproval of the waiver request.
- Execute an appropriate agreement for the project.
- The District keeps a file of all correspondence and documentation pertaining to the waiver and related equivalent-match project(s). Include in this file the subsequent documentation received from the Local Government pertaining to completion of the equivalent-match project work.
- If the district has not been notified by the Local Government that the equivalent-match work has been completed within the specified three-year period, the district inquires as to the status of the work. If it is determined that the work has not been accomplished and no significant progress has or is being made toward such accomplishment, then the five-year period for exclusion of the Local Government from such waivers may be invoked, or an extension requested from the Bridge Division.

Requests for Remedial Work on Completed Off-System Highway Bridge Program Projects (UTP Category 6 OFF)

During its post-construction service life, all bridges will eventually require maintenance. Thus, one of the provisions of the usual advanced funding agreement executed between the state and local government on these projects states: “After the project has been completed, the local government shall accept full ownership and operate and maintain the facility authorized by the agreement for the benefit of and no charge of toll to the public.”

However, there may be instances where a local government will approach the district requesting repair or other remedial action by TxDOT on a completed off-system bridge project with the local government requesting the remedial action due to poor design or design error.

The presence of design deficiency should be determined by a thorough review of all the pertinent information and facts.

Section 4 — Bridge Maintenance and Improvement Program

Overview

TxDOT has a large number of aging on-system bridges in its inventory. To date, nearly half are 50 years of age or older. Allowing bridge conditions to deteriorate to the point where replacement is required leads to higher overall costs and requires even greater funding to address bridge condition across the inventory. In order to maximize the useful life of a bridge, a systematic process for preservation and maintenance is integral to any bridge management program and will reduce overall life-cycle costs.

By dedicating additional funds for bridge maintenance, TxDOT Administration worked with the Bridge Division to develop the Bridge Maintenance and Improvement Program (BMIP). The program goal is to address bridge condition needs through systematic preventive maintenance to reduce life-cycle costs. The BMIP will improve physical conditions (not functionality) of on-system bridges by addressing any and all conditions that could limit its serviceability or longevity through continued deterioration. The Bridge Division anticipates that through effective preventive maintenance actions, the service life of bridges addressed by the program will be extended a minimum of 25 years, with only cyclic maintenance needed for the next 10 years.

The following are definitions for some of the common terms used when discussing eligibility for the BMIP.

Bridge Preventative Maintenance. A planned, cost-effective treatment that preserves, improves, or delays future deterioration of the condition of a bridge.

Bridge Cyclic Maintenance. Activities performed on a pre-determined interval to preserve the condition of a bridge or bridge element.

Eligibility Requirements

To be eligible for the BMIP (Category 6 BMN), a bridge must have a condition rating of 5 or 6 for at least one of the following: deck, superstructure, substructure, culvert or channel. The bridge is not eligible for BMIP if it is eligible for HBP funding. Completed projects must have all element ratings of 7 or greater. In rare cases it may not be feasible to raise each element rating to a 7. In those circumstances, a report explaining why the higher element rating was not achieved must be added to the bridge file. The report must include justification and an explanation of why the lower element rating will not affect service life or long-term durability. Restoring every element to these condition levels helps ensure the goal of obtaining another 25 years of service life.

In addition to general maintenance activities that address the structural condition ratings, specific work categories are listed below for inclusion and exclusion related to eligibility of this funding:

- Included Work Categories
  - Re-decking projects when deck condition meets the BMIP criteria.
  - Bridge raisings if the bridge has damage due to over-height impacts (superstructure equals 5 or 6 as a result of impact damage). Additional bridges could be included on a case-by-case basis to ensure that raising one does not move the impact problem to another bridge.
  - Relief joints in concrete pavement and/or approach slab work if action helps to improve deck, substructure, or superstructure element ratings (limit of 40 feet from end of bridge).
  - Approach guard fence, safety end treatment, and transition when associated with other approved work (up to 100 feet per bridge corner).
  - Steel protective coatings. All painting projects under this program must use third-party paint inspection services provided and funded by the Construction Division.
  - Post-tension repairs. Overview during implementation must be coordinated with Bridge Division to ensure inspection forces are experienced and trained in repair work.
  - Retrofits of two-column bents and crash-wall installation.
- Excluded Work Categories
  - Widening projects that require installation of additional substructure elements. Minor widening in conjunction with deck replacement that can be accommodated using the existing substructure will be eligible.
  - Bridge replacements.
  - Bridge rail replacement-only projects.
  - Debris removal-only projects, although debris removal may be included when addressing other defects on the bridge through BMIP.
  - Projects to address critical findings. While the Bridge Division remains available to assist Districts in responding to critical findings, it is not the goal of the BMIP to serve as a reactionary funding source to address such issues. The BMIP Committee may make exceptions to this rule in limited circumstances.

Statewide Prioritization and Programming

Safety and improvement to the physical conditions of the State's on-system bridges are TxDOT's main goals in the prioritization of the bridges using BMIP funds. The Bridge Division will develop an initial list each FY of eligible bridges in each district and distribute to the districts for the annual program call. After reviewing the lists, Districts will provide: any additions desired; their desired FY; rankings to prioritize their projects; an initial estimate; and a scope of work for each project. The scope of work will follow the goal of restoring all condition states to a level of 7 or greater.

A BMIP Committee composed of Bridge Division, Maintenance Division, and District representatives will use the District-prioritized lists to compile a master statewide priority listing to narrow the number of projects down to match the annual fiscal funding cap of the program. Using this mas-

ter list, Bridge Division will conduct condition surveys to verify the scope of work and the estimates provided. The results of the condition surveys may be used to adjust the project list and cost estimates. A final project list will be set by the BMIP Committee and will be posted as part of the Unified Transportation Program (UTP). A five year priority listing will be developed and maintained by the Bridge Division. All project eligibilities and priorities are subject to re-evaluation and change each year.

Table 2: Bridge Maintenance and Improvement Program Selection Process Schedule

Program Time	Month	Time Frame	Action Items
List Development	December	1 month	BRG develops lists of all eligible BMIP projects.
Program Call	January - February	2 months	Districts select new candidates and update current estimates and lettings.
Candidate Project Selection	March	2 weeks	BMIP Committee develops candidate list from District-submitted projects and reviews current project changes.
Selection Comments and Special Considerations	March	2 weeks	Districts comment on selections and propose special considerations.
Candidate List Finalized	March	End of month	BRG prepares final candidate list with special considerations.
Candidate List Published	March	End of month	Final BMIP list sent to Districts and BRG PMs.
DCIS Updates to Current Projects	April	1 month	Districts submit DCIS changes to current BMIP projects.
Condition Surveys	April - September	6 months	BRG or Districts conduct condition surveys on candidate list. BRG review required.
Program Call Finalized	September	1 month	BMIP Committee finalizes program list and submits to BRG PM and FIN.
Build New Project CSJs	October	1 month	Districts build new CSJs from final list. FIN verifies with list provided.

Table 2: Bridge Maintenance and Improvement Program Selection Process Schedule

Program Time	Month	Time Frame	Action Items
Develop PS&E	Submit package 3 months pre-letting	9-24 months	District begins survey, permitting, and layout development. BRG review required.
Bridge Rehab Plans	Begin design no later than 6 months pre-letting.	Minimum 3 months	Bridge plans developed by District, Consultant, or BRG. BRG review required.

Section 5 — Railroad Grade Separation Program

Overview

The Railroad Grade Separation (RGS) Program addresses the construction of new grade separation structures at existing at-grade highway-railroad crossings and the rehabilitation or replacement of deficient highway underpasses of railroads on the state highway system. The eligible state highway system routes must be of a classification greater than local road or rural minor collector on the functional classification scale; i.e., they must be classified as federal-aid highways. Title 23 of the CFR Part 646 Subpart B – Railroad-Highway Projects provides federal policy and guidance on these types of projects.

Selected and prioritized highway-railroad grade separation projects are in some instances authorized in funding Category 6 RGS of the yearly Unified Transportation Program (UTP) under the CONSTRUCT level of authorization. Category 6 RGS funding is targeted for each of the following:

- new grade separation structures
- remedy of deficient railroad underpasses

Candidate projects for construction of new grade separation structures are prioritized using a cost-benefit index, while projects for railroad underpass replacement/rehabilitation are prioritized using a priority rating. The cost-benefit index and priority rating are summarized in the Statewide Prioritization and Programming section and described in detail in Chapter 10 of the Rail-Highway Operations Manual.

Eligibility Requirements

Funding for Category 6 RGS in these projects should be limited to the actual structure and other work necessary to make the structure serviceable and consistent with good design. This limits Category 6 RGS-funded approach roadway work to that which is sufficient to transition the gradeline of the structure to an attainable touchdown with the existing or new approaching roadway that is at or near level grade. Roadway and other work that is outside these limitations should be funded from other categories.

These limitations should particularly control when the new or replacement structure will be constructed on a new alignment or at a new location.

Except in extraordinary situations, the existing at-grade highway-railroad crossing should be eliminated.

Statewide Prioritization and Programming

New Highway-Railroad Grade Separation Projects

The cost-benefit index used in prioritizing new highway-railroad grade separation projects is the estimated cost in millions of dollars that would be saved in highway user cost over a 50-year design life of the new grade separation structure constructed at the existing highway-railroad crossing. The higher the estimated user cost, the higher the priority. The estimated user cost includes costs due to casualties (fatalities and injuries) and personnel and traffic equipment delay.

Factors used in calculating a cost-benefit index are as follows:

- Average daily traffic
- Number of train movements
- Number of highway fatalities, injuries, and property damage only crashes
- Period (range) in years for which casualty data are available
- Estimated yearly costs for personnel and traffic equipment delays due to waiting for trains to pass

The data described for cost-benefit index calculation are compiled with data from the National Safety Council, CST, the Internal Revenue Service, and the Equipment Watch Rental Rate Blue Book.

When a new highway-railroad grade separation project eliminates an existing highway-railroad crossing with an active warning device (or is ordered by a state regulatory agency to install one), the respective railroad company is federally required to provide 5% of the project cost. See 23 CFR 646.210 for more detailed information.

Railroad Underpass Replacement/Rehabilitation Projects

Projects for railroad underpass replacement/rehabilitation are prioritized using a priority rating or score on a numerical scale of 0 through 100. The higher the number, the less sufficient the structure for underpassing highway traffic, and thus, the higher the priority for replacement/rehabilitation.

The attributes and relative weights used in calculating a priority rating score are as follows:

- Vertical clearance - 50%
- Percent trucks - 30%
- Horizontal clearance - 15%
- Average daily traffic - 5%

This rating calculation uses the Bridge Inspection Database appraisal ratings (0 through 9) for vertical and horizontal clearance. The Bridge Inspection Database provides percent trucks and average daily traffic items.

Table 2-3: Railroad Grade Separation Program Selection Process Schedule

Program Time	Month	Time Frame	Action Items
List Development	December	1 month	BRG develops lists of all eligible RGS projects.
Program Call	April	1 month	Districts select new candidates and update current estimates and lettings.
Project Selection	May	1 month	BRG/TRF develops list of District candidate projects in order of prioritization.
Selection Comments and Special Considerations	June	1 month	Districts comment on selections and propose special considerations.
Program Call Finalized	July	1 month	BRG prepares final call list with special considerations.
Final List Sent to FIN	July	1 month	BRG sends final RGS list to FIN.
DCIS Updates	August	1 month	Districts submit DCIS changes and build new CSJs.
Develop PS&E	Submit package 3 months pre-letting	12-24 months	District begins survey, permitting, and layout development. BRG review required.
Bridge Plans	Begin design no later than 6 months pre-letting	Minimum 3 months	*Bridge plans developed by District, Consultant, or BRG. BRG review required.

* NOTE: Per the Rail-Highway Operations Manual, Chapter 2, 12-18 months is needed to get an agreement for an overpass from the time TRF-RSS receives the Exhibit A. 24+ months is needed for an underpass structure.

The main steps involved in the agreement process are:

- Execution of preliminary engineering agreement (TxDOT + RR)
- Design approval by BRG + Traffic Operations Division Rail Safety Section (TRF-RSS).

- Design review by RR or RR Company's consultant.
- Design approval by RR for both plans and theoretical 5% cost calculations.
- Estimates from RR for any track, flagging, and grade crossing work.
- Agreement review and signatures by RRs to TRF-RSS.
- Ex B process occurs after the agreement has been signed (100% plan approval).

Category 6 Developmental Authority (6DA) can be utilized to perform a feasibility study to determine the effects of changing a highway-railroad underpass structure to a highway-railroad overpass structure. Overpass structures are more desirable to the Department and the railroads. Contact your Bridge Division project manager for more information.

Section 6 — Rail Replacement Program

Overview

The Rail Replacement Program (RRP) is sub-program funded out of the Bridge Maintenance and Improvement Program (BMIP). In September 2014, nearly 50 percent of TxDOT's on-system bridges were coded in the Bridge Inspection Database as having substandard rails. While TxDOT does have policies for the replacement of substandard rails in association with other roadway work, prior to the RRP, no single program existed that encouraged and provided funding for the replacement of rails on bridges that were in otherwise good condition.

The goal of the RRP is to improve safety on bridges and bridge-class culverts that are in good condition, but have no traffic safety features, or have traffic safety features that do not comply with the Manual for Assessing Safety Hardware (MASH) or the National Cooperative Highway Research Program (NCHRP) Report 350. The funding for this program will come out of the BMIP (Category 6 BMN).

The RRP funding per bridge project will include the cost for replacing the entire non-compliant bridge rail plus the cost of adding the minimum required MBGF length per bridge rail corner not to exceed 100 feet per corner. For culverts, the program will fund construction of a safety end treatment (SET) or MBGF if it is the more appropriate choice for the location.

Funding and policy for the RRP is supported by FHWA's FAST Act and 23 CFR 133(b)(15), which states that eligible projects include highway and transit safety infrastructure improvements and programs.

Refer to the Bridge Railing Manual, Section 2: FHWA Policy on Bridge Railing: Overview, for a list of numerous policy memorandums and reports issued by FHWA, the American Association of State Highway Officials (AASHTO) and the National Cooperative Highway Research Program (NCHRP) regarding bridge railing safety. Federal laws have also been passed that include measures to enhance the crash worthiness of roadside features.

Eligibility Requirements

In order to be considered eligible for the RRP, a bridge or bridge-class culvert must meet the following eligibility requirements:

- **On-system.** The RRP will only fund the replacement of bridge rails on on-system, TxDOT owned bridges. Bridges that are a part of a Comprehensive Development Agreement (CDA) or other non-state funded projects are not eligible. The focus of the RRP is on structures that have no other available funding options.

- **Not historic**. The coordination process required to obtain approval for rails installed on historic trusses is more complex than for other highway bridges, and design and installation requires special consideration. Rail upgrades to historic trusses should be performed when the bridge undergoes a general restoration.
- **Not eligible for HBP, or not SD or FO.** The RRP will focus only on on-system structures that are not currently eligible for replacement or rehabilitation. Bridges that are structurally deficient (SD) or functionally obsolete (FO) or are eligible for the Highway Bridge Program (HBP) will not be considered. The Division may consider expediting a project in the HBP at the time when special consideration projects are requested.
- **Condition rating >5.** The deck/superstructure/substructure/culvert rating must be greater than 5.
- **Non-compliant or substandard rail.** The bridge must have a non-compliant or substandard bridge rail, or have no safety feature, as indicated by the first digit "0" in Item 36, "Traffic Safety Feature" of the Bridge Inspection Database. A bridge is identified as having a non-compliant traffic safety feature if it lacks a safety feature, or has a safety feature that is non-compliant with MASH or NCHRP 350. Rails that are height-deficient are also considered non-compliant, but are subject to additional funding restrictions. However, the RRP will not fund work required to address height-deficient rails where the deficiency is due to the overuse of overlay on bridge decks. This condition can easily be addressed by removing the overlay and/or tapering the overlay from the exterior lane to the toe of the rail. These height deficiencies should be addressed by the Districts. Refer to the Bridge Railing Manual for more information.

Some additional situations affecting eligibility for RRP funds are described below:

- **Compliant safety shapes not meeting FHWA test level requirements.** If the bridge rail is a compliant safety shape, but the test level of the rail shape does not meet the posted speed of the roadway, then this rail replacement is eligible for RRP funding. RRP will also fund replacement of rails which do not meet the required FHWA minimum for a TL-3 designation on NHS bridges.
- **Bridge rails coded "1" in the Bridge Inspection Database.** Any bridge rails marked as a "1" in the first digit of Item 36 are not eligible for the program. If there is a question as to validity of the Bridge Inspection Database coding, please refer to the Bridge Railing Manual, Chapter 4, Section 2, Table 4-2. If a discrepancy with the as-built condition and Bridge Inspection Database coding is discovered, please coordinate with your District Bridge Inspection coordinator to have the database updated. Please utilize the Rail Identification Guide to properly identify the existing bridge rail. The Rail Identification Guide can be found at the following link: https://ftp.dot.state.tx.us/pub/txdot-info/library/pubs/bus/bridge/railing.pdf
- **Economic benefit.** With approximately 15,000 bridges with rails as non-compliant at the time of RRP's implementation, the first step in identifying candidate bridges is to filter out the bridges that are in a condition where retrofitting a new bridge rail would not be economic.

- **Funding Limitation.** RRP funding will cover the cost of approach guard fence, safety end treatment, and transition up to 100 feet per bridge corner. If the total LF of approach rail exceeds 400 LF per bridge, non-Category 6 funding will be required to cover the total additional approach rail cost.

Statewide Prioritization and Programming

Damaged bridge rails or frequently impacted rails are the highest RRP priority. Evidence of repeated collisions or significant impacts needs to be brought to BRG's attention for funding review. BRG wants to ensure that significantly damaged substandard rails are not repaired in kind; therefore, a guidance is provided stating if 10 percent or 75 feet, whichever is least, of the entire bridge rail is damaged, all of the railing should be replaced with a compliant rail. The intent of this guidance is to discourage repairs to non-compliant rail due to lack of maintenance funds. A newer rail will help save maintenance funds because it will fare better in a vehicular collision, and it will be of standard construction, which is easier to repair.

Prioritization will also be based on Average Annual Daily Traffic (AADT) greater than or equal to 10,000 vehicles per day (vpd) and on bridges that are on the National Highway System (NHS). Consideration will also be given to design or posted speeds, whichever is higher, of 50 mph and greater. Bridges with high impact frequencies, but AADT lower than 10,000 vpd will be considered by BRG for inclusion in the RRP on a case-by-case basis.

The Bridge Division will prioritize candidate projects based on the below criteria and with input from the Districts. The criteria to prioritize RRP projects are as follows:

- Rating 1 -- Rail damage is >= 10% of bridge rail or 75 ft. (whichever is the least)
- Rating 2 -- AADT >= 10,000 vpd
- Rating 3 -- On the NHS and the posted/design speed >= 50 mph
- Rating 4 -- Not on the NHS and the posted/design speed >= 50 mph
- Rating 5 -- AADT < 10,000 and with an accident history (case-by-case basis)

Districts are given the opportunity to request special consideration projects for any of the project development years. Due to the funding constraints, however, districts should be prepared to delay one or more of their previously approved projects in that fiscal year.

The RRP has an annual call for project consideration. Projects are programmed for four years at a time. The first two years of projects are included in the department's 24- month letting schedule with the following two years in a plan development stage. All of these projects are authorized for construction letting for their respective years. All project letting dates are subject to change based on changing conditions, fiscal funding constraints, or emergency projects.

Each year the Bridge Division develops a list of eligible bridges based on the prioritization criteria listed above for the districts to review and submit for consideration for available RRP funds.

Table 2-4: Rail Replacement Program Selection Process Schedule

Program Time	Month	Time Frame	Action Items
List Development	July	1 month	BRG develops lists of all eligible and prioritized RRP projects.
Program Call	August	1 month	Districts select new candidates and update current estimates and lettings. Check validity of rail type.
Project Selection	September - October	2 months	BRG develops list of District candidate projects. Districts visit bridges and fill out Form 2488 noting discrepancies. RRP project can still be removed at this time.
Selection Comments and Special Considerations	September - October	2 months	Districts comment on selections and propose special considerations.
Program Call Finalized	November	End of month	BRG prepares final call list with special considerations.
Final List Sent to FIN	November	End of month	BRG sends final RRP list to FIN.
DCIS Updates	December	1 month	Districts submit DCIS changes and build new CSJs.
Develop PS&E	Submit package 3 months pre-letting	9-24 months	District begins survey, permitting, and layout development. BRG review required.
Bridge Rail Plans	Begin rail design no later than 6 months pre-letting	Minimum 2 months	Bridge plans developed by District, Consultant, or BRG. BRG review required.

Chapter 3 — Preliminary Design Features

Contents:

Section 1 — General Features

Section 2 — Features Based on Bridge Location

Section 1 — General Features

Bridge Standard Drawings

Bridge standard drawings are available for many structure types, skews, and common bridge widths. These standard drawings contain systems and details that can be used in bridge plans without modification.

Many standard drawings are available on the Texas Department of Transportation (TxDOT) main website (use the browser's "Edit-->Find" menu to locate individual drawings.) The website also contains instructions about the use of these graphics files.

Bridge Widths

For all new and replacement projects (4R) including freeway rehabilitation, carry the full usable shoulder width of the approach roadway across the structure. Conform bridge widths to the requirements in Chapter 3 of the Roadway Design Manual, which presents the design criteria for 4R projects for various roadway functional classifications and traffic volumes. Construct bridge widths for structures in complex interchanges containing flares, gores, etc. to full width of the approach roadway, as well.

For non-freeway rehabilitation projects (3R) where the bridge structures are to be modified, set bridge widths at least to the approach roadway width. Otherwise, conform bridge widths to the requirements in Chapter 4 of the Roadway Design Manual, which presents the design criteria for 3R projects for various roadway functional classifications and traffic volumes.

Minimum bridge width requirements for special facilities, such as off-system bridge replacement and rehabilitation projects, Texas Parks and Wildlife Department projects, and bicycle facilities can be found in Chapter 6 of the Roadway Design Manual. Minimum bridge width requirements for off-system historically significant bridge projects can be found in the Historic Bridge Manual.

Bridge and Span Lengths

In planning stages, the length of the bridge is an approximation based on available preliminary information which becomes more refined as the project progresses. The length of the bridge depends on such factors as existing topographical conditions at the site, the width of the obstruction being crossed (other roads, waterway, railroad tracks, etc.), the roadway alignment, highway design criteria (sight distance, maximum grades, etc.), economics, and plans for future development. When determining preliminary bridge lengths, set the "begin bridge" point and "end bridge" point at whole station numbers and on a tangent alignment, if possible. This geometry can be accommo-

dated by moving the point of curvature (PC) or the point of tangency (PT) off the bridge, if allowable.

The number of spans, length of spans, and bent locations can be determined once the preliminary bridge length is set. Where bridge geometry and site conditions allow, place bents such that interior span lengths are equal. If possible, locate the bents at whole station numbers. If the bridge is crossing a stream, spanning the channel is recommended to decrease the probability of future scour issues.

Span length requirements limit the available options for superstructure. Select the most economic superstructure type that meets span length requirements and satisfies aesthetic needs at the site. Recommended span lengths, approximate depths, and associated bridge costs for various superstructure types can be found on the TxDOT Bridge Division (BRG) website. The process of setting bridge geometry consists of iterative steps that take place during development of preliminary bridge layouts. During this process, the district and divisions coordinate to develop a plan for an economically feasible, aesthetically pleasing structure that serves its design purpose.

Vertical Curvature

Conform bridge vertical curvature to curvatures permitted on sections of roadway for the same conditions of traffic and terrain. Basic design criteria for vertical alignment can be found in Chapter 2 of the Roadway Design Manual,

Be aware of the following important factors when determining the vertical alignment of a structure:

- On controlled-access highways where crossover roads intersect frontage roads near the main lanes, set the vertical curvature of the crossover structure to allow adequate sight distance for crossover and frontage road traffic. Locate intersections farther away from bridges to provide adequate sight distance on steep crossover grades, if necessary.
- In areas where icing is prevalent, design structures with a flatter grade than comparable sections of roadway because they are more susceptible to icing and likely to present a traffic hazard in the early stages of an ice storm.
- On long, flat grades, use a small crest vertical curve throughout the bridge length to prevent the illusion of sag and to improve deck drainage.

Horizontal Alignment

Place a bridge structure on tangent alignment if this can be accomplished without sacrificing the overall geometric design of the highway. Tangent alignment results in lower structure costs by simplifying plan preparation and bridge construction. Consider overall project economics when setting horizontal alignment for the structure. While building structures on a tangent alignment is generally more economical, this may not be feasible in areas with high right-of-way costs. Build curved

structures where their geometry fits the curve geometry for the roadway sections. Tightly curved alignments can significantly restrict the type of superstructure. Basic design criteria for horizontal alignment can be found in Chapter 2 of the Roadway Design Manual.

Skew

Build structures on a skew if necessary to match the alignment of roadways, railroad tracks, or stream flow. If a skew is required, consider the following:

- Normally, skews should be limited to the minimum angle practicable. Standards for several beam types and roadway widths are available in skews of 30 degrees and 15 degrees. Skews in excess of 30 degrees usually will require special design considerations.
- For railroad overpasses, place bents parallel to railroad track alignment, if possible.
- For railroad underpasses, each railroad company may have its own limitations on acceptable skew angle.
- Skewed structures that have horizontal curvature require special geometric and structural design, and additional time will be required for plan preparation.
- Slab breakbacks and special slab reinforcing details may be required. Refer to the Bridge Detailing Guide for more information.

Superelevation, Transitions, and Cross Slopes

Minimize the superelevation rate (emax) whenever possible. Ranges of emax are necessary. Hold the maximum superelevation rate on structures to 8% regardless of the degree of curvature due to the tendency of vehicles to slide toward the inside of the curve when icing conditions exist. Where roadway superelevation rates are less than 8%, match the superelevation and transition rates on structures to those specified for the sections of roadway. Basic design criteria on superelevation can be found in Chapter 2 of the Roadway Design Manual.

Do not use spiral transitions on bridges. The same effect as a spiral curve can be achieved by compounding smaller degree curves into the principle curve. On preliminary bridge layouts the rate of transition from full superelevation to normal crown should be specified in enough detail to enable the designer to define the roadway surface.

The cross slopes on bridges may be set to match the approach roadway. Usual crown is 1.5% or 2%. In some cases, 1% is used on bridge standards. In this case, transition the approach roadway slope to fit the bridge.

Bridge Medians

Use a 6-foot median width for pedestrian refuge in accordance with Public Rights-of-Way Accessibility Guidelines (PROWAG) in urbanized settings on new construction projects and where practical on reconstruction projects.

Median widths are measured between the inside edges of opposing travel lanes. Where narrow medians (4 ft. to 16 ft.) are used, carry the median uninterrupted across the bridge structure.

When the median width is 30 ft. or less and a median barrier is used on the approaches, use a single structure with a closed flush median and a median barrier extended uninterrupted throughout the structure length. When the median width exceeds 30 ft., construct dual structures with an open median and suitable guardrail connected to the bridge railing.

Additional design considerations for determining median width can be found in Chapter 2 of the Roadway Design Manual.

Sidewalks and Curbs on Bridges

Consider pedestrian and driver safety when sidewalks are provided on bridges. Make pedestrian facilities accessible to all persons and design them in accordance with the Americans with Disabilities Act (ADA) and the Texas Accessibility Standards (TAS). Information on ADA and TAS, including general concerns and basic design criteria, can be found in Advanced Planning -- General Considerations in Chapter 4, Section 1 of this manual and Chapter 2 of the Roadway Design Manual.

The need for sidewalks usually occurs in urban areas, on frontage road bridges, or where a depressed highway crosses under a city street. In urban areas, consider placing sidewalks on both sides of any new construction or reconstruction bridge project. Provide a suitable barrier rail or combination railing, if required. The use of barrier rail to separate vehicular from pedestrian traffic is governed by the following criteria:

- Appropriate barrier rail is required when the design speed >= 50 mph.
- For design speeds >= 45 mph, but < 50 mph, consider appropriate barrier rail where bridge site specific conditions allow without interference to pedestrian movements, intersecting roadways, or other features.

Consider the following additional information when selecting barrier rails at sidewalks:

- American Association of State Highway and Transportation Officials (AASHTO) height requirements for pedestrian railing do not apply to the traffic barrier rail. Exercise engineering judgment.
- Properly protect ends of barrier rail.

- A light pedestrian rail or chain-link fence may be used on the outside of the sidewalk when a barrier rail is provided on the inside of the sidewalk.
- Additional guidance can be found in the Bridge Railing Manual.
- Bridge pedestrian rail standards can be found on BRG's standards web page.

Curbs on Bridges. Do not use curbs on bridges except in conjunction with sidewalks. Do not use curbs directly in front of guard fence, barrier rail, or traffic rail.

If curbs are used:

- Make curb height meet or exceed height of the approach roadway.
- Do not make curb height less than 5-3/4 in. or greater than 8 in.

Refer to Chapter 2 of the Roadway Design Manual for curb types and considerations.

Bike Paths

If a bike path is provided on a bridge, the design is governed by AASHTO's current Guide for the Development of Bicycle Facilities.

Additionally, TxDOT has designated the following minimum design criteria:

- The minimum lane width is 14 ft. for new shared lanes on a signed, designated bicycle route.
- The 14-ft. usable lane width for shared use in a wide curb lane is measured from the edge stripe to the lane stripe or from the longitudinal joint of the gutter pan to the lane stripe. The gutter pan should not be included in the usable width. Do not include the curb offset as part of the usable lane width for a shared use in a wide curb lane.
- Widths less than 14 ft. require a design exception.
- Provide a 5-ft. shoulder (4-ft. shoulder and 1-ft. barrier offset) on the structure and along the adjacent barrier for all projects involving bridge replacements or bridge deck replacements/ rehabilitations of on-system roadways or off-system roadways with greater than 400 ADT.

Illumination

Coordinate lighting of bridge structures with lighting of approach roadways. Cooperate with the roadway design engineer to determine the locations of light mounting brackets. Include details for conduit and brackets for all lighting mounted to the structure. Standards for bridge lighting details can be found on BRG's standards web page.

Railings

Select bridge railing that is adequate to accommodate the design vehicle under design impact conditions. The rail must meet the requirements of the AASHTO Manual for Assessing Safety Hardware (MASH), or the National Cooperative Highway Research Program (NCHRP) 350. All newly implemented rails should meet MASH requirements.

TxDOT has developed many railing types and created standard drawings for use in different situations. These standard drawings are readily available for use on highway bridge projects and should be included in the bridge details. The Bridge Railing Manual provides further guidance on TxDOT railing types.

Under certain conditions, barriers or combination rails must separate sidewalks from vehicular traffic. Refer to Sidewalks and Curbs on Bridges in this section for guidance.

Refer to Chapter 2 of the Roadway Design Manual and Chapter 2 of the Bridge Railing Manual for information on the use of railings on bridge-class culverts.

Beginnings and Ends of Bridges

Stream Crossings. For stream crossing structures, make the slopes of embankments at bridge ends a maximum of 2:1 in a direction normal to the abutment cap. Side slopes should be normal to the roadway and no steeper than 3:1. Use stone riprap (preferred) or concrete riprap under the bridge and wrapped around the embankment, terminating when the slope becomes 3:1 or flatter. Steeper slopes may be used for special conditions but should be avoided where possible to allow for easier placement of revetment and greater slope stability. The Bridge Division recommends using flexible revetment (stone protection, interlocking articulated concrete blocks, gabion mattresses, etc), where possible. If flexible revetment is not possible, then use 5-in., Class B concrete riprap (RR8) for stream crossings. For structures in reservoirs, make the revetment at bridge ends the same as that used to protect the roadway embankment at stream crossings, which is usually stone protection or soil cement riprap.

Overpasses. The slopes indicated above are also satisfactory for highway overpass structures, except that a 3:1 slope may be used in a direction normal to the abutment cap. Use a flatter slope where greater sight distance under a structure is needed. When the 3:1 slope is used, it is common to use only a shadow type revetment, extending no more than 2 ft. beyond the horizontal projection of the structure. However, various factors (geometry, soil conditions, etc.) could cause the revetment to extend a greater distance beyond the horizontal projection of the structure. If using the shadow type revetment, for skewed structures, construct the acute side normal to the abutment cap to prevent erosion at the edge of riprap. Curbs may also be used at the edges of riprap to prevent erosion. Use 4-inch Class B concrete riprap (RR9) for highway overpass structures.

Approach Slabs. Use bridge approach slabs at bridge ends for vehicular structures on all major highways. The approach slab covers an area behind the abutment backwall where good compaction of base and sub-base is difficult to obtain. Using approach slabs will reduce maintenance due to settlement adjacent to abutment backwalls. Such settlement causes increased impact and roughness at bridge ends, subsequent horizontal movement, and cracking of the abutment. The approach slab standards are available on BRG's standards web page.

For roadways that cross streams that could potentially meander, consider designing the abutment(s) as interior bents. This would allow the backwall to be removed and the bridge extended if needed. This does not add any additional cost to the structure.

Design Exceptions, Waivers, and Variances

A design that complies with the Department's design manuals is based on documented engineering research or practice. Any design that is an exception to usual standards requires a documented, logical, evaluation process explaining why the standards are not met. The design exception, design waiver, and design variance procedures establish this documentation.

Design Exceptions

As of May 5, 2016, the Federal Highway Administration's (FHWA's) guidance memorandum, available in docket FHWA-2015-0020, has revised the policy on the controlling criteria for design and documentation of design exceptions. In 1985, FHWA designated the original 13 controlling criteria for geometric design. This new revision reduced the criteria to ten, which focuses the application on NHS, high-speed roadways (i.e. design speed >= 50 mph). Only two criteria apply on NHS, low-speed roadways (i.e., design speed < 50 mph).

Design exceptions are required whenever the controlling criteria mentioned above are not met. A formal design exception should be processed when the designer anticipates that the recommended guidelines for these controlling criteria cannot be met. The determination of whether a design exception exists rests with either the district engineer or the Bridge Design Exception Committee (BDEC), depending on the controlling criteria in question.

The only criteria requiring the BDEC's design exception approval are structural capacity and bridge rails. All other criteria require the district engineer's approval. Refer to the Roadway Design Manual and the Project Development Processes Manual for more information on these criteria.

The Chair of the BDEC is the Director of the Bridge Division, and the membership is composed of:

- Director, Project Development Section, Bridge Division
- Director, Design Section, Bridge Division
- Director, Field Operations Section, Bridge Division

- Project Manager, Project Development Section, Bridge Division

The district engineer or BDEC will serve as the final arbiter on all design exception requests on projects with state oversight. Design exceptions on projects with federal oversight or on the interstate system will be submitted to the FHWA for approval. The Bridge Division project manager is the district point of contact when requesting design exceptions that are the responsibility of the BDEC.

Design Waivers

When criteria are not met in a non-controlling category, a design exception is not required. In these cases design waivers at the district level will handle the variations from the recommended design criteria. Design waivers will be granted at the District's authority. Permanently retain the complete documentation in the district project files and furnish a copy to the Design Division. For a listing of the types of non-controlling criteria that will require a design waiver, see Design Exceptions in the Roadway Design Manual.

Design Variances

Request a design variance whenever the design guidelines specified in the Americans with Disabilities Act Accessibility Guidelines (ADAAG) and the Texas Accessibility Standards are not met. Send design variances to the Design Division to be forwarded to the Texas Department of Licensing and Regulation for approval.

Corrosion Protection Systems

Protecting reinforcing steel is critical to the design life of a concrete structure. The following methods of inhibiting corrosion, either in combination or alone, are currently used by TxDOT:

- Increased concrete cover
- High Performance Concrete (HPC)
- Corrosion-resistant reinforcement (galvanized, low carbon/chromium, dual-coated, stainless)
- Epoxy-coated reinforcement
- Glass fiber-reinforced polymer bars (GFRP)

Climatic conditions determine which structures to protect. Guidelines for the appropriate use of corrosion protection systems within the state can be found on the TxDOT BRG website.

Loads on Bridge Decks

Design all new bridges for a minimum of HL93 loading according to the most current edition of the AASHTO Load and Resistance Factor Design Bridge Specifications.

Excavation Protection Requirements

In accordance with state and federal laws, whenever a project involves excavations for linear installations such as pipe and conduit, equal to or deeper than 5 ft., include Item 402, "Trench Excavation Protection," in the contract to compensate the contractor for determining or providing the specified safety precaution system.

If the existing embankment is removed more than five feet below the existing ground, then Item 403, "Temporary Special Shoring," is required as a pay item. Clearly show the limits of the temporary special shoring on the plans.

Bridge Joints

Bridge deck joints have proven to be both a construction and a maintenance problem and, as such, should be used only as required by design. Where they are necessary, determine the type and size of the joint by the type of superstructure, the length of structure that is contributing to the expansion to be handled at the joint location, and the need to seal the joint against water leakage.

Use bridge deck continuity, which minimizes the number of expansion joints, when possible. Seal or drain all expansion joints in deicing zones. Use open joints in most stream crossing structures; however, environmental concerns may necessitate sealed joints for some structures. Seal joints for all grade separation structures.

Utilize the latest standard drawings for expansion joints for armor joints and sealed expansion joints (SEJ). Contact the Bridge Division’s Construction/Maintenance/Fabrication Branch for details of polymer nosing and other retrofit type joint systems.

Design parameters occasionally require a longitudinal joint in the bridge deck to accommodate extreme bridge width, jumps in elevation across the width of the deck, or construction phasing requirements. In all cases, place these longitudinal joints next to a bridge rail or concrete traffic barrier (CTB). Do not place them in traffic lanes due to the potential hazard to motorcyclists. If needed, seal longitudinal joints against leakage in a manner similar to transverse joints.

Stage Construction—Existing Structure Removal

Specify removal of the existing structure is in accordance with Standard Specifications Item 496, “Removing Structures.”

The partial removal of an existing structure begins with cutting and removing the slab. The location of the cut is called the breakback. The approximate location of the breakback is determined through coordination with the traffic and highway engineer and is based on lane width requirements of both the new structure and the partial structure to remain in place. The bridge designer should determine the exact location of the breakback point based on the structural capacity of the existing structure.

The breakback is generally located over a beam and must be supported by a stable substructure. After the slab is cut and removed, the beams are removed and the substructure, or a portion thereof, is demolished. If necessary, footings are removed and drilled shafts and piles are cut and removed to a minimum distance a minimum of 2 ft., or as specified in the plans, below the proposed ground.

Stage Construction—New Substructure

Below are a few general rules of thumb for staged substructure design. Please refer to the Geotechnical Manual for more information about substructure design for stage construction.

Table 3-1: Minimum Drilling and Pile Driving Clearances

Work Type	Minimum Horizontal Clearance
Drilling	2 ft.
Pile Driving	2 ft.

Foundations. If possible, avoid locations of existing foundations. For widenings, see the Geotechnical Manual, Chapter 5, Section 1, for guidance.

Abutments. At abutments, temporary special shoring should be located at a sufficient distance to allow the reinforcing steel to be projected from the abutments for splicing. If this is not possible, locate foundations (drilled shafts or piling) close to the stage construction joint and dowel the two sides of the cap together, or provide a sealed expansion joint.

Interior Bents. If possible, use independent bents. If a single structure is required, the reinforcing steel can be spliced using a lap, a mechanical coupler, or butt weld, depending on space constraints. If splicing is used, provide adequate horizontal and vertical clearances to account for the projecting reinforcement. Protect the exposed reinforcement. If available clearances are limited, use mechanical couplers or butt welds. Due to the complexity of couplers and welds, accurate details and proper structural detail notes are essential.

Stage Construction—New Superstructure

The critical factors in slab design are the location of the stage construction joint in the slab and the available clear distance for splicing the mat reinforcing are critical factors in the slab design. Please

refer to the TxDOT BRG web page for more information on superstructure design for phased construction.

Temporary Railing

For guidelines on selection and placement of temporary railing, refer to the Bridge Railing Manual.

Section 2 — Features Based on Bridge Location

Highway Grade Separation

Vertical Clearance. Provide 16 ft. 6 in. minimum vertical clearance over the roadway, including usable shoulders on all new highway grade separation structures, and highway-railroad underpasses.

The minimum vertical clearance of 16 ft. 6 inches is required with no exceptions for structures over main lanes of interstate or controlled access highways within cities where this minimum vertical clearance is provided on an interstate loop around the city. Vertical clearances should be provided in accordance with the Roadway Design Manual on all other systems of highways with separations involving interchange facilities, other highways, public roads, or city streets. Where these minimum clearances are impractical or excessively expensive to provide, pursue a design exception. Refer to the Roadway Design Manual and the Project Development Process Manual for information about the vertical clearance design exception process. In such cases, vertical clearance will be held as near as practicable to 16 ft. 6 in. Vertical clearance may never be less than 14 ft. 6 in.

The above-specified clearances apply over the entire width of roadway including usable shoulders and include an allowance of 6 in. for future pavement overlays. Where a sag vertical curve exists on the roadway underneath the structure, vertical clearance should be calculated above the midpoint of a 50-ft. chord.

Horizontal Clearance. Information on horizontal clearance can be found in the Roadway Design Manual.

Airway-Highway Clearances. Where grade separation structures or multilevel interchange structures extend above ground level in the vicinity of airports, obtain clearance in accordance with the Roadway Design Manual.

Structures Over Streams

Information in the following section provides general reference on common design features of structures over streams. Refer to the Hydraulic Design Manual whenever planning and developing a structure over a stream.

For new locations crossing a stream, conduct a minimum investigation to establish an approximate design high-water elevation. Establishing a high-water elevation early in the design process will aid in identifying any complication concerning the stream crossing while the location of the route is flexible enough to be shifted.

For existing locations, determine the hydraulic adequacy of the existing structure. If the runoff from a storm of documented design intensity has not actually been carried through the structure, the declaration of past adequacy is meaningless. If reliable flood control devices such as National Resources Conservation Service (NRCS) dams have been constructed upstream, an existing structure may be entirely adequate but may also be too large.

The hydraulic adequacy of an existing structure can be verified in only two ways:

- documentation that the structure actually has accommodated a flood of at least the approximate design frequency
- hydrologic and hydraulic investigation similar to that necessary to design new drainage structures

If investigation is necessary, information from old plans may be used provided that the information is verified and, if necessary, updated. Pay particularly close attention to runoff factors. If no documentable design flood has occurred and old design data are not available, hydrologic and hydraulic information must be furnished with the plans, specifications, and estimates (PS&E) or with preliminary layout submissions, keeping the extent of the investigation in line with the importance of the structure.

When an existing structure is determined to be inadequate, one of two actions may be taken. Either adjust the size of the facility as appropriate, or give the structure a new capacity rating with a corresponding decrease in the hydraulic standards that were previously established. Either action must be documented in the plans. Consult the Design Division's Hydraulic Section when reducing the hydraulic opening.

The flood frequency used to determine the size of the waterway openings and the desired roadway profile is very important to the design. Base the minimum frequency on economics and risk except on interstate highways, which require a minimum 50-year flood frequency. Do not automatically select the frequency based upon highway classification because other factors can create a need for a higher type hydraulic facility. These factors include land use (both upstream and downstream of the highway), safety to traveling public, debris, environmental concerns, and others. Estimate land use for 20 years into the future.

In addition, apply the 100-year flood event (base flood) on certain proposed highway/stream crossing facilities to determine whether a proposed crossing will cause a flood to damage the highway or any other property beyond damage which would have occurred without the proposed facility. Consider that the flood may be conveyed both over the roadway and through the openings when evaluating whether significant damage occurs to the highway or other property.

Analyze the flood for all highway/stream crossings with one or more of the following:

- bridge-class structures,

- some feature within the influence of the 100-year flood plain to which significant damage could occur, or
- federally established 100-year flood plain boundaries.

Bridge-Class Culverts. Follow the procedure for the hydraulic design of bridge-class culverts in accordance with the Hydraulic Design Manual. Additional information on bridge-class culverts such as length, cover, safety treatment, and headwalls can also be found in the manual.

When considering replacing a span bridge with a culvert, ensure that drift accumulation is not a problem.

Railing and safety-end treatment requirements for bridge-class culverts can be found in Chapter 2, Section 7 of the Roadway Design Manual and Chapter 2 of the Bridge Railing Manual.

Existing Bridge-Class Culverts. Follow the procedure for analyzing the hydraulic capacity of existing bridge-class culverts in accordance with the Hydraulic Design Manual.

Railroad Overpasses

Highway structures over railroads are referred to as railroad overpasses. Most railroad companies require 23 ft. 4 in. of vertical clearance from edge of railroad right-of-way to edge of railroad right-of-way, but vertical clearance requirements should be confirmed with the railroad company during early design stages. For widening of existing structures, it is usually satisfactory to provide no more clearance than is provided by the existing structure. Per Texas Administrative Code, Title 43, Part 1, Chapter 7, Subchapter D, Rule 7.36, the minimum vertical clearance is 22 ft. 0 in. from the top of the track to the lowest part of the bridge, and the minimum horizontal clearance is 8 ft. 6 in. from centerline of tracks to face of pier or other obstruction. These legal minimums include temporary construction clearances as well. However, the desired minimum horizontal clearance is 12 ft. Some railroad companies require greater horizontal clearance. Deviations to the clearance requirements in the Texas Administrative Code may be obtained through a clearance deviation to be approved by the Texas Transportation Commission.

Current American Railway Engineers and Maintenance of Way Association (AREMA) specifications require pier protection or crash walls where the clearance between centerline of tracks and face of pier is less than 25 ft. Place all piers so as not to interfere with drainage. If requested by the railroad company, horizontal clearance will be provided to allow the railroad use of off-track maintenance equipment. All clearances required because of future plans of the railroad company must be substantiated by documented plans and appropriated funding by the railroad company to do the work within the next five years.

Railroad Underpasses

Highways under railroad structures are referred to as railroad underpasses. Plan and design railroad underpasses in close cooperation with the Railroad Company or companies involved. Most railroad companies do not employ sufficient engineering staff to prepare the detailed plans for such structures. The Bridge Division will prepare the detailed plans for railroad underpass structures when requested by the District and agreed to by the railroad company.

An underpass imposes an added maintenance burden and restricts expansion of the railroad line. An underpass also may result in restricted horizontal or vertical clearance and present a drainage problem for the roadway underneath. Explore all options before resorting to expensive pump stations. For certain conditions an underpass is the only workable solution for highway-railroad separation. In any case, where an underpass is proposed, the District should prepare comparative estimates of an underpass versus overpass and furnish these to the Bridge Division project manager with reasons for proposing the underpass

Clearances. Comply with the required clearances for highways underneath railroad structures as outlined in the Highway Grade Separations section of this manual, except as follows:

- For the usual conditions, use the minimum horizontal clearances from the edge of the traffic lane to the face of pier permitted in the Roadway Design Manual. Provide greater clearance where the overall cost of the structure will not be materially increased.
- Because the railroad live load can appreciably increase the cost of longer spans use shoulder widths with introduction of guardrail on the approaches to and through the structure. Place the face of the pier or abutment 2 ft. to 6 ft. outside the face of the guardrail.
- Consider pedestrian and bicyclist needs at the underpass. When present, pedestrians and bicyclists should be protected from vehicular traffic by a barrier.

Structure Types. Selection of a suitable structure type involves consideration of all facets of an underpass project, but some determination of type must be made early in the preliminary stage of project development. See the design guidelines for the affected railroad company for recommended structure types. The following provides general guidance for this determination:

- Decks of underpasses may be either concrete or metal deck plate. While metal deck plate is most expensive, it usually affords the minimum distance from top of rail to lowest point on superstructure and may be necessary where tight clearance conditions exist.
- Through-plate girders with floor beam and knee brace system offer the shallowest depth of section below rail. Required grade differential from railroad profile to highway profile is not appreciably affected by an increase in span length. Certain railroads object to this type of structure because of its vulnerability to damage by shifting freight loads or derailments. In cases where vertical clearances are critical, the through-plate girder, although expensive, is sometimes the only logical solution. Do not use this type of structure for more than two tracks.

- Deck-type structures may employ simple steel I-beams or plate girders, prestressed concrete I-beams, or prestressed concrete box beams. Continuous steel I-beams or post tension concrete beams may be used in unusual circumstances. Such structures increase in depth as the span length increases. Railroad companies have differing requirements for structures. Arriving at an acceptable structure type is a matter of design and negotiation.

The Bridge Division project manager will assist in specific details for each individual project.

Handling Railroad Traffic. The method of handling railroad traffic during construction usually affects the type of structure that is to be built. Close coordination is necessary with the railroad company through the Rail Safety Section of the Traffic Operation Division (TRF-RSS), assisted by the Bridge Division project manager. Consider the following ways of addressing this issue:

- A railroad detour or shoofly track may be constructed. This facility should be as near as practicable to the underpass construction site and as short as acceptable to the railroad company to minimize costs. Where an existing underpass structure is present, the shoofly will require a temporary structure over highway lanes unless highway traffic can be temporarily rerouted.
- Avoiding a shoofly track eliminates unnecessary bridge costs. The railroad company and TxDOT, working together, can drop a preconstructed bridge into place with little or no interruption to train traffic. Both parties would share the construction work involved in the project. TxDOT prefers this method, but few railroad companies endorse it. Therefore, the concept should be addressed very early with the railroad company to ensure the project is a candidate for this type of construction.
- Always investigate the possibility of constructing the new underpass near the present track and later relocating the track over the new structure. Explore this possibility because it offers the minimum construction cost for the underpass structure. However, a permanent realignment of the railroad may be excessively costly or unacceptable to the railroad company.
- Stage construction may be possible where part of the new structure is built to carry rail traffic while the remainder of the bridge is completed.
- Consider raising the track if drainage of the underpass section is critical or an increase in vertical clearance is required.
- Investigate items such as joint operations between two railroad companies, abandonment of a line, and similar changes in railroad facilities in the planning stage of a railroad underpass.

Pedestrian Bridges

ADA and TAS Considerations. Design all pedestrian facilities so they are accessible to all persons and in accordance with the American with Disabilities Act (ADA) and the Texas Accessibility Standards (TAS). Always refer to the Americans with Disabilities Act Accessibility Guidelines (ADAAG) and the TAS for complete design requirements.

Structure Width. Construct decks on pedestrian crossings 8 ft. wide, or wider, where pedestrian volumes indicate.

Clearances for Pedestrian Structures. Pedestrian crossover structures are subject to severe damage or collapse when hit by a high load or a loaded truck out of control. Since the probability of loss of life is great under such conditions, these structures have more vertical and horizontal clearance than required for vehicular overpasses. Provide pedestrian crossovers with 17 ft. 6 in. vertical clearance over the travel lanes and shoulders. Consider higher vertical clearances for freight routes.

Railing and Fencing. Provide a 1-ft. high parapet on either side of a pedestrian crossover with a 5 ft. to 6 ft. woven wire fabric type fence mounted on top. In the interest of safety for children using such structures and also to protect the highway traffic beneath, cover portions of the walkway over the highway lanes and shoulders to entirely enclose the walkway. Where such overpasses are near schools or will be used by a substantial number of children, extend the covering to near the grade point at each end of the structure, if feasible.

Ramp Approaches. Ramp approaches may be tangent extensions of the main structure or may be right angles to the structure forming an L, U, or Z shape. Spiral ramps may also be used. Do not use stairs due to limited accessibility.

Illumination. Pedestrian crossovers normally are lighted by street or highway lighting standards placed in the vicinity.

Overhead Sign Supports

Use TxDOT bridge standards where applicable. The Bridge Division is available to assist in the design of sign bridges not covered by the standards.

Federally Funded Off-System Bridges

Design off-system bridges that are replaced with federal funds in accordance with the design criteria in Chapter 3 of the Roadway Design Manual for the appropriate roadway classification.

Design off-system bridges that are rehabilitated with federal funds in accordance with the design criteria in Chapter 4 of the Roadway Design Manual for the appropriate roadway classification. However, if the current average daily traffic (ADT) is 400 or less on an off-system bridge to be rehabilitated or replaced, and the facility is not likely to be added to the designated state highway system, then use the design criteria presented in Chapter 6 of the Roadway Design Manual.

For hydraulic design criteria, refer to the Hydraulic Design Manual. Also see Chapter 3, Section 2 of this manual.

Historic Bridges

Historic bridges frequently cannot be cost-effectively upgraded to meet the usual design standard for roadway width, load carrying capacity, or traffic railing without significantly altering the aspects that make the bridge historically significant. Governments regulatory entities realize the importance of historic structures and have created guidelines that ease some constraints.

The design criteria for on-system historically significant bridges must comply with the design criteria presented in Chapter 4 of the Roadway Design Manual. However, federal law allows flexibility in design criteria on a case-by-case basis when approved as a design exception.

TxDOT and FHWA have developed design criteria for off-system historically significant bridges in order to eliminate the need for some design exceptions. These design criteria can be found in Chapter 2 of the Historic Bridge Manual. Historic off-system bridges that cannot be upgraded to meet or exceed these minimum criteria may be considered for preservation projects on a case-by-case basis when approved as a design exception.

Some important planning considerations concerning historic bridge projects, including coordination with outside divisions and agencies as well as the project letting schedule, are discussed in the section titled Advanced Planning -- Considerations Based on Bridge Location in Chapter 4, Section 2. Moreover, TxDOT has developed specific procedures for the coordination of projects concerning historic bridges. These procedures can be found in the Historic Bridge Manual.

Bridges Not Funded by TxDOT

Bridges not funded by TxDOT but crossing TxDOT right-of-way must meet TxDOT design criteria. In these cases, the Bridge Division negotiates agreements between the State and the owner. The bridge project manager, in conjunction with the district, will coordinate a satisfactory agreement setting forth the financial responsibility and commitments, including maintenance and liability, of each party involved. Submit the PS&E to the Design Division in accordance with the usual PS&E and construction letting processes.

Chapter 4 — Advanced Planning

Contents:

Section 1 — General Considerations

Section 2 — Considerations Based on Bridge Location

Section 3 — Agreements and Permits

Section 4 — Utility Attachments

Section 1 — General Considerations

New Bridges

Follow the Bridge Division standard drawings in the planning of all structures when applicable.

A bridge consists of a superstructure and a substructure. The superstructure includes the bridge deck and beams. The substructure includes the cap and foundations of the abutments and the cap, columns, and foundations of the interior bents. Review the guidelines for selecting an appropriate superstructure and a discussion of substructures on the TxDOT website.

Superstructure. The superstructure is critical in the performance and cost effectiveness of a bridge. Many types of superstructure are used by TxDOT. Choosing an appropriate superstructure depends on factors such as:

- Span length
- Vertical clearance
- Hydraulics (freeboard)
- Speed of construction
- Economics
- Aesthetics

Span length requirements and vertical clearance are generally the controlling criteria when choosing the superstructure. Span lengths are determined based on bridge location, geography, and structural limitations. Vertical clearance is based on bridge location and federal and state requirements. General design criteria concerning span lengths, clearances, and other design features are discussed in Chapter 3, Preliminary Design Features, of this manual.

Speed of construction, economics, and aesthetics also influence the choice of superstructure. Construction times and costs vary for superstructures. The location of the bridge often influences use of aesthetics. (For more information, see the Landscape and Aesthetics Design Manual). Generally, the more aesthetically pleasing the bridge, the more it costs.

Substructure. The structural elements used in the superstructure often influence the design of the substructure. Substructure caps can be either steel or concrete, though concrete is most common. Concrete bent caps are rectangular or inverted tees, and their methods of construction are either conventionally reinforced cast in place, precast, or post-tensioned for larger spans. Steel is also used for integral caps and box caps of straddle bents that span a large distance.

The cap is supported by reinforced concrete columns, reinforced concrete piles, or steel piles, though reinforced concrete columns are the most common. Reinforced concrete columns can be

either single or multiple. Column selection depends on available construction space, right-of-way limitations, bridge width, stage construction, use of rapid construction techniques, and aesthetics. Consider use of three column bents where appropriate, such as for bridges over a body of water where there is a potential for scour or significant drift, and for bridges over roadways where there is a potential for vehicular impact with the columns.

The bent configuration and subsurface conditions determine an appropriate foundation type. Abutment foundations are usually prestressed concrete piles, steel piles, or drilled shafts. Foundations for multiple-column bents generally consist of concrete drilled shafts at each column. Single-column bent foundations consist of rectangular footings supported by drilled shafts or piles. Make the choice of foundation type as flexible as possible in preliminary planning to allow an economic design in the detailed plan preparation stage.

Chapter 4 of the Bridge Design Manual - LRFD discusses the use and design of substructures used by TxDOT.

Design Loads and Design Specifications. Load and Resistance Factor Design (LRFD) is a design methodology that makes use of load and resistance factors based on the known variability of applied loads and material properties. In 1994, the American Association of State Highway and Transportation Officials (AASHTO) published the first AASHTO Load and Resistance Factor Design Bridge Specifications. The Federal Highway Administration (FHWA) has mandated the use of LRFD for all bridges on which preliminary engineering is initiated after October 2007.

Use HL-93 design live load as described in the AASHTO LRFD Bridge Specifications unless design for a special vehicle is specified or warranted. Design widenings for existing structures using HL-93. Load-rate existing structures using the appropriate AASHTO method as defined in the TxDOT Bridge Inspection Manual. Show load rating and design loads on the bridge plan, for example HS-21.5 (Existing) and HL-93 (New).

For routes where heavy truck traffic is expected, such as on North American Free Trade Agreement (NAFTA), routes use a design load of HL-93. LRFD and HL-93 provide a more rational design and a better model of live loads expected along NAFTA routes than previously used loadings such as HS-25.

New superstructures, substructures, and culverts are currently designed using LRFD. See the LRFD Bridge Design Manual for design recommendations and the Bridge Division website for standard drawings developed for HL-93.

Modification of Existing Structures

Modifications such as widening, strengthening, or raising a structure are often required to meet increasing traffic demands at existing bridges. Modifications of bridge projects funded by any category of funding may occur only after an analysis of the following:

- An appraisal of the structural adequacy and condition of the existing structure
- An economic study of replacement versus modification
- A study of the method and handling of traffic during construction

Appraising the Existing Structure. Use the following procedure to determine the structural adequacy and condition of the existing structure:

1. Inspect the as-built plans to determine the load capacity.
2. Perform a load rating if plans indicate a design less than H20. Have qualified bridge engineers within the District perform the load rating, or request that the Bridge Division perform a load rating. A load rating is not required if plans indicate a design of H20 or greater unless the bridge was designed using Supplement No. 1 to 1944 AASHO Design Specifications for Texas Bridges (THD No. 1). For bridge-class culverts, a load rating is required only if the culvert carries direct traffic (2 ft. of fill or less). At a minimum, the bridge must be able to carry or be improved to carry an HS20 operating loading and must have condition ratings as follows:
   - Item 58 (Deck) - Rating greater than or equal to 4
   - Item 59 (Superstructure) - Rating greater than or equal to 5
   - Item 60 (Substructure) - Rating greater than or equal to 5
   - Item 62 (Bridge-class Culvert) - Rating greater than or equal to 5

     These criteria are minimum load rating criteria for an on-system bridge that does not require load posting. Do not widen and/or rehabilitate a bridge if load posting would still be required after work is completed, with the exception of historically significant bridges discussed later in this chapter.
3. Submit the load rating report to the Bridge Division project manager. Include the load rating calculations in the report, signed and sealed by a licensed professional engineer. Planning can continue only if the Bridge Division approves the load rating for the bridge.
4. Request that the Bridge Division perform a condition survey, or qualified bridge engineers within the District may perform the condition survey if the Bridge Division approves the load rating.
5. Submit the condition survey report to the Bridge Division project manager. The condition survey report must be signed and sealed by a professional engineer. The Bridge Division Field Operations Section Director will also consider the following factors in determining whether to rehabilitate or replace a structure:
   - HS inventory loading
   - Condition of the bridge as determined by the condition survey
   - Type of structure
   - Intended use (for example, average daily traffic, percent of truck traffic, location, etc.)

Plan development can continue only if the Bridge Division concurs with the condition survey recommendations. These criteria apply to all bridge types, including bridge-class culverts. Replace bridges with a load capacity that cannot be economically strengthened to an HS20 operating loading, with the exception of historically significant bridges discussed later in this chapter. Contact the Bridge Division project manager if division services are required.

Load Rating. The inventory load rating represents the heaviest loads that can safely use the bridge for an indefinite period of time. Use the load rating to determine if the structures can be considered a candidate for widening or rehabilitation pending a satisfactory condition survey. The district may perform the load rating or request the Bridge Division to perform the load rating.

Provide the following information to the Bridge Division project manager when requesting the Bridge Division to perform the load rating:

- Job number of the original bridge project
- Job numbers for any subsequent work performed on the structure
- Indication of existing and proposed overlay thickness
- National Bridge Inventory (NBI) structure number
- Map of bridge location
- Description and timeline of proposed work
- Project contact person and phone number

Include the following in the load rating:

- A review of the as-built bridge details, bridge details from subsequent work at the bridge, and Bridge Inspection Database records. Assume the load rating to equal the design loading indicated on the as-built bridge details under the following conditions:
  - As-built bridge details accurately represent the bridge.
  - Damage or deterioration has not weakened the bridge.
  - Overlay does not exceed 2 in.
  - Bridge was not designed using Supplement No. 1 to 1944 *AASHO Design Specifications for Texas Bridges* (THD No. 1).
- A signed and sealed report by the engineer of record. The report will include the following:
  - The load rating
  - Rating calculations; note method (load factor/working stress/load resistance factor) used in the calculations.

Condition Survey. The condition survey identifies structural deficiencies that prohibit a reasonable service life with normal maintenance. Note conditions of the foundation, substructure, and compo-

nents of the superstructure in this survey. The Bridge Division or qualified and experienced representatives of the District will conduct the condition survey.

Include the following in the condition survey:

- A written description of the following conditions as observed during the visual examination of the structure:
  - Settlement of the foundation
  - Spalling, cracking, or deterioration of the concrete and corrosion of the reinforcing steel in the substructure
  - Deterioration in steel protective systems (paints or coatings) and corrosion/section loss in the structural steel elements
  - Movement or rotation of the abutments due to approach slab or pavement movement
  - Any damage or defects of the beams or girders and bearings
  - Unsound concrete, cracking, delaminations, or efflorescence and depth and corrosion of the reinforcing steel in the top and bottom of the deck
  - Deterioration of the overlay due to defects or damage in the underlying concrete
- Photographs of the following:
  - Bridge ends
  - Bridge elevations
  - Bridge approaches
  - Problem areas
  - Views upstream and downstream, if applicable
- A review and analysis of the extent of the deficiencies and the feasibility of repair. Replacement is usually recommended if a 20-year service life cannot be predicted.
- A review of the hydraulic adequacy, if applicable

Where the condition survey indicates that restoration of the bridge deck is warranted, a more detailed field appraisal to further define the deficiencies may be recommended by the Bridge Division. This more detailed appraisal may require one or more of the following:

- Delamination detection to determine the extent of internal fractures of the concrete
- Determination of the extent of reinforcing steel corrosion
- Determination of areas with inadequate concrete cover over the reinforcing steel
- Chemical analysis to determine extent of chloride contamination

Important Considerations. Additional considerations include the following:

- Superstructure -- Bridge widenings should be of similar type construction to that of the existing structure. Prestressed beams are satisfactory for use in widening some common structures.
- Substructure -- The proposed foundation should be similar to that of the existing structure. This is particularly necessary where differential vertical movement in the foundation material can damage the widened facility.
- Bridge railing -- Replace or retrofit the railing on both sides to meet AASHTO Manual for Assessing Safety Hardware or National Cooperative Highway Research Program (NCHRP) 350 standards. This is required even if widening is to be done on one side only.
- Minimum design criteria such as vertical and horizontal clearances -- Modifications should normally not encroach on the waterway, highway, or railway clearances beneath the existing structure. Make every effort to maintain or improve the existing clearances; however, a design exception may be requested if the minimum clearances are not met.
- Asymmetric Widening -- The effects of widening one side only versus widening both sides.
- Flat slab bridges – Flat slab bridges designed with Illinois Bulletin 346 are not practical for phased construction due to the structural nature of the curb. Special design provisions will need to be considered if phased construction is deemed necessary.
- Establish the proposed roadway centerline -- Consult with the Bridge Division to determine an appropriate centerline. Factors that affect the location of the proposed centerline include: existing roadway alignment, embankment widening, and traffic control.
- Removing existing structures -- When an existing structure is replaced, the district determines if the state will retain salvageable material such as structural steel, railing, or timber. If the district elects not to retain salvageable material, transfer the material to the contractor in accordance with Texas Standard Specifications, Item 497, Salvageable Material.
- Removing paint -- Follow the procedures for determining whether the paint should be considered hazardous. If hazardous paint is identified, refer to Environmental Concerns – Hazardous Paints, later in this section, for more information. Contact the Construction Division's Materials and Pavements Section (CST/M&P) in the early stages of the planning process if the presence of hazardous paint is suspected or if there are any questions concerning the necessity of a separate painting contract.
- Abating asbestos -- Follow the procedures for the identification, notification, and abatement of asbestos. If asbestos is identified, make proper notification to the Texas Department of State Health Services. Perform asbestos abatement separately from the prime contract wherever possible. If possible, abate asbestos-containing material before construction begins. Refer to Environmental Concerns – Asbestos, later in this section, for more information. Contact the Bridge Division's Construction/Maintenance/Fabrication Branch in the early stages of the planning process if the presence of asbestos containing material is suspected or if there are any questions concerning the proper procedures to be employed.

Stage Construction

Replacing an existing bridge with a new bridge or widening an existing bridge often requires stage construction. Keeping lanes of the existing bridge open while the first phase of the construction of the new bridge takes place maintains minimum traffic needs. Each project may require unique solutions or have individual needs. These unknowns make the planning and design of stage construction a challenging process. The uniqueness of each project requires engineering judgment and experience in developing the bridge plans. Resolve any uncertainties early in the preliminary plan preparation stages.

The guidelines below on early planning, bridge layout and structural details, and design assist planners and designers with some aspects common to most stage construction projects.

Early Planning. Consider the following factors in early planning:

- Determine the need for stage construction early in the planning stages. Due to the complexity of stage construction, other solutions may be preferable.
- Identify the traffic control needs of the project prior to the development of the bridge layouts. Communication between the engineer responsible for traffic control and the design engineer is critical during the preparation of the bridge layouts and the construction sequence process. Temporary single lane crossings over a structure are used occasionally. Refer to Traffic Control Plan TCP (2-8)-12 standards.
- Leave exact breakback locations up to the designer, if possible.

Bridge Layout and Structural Details. Proper plan preparation is essential in both producing a quality product and adhering to the letting schedule.

- The individuality of each project necessitates the need for greater detail in the structural plan. Do not leave decisions up to the contractor unless as specified in the structural detail notes. Provide thorough details for complex construction or unique solutions to avoid any confusion.
- Delays often result due to the lack of information in the layouts. The Bridge Plan Review Process -- Preliminary Bridge Layout Review (see Chapter 5) section of this manual contains guidelines for preparing bridge layouts for projects that include staged construction.

Design Guidelines. Design guidelines can be found in the Preliminary Design Features -- General Features (see Chapter 3) section of this manual.

Detour/Temporary Crossing Structures

If a project must maintain traffic during bridge replacement and staged construction is not feasible, provide a temporary structure to handle traffic during construction of the new structure.

Temporary bridge structures are not a common element in most bridge projects. Careful coordination between the bridge designer, the traffic control engineer, the environmental coordinator, and the bridge project manager should occur early in the process to properly design these structures.

A common type of temporary structure is the pre-engineered, pre-manufactured, modular structure Pre-manufactured bridges come in a variety of span lengths, widths, and load carrying capabilities. Depending on the size involved, they can usually be erected with a minimum of heavy construction equipment and a minimal amount of labor. Due to their modular nature, they are usually easy to transport and erect.

Another option is to build a new, temporary substructure alongside the existing structure and move the existing superstructure onto the temporary alignment as the detour. Then, the new bridge can be built on the existing alignment. Alternatively, a new superstructure can be built on temporary bents on the temporary alignment and used as a detour while the existing bridge is demolished. Then, once the new substructure is built, the new superstructure can be moved from the temporary alignment to the new substructure on existing alignment. These methods minimize the amount of time the road must be closed to traffic when replacing bridges on the existing alignment.

Temporary structures are sometimes constructed of the same types of structural elements found in permanent bridges, for example, prestressed box beams as well as steel I-beams. It is almost impossible to determine in advance what type of structure will be most economical in a particular situation. It is, therefore, best not to design a particular type of temporary structure but to allow the contractor to provide the temporary structure needed.

If the project allows the contractor to provide the temporary bridge for a project, the plans must include certain items:

- The required number and width of traffic lanes and the required design loading
- The alignment of the temporary structure
- Any special requirements, such as limits on fill, right-of-way, or other environmental restrictions

Economic Comparisons and Alternate Designs

A cost-per-square-foot comparison among structure types during the initial planning stages of a project is a simple and quick way to compare structure options, and will assist in determining the most economical structure type. Bridge Unit Costs can be found on Bridge Division's web page at the following location: http://www.txdot.gov/inside-txdot/forms-publications/consultants-contractors/publications/bridge.html#unit. The Bridge Division will assist in furnishing current structure costs.

Providing alternate bid items is sometimes warranted. This allows the contractor to bid the most economical design. Allowing alternate bid items can require multiple designs of an item to be

shown on the plans. Examples include drilled shafts versus piles and double tee beams versus pan form girders. Alternate foundation designs are suggested for structures over $2 million unless experience has shown a particular foundation is warranted.

When considering bridge rehabilitation or widenings over replacement, a life-cycle cost analysis can be a prudent method of determining the best course of action. The Bridge Division project manager can assist with these calculations.

State versus Federal Oversight

Each year the Federal Highway Administration (FHWA) and TxDOT select a list of projects for which FHWA will have oversight through plan review and approval. All other projects will be TxDOT's responsibility. A list of each year's project selection can be found in the current FHWA oversight agreement.

If FHWA has oversight, submit the preliminary bridge layouts to the FHWA through the Bridge Division project managers. Add one month to the total lead time for projects including major bridges or unusual structures requiring FHWA headquarters approval.

Environmental Concerns

FHWA is responsible for assuring that the projects it funds do not have significant environmental impacts or, if they do, that appropriate action is taken. The following Environmental Affairs Division assessments, listed in order of investigative detail from least to most, may be requested:

- Categorical Exclusion (CE)
- Environmental Assessment (EA)
- Finding of No Significant Impacts (FONSI)
- Environmental Impact Statement (EIS)

For more information, see the Environmental Management System Manual and the Hazardous Materials in Project Development Manual. These manuals are internal to TxDOT, so if you need access, please contact the TxDOT District office with which you are working, or the Bridge Division project manager.

The Environmental Affairs Division (ENV) supports the district environmental coordinator. The environmental coordinator conducts assessments and works closely with the Bridge Division project manager when evaluating environmental concerns. This coordination should occur as early as possible in the project development process. The Environmental Permits, Issues, and Commitments (EPIC) sheet is initiated in the district in the preliminary project development stage to ensure that all environmental issues are addressed. To obtain information concerning access to the Texas Envi-

ronmental Compliance Oversight System (Texas ECOS) and EPIC, contact ENV. Such concerns may include the following:

Proximity to Hazardous Sites. An assessment of all potential right-of-way properties that could be contaminated with hazardous substances, as well as adjacent properties from which contamination could migrate should be conducted early in the planning stages when time and options remain to address these critical problems.

Hazardous Paint. Most of the early paint formulations used to paint steel components on bridges contained lead and chromium. Blast-cleaning operations are likely to create hazardous waste and worker protection requirements according to federal and state regulations. Previous blast cleaning of older bridges did not remove 100% of lead paint. Demolition and repair operations that require cutting (especially torch cutting) or welding of painted steel may release hazardous fumes. For all projects requiring removal, cutting, or welding of painted steel components, identify the type of paint on the structure prior to plans, specifications, and estimates (PS&E) submittal to the Bridge Division for review. If the structure ever had lead paint, it should be noted in the plans that lead paint and other hazardous materials are likely still present, blasting requires full containment and QP2 certification per Item 446. If complete painting records, including any spot-painting dating back to initial construction and painting, are not available to identify the type of paint on the structure, submit samples per Form Tex-819-B, http://ftp.dot.state.tx.us/pub/txdot-info/cst/TMS/800-B_series/pdfs/ctm819.pdf, to determine the potential hazards. Alternatively, testing for lead and other metals can be included in the scope of work when an asbestos consultant is retained to identify asbestos-containing materials prior to bridge demolition or renovation work.

Asbestos. Identify and address asbestos issues early in the project development to minimize impacts to construction and project costs. Many TxDOT projects are regulated under the National Emission Standards for Hazardous Air Pollutants (NESHAP) found in 40 CFR 61 Subpart M. According to the EPA, federal asbestos standards for renovation and demolition apply to demolition and renovation work on bridges. The Department of State Health Services (DSHS) is responsible for administering these regulations in Texas. Asbestos Containing Material (ACM) is defined as any material that contains greater than one percent asbestos based on examination by an approved laboratory method. Under the asbestos rules, an Asbestos Demolition/Renovation Notification Form must be sent to DSHS at least 10 working days prior to commencing demolition of a bridge structure, even when no asbestos is present. Notification is also required for renovation/abatement work that would disturb regulated asbestos containing material equal to or greater than the following quantities: 260 linear feet of pipe, 160 square feet on other components (coatings), or 35 cubic feet where length or area could not previously be measured. TxDOT has developed specifications and special provisions to address typical asbestos abatement work. In addition to EPA standards, worker health and safety issues must be considered whenever asbestos-containing materials are disturbed. Additional information is available in the Guidance for Handling Asbestos in Construction Projects found in ENV's Hazardous Materials Toolkit at: http://www.txdot.gov/inside-txdot/division/environmental/compliance-toolkits/haz-mat.html

Hydraulic Impacts. In order to comply with 23 CFR Part 650 Subpart A, provide a summary of complete hydraulic studies for the inclusion in environmental review documents.

Wetlands Impact. Under Section 404 of the Clean Water Act, the U.S. Army Corps of Engineers (COE) regulates the discharges of dredged or fill material into "waters of the U.S., including wetlands." Prior authorization is required from the COE to deposit dredged or fill material into wetlands or any "waters of the U.S." See 40 CFR 230.3 for definitions of the terms "wetlands" and "waters of the United States." Refer to Advanced Planning -- Agreements and Permits in Chapter 4 of this manual for additional information concerning COE requirements and Section 404 permits.

Storm Water Runoff. Bridge projects may be subject to storm water abatement requirements. The TxDOT publication Storm Water Management Guidelines for Construction Activities (TxDOT, 1993) details the department's procedures and recommended best management practices to be included in a Storm water Pollution Prevention Plan (SW3P) for proposed projects. The Hydraulic Design Manual contains useful information as well. Federal requirements can be found in 23 CFR Part 650 Subpart B.

Mitigation of Environmental Impacts. Bridge projects may require mitigation of environmental impacts by replacement of trees and other vegetation. This mitigation is eligible for federal funding under the same category of work as the original bridge project.

Because mitigation projects are usually let sometime after the bridge contract has been let or completed, it may be necessary to separate the mitigation contract from the bridge contract. Mitigation contracts are typically kept open for a period of about two years after planting to ensure that the plants take root and become established. Link the mitigation contract to the bridge project in order to receive reimbursement from FHWA.

The mitigation portion of the project will have its own FHWA project number and its own control-section-job (CSJ) number. FHWA form Federal Project Authorization and Agreement (FPAA) ties the bridge and mitigation contracts together. This form has a comment field to indicate that both contracts are connected to the same project. When the FPAA form is sent to the FHWA, explain in the cover letter that the mitigation contract is part of the bridge contract.

Although the mitigation project can be let in a different fiscal year than the bridge project, let the mitigation contract for construction as soon as it is reasonably practical in order to maintain continuity with the bridge project.

Historically Significant Bridges, Property, and Archeological Coordination. With the exception of most of the interstate system, federally funded projects involving historic bridges must comply with Section 4(f) of the United States Department of Transportation (U.S.DOT) Act of 1966 and with Section 106 of the National Historic Preservation Act of 1966. Therefore, TxDOT must coordinate with the State Historic Preservation Officer (SHPO) of the Texas Historical Commission (THC) and the FHWA to assess the effects of federally funded projects on historic resources. In addition, for state funded (non-federal) projects involving bridges that have been des-

ignated State Archeological Landmarks, coordinate efforts with the SHPO to assess the impact of the project on the landmark structure in accordance with the State Antiquities Act. Additional information concerning the requirements of Section 4(f) of the U.S.DOT Act of 1966, Section 106 of the National Historic Preservation Act of 1966 and the State Antiquities Act can be found in the Historic Bridge Manual.

Accessibility/ADA Considerations

Pedestrian bridges, bridges with sidewalks, and highway rest and picnic areas are the most common highway facilities that require Americans with Disabilities Act (ADA) and Texas Accessibility Standards (TAS) compliance. Features that must meet specific requirements include the following:

- Maximum curb ramp slope
- Cross slope and grade on sidewalks
- Minimum sidewalk clear width
- Sidewalk passing space
- Objects protruding into the sidewalk
- Location of curb ramps and sloped areas
- Diagonal curbed ramps
- Raised curbed islands
- Drop-offs (or curb heights) greater than 9 in.
- Handrails

Additional information on ADA and TAS requirements can be found in Chapter 2 of the Roadway Design Manual. However, always refer to the current Americans with Disabilities Act Accessibility Guidelines and Texas Accessibility Standards for complete ADA and TAS requirements.

Section 2 — Considerations Based on Bridge Location

Highway Grade Separations

A highway grade separation is a bridge that carries vehicular traffic over vehicular traffic. This type of structure is often referred to as an overpass or an underpass. For proper nomenclature of an overpass or underpass, refer to the Bridge Detailing Guide. These structures allow the highway to safely accommodate high volumes of traffic through intersections. Some controlling factors in the planning of a highway grade separation include highway geometry and the available right of way.

Visual distractions on a highway are hazards. For this reason, the grade separation structure should conform to the highway alignment and cross section. Limit its profile to grades that allow sufficient stopping sight distance. The transition from roadway to grade separation should be designed such that the driver's behavior is not altered by erratic changes.

The availability of adequate right-of-way may limit the possible structure types and construction processes, which can lead to increased costs. Stage construction may be required in locations with inadequate right-of-way. Additionally, considerations such as span lengths, soil characteristics, and skew may also affect the structure's design.

Structures over Streams

Bridges and culverts carrying vehicular traffic over a body of water are considered hydraulic highway facilities. When planning a structure over a body of water, consider each related hydraulic facility in the project as part of a total system conveying water. Related hydraulic facilities can include open channels, storm sewers, pump stations, and some reservoirs. See the Hydraulic Design Manual for discussions of hydraulic facilities.

Plan hydraulic facilities early in project development to uncover unusual problems that may become much more difficult to address at later stages. Early planning is particularly important with respect to highway location. Navigable stream and wetland crossings require permits from the U.S. Army Corps of Engineers (USACE) and the U.S. Coast Guard (USCG). Agreements must often be executed for storm sewer projects; facilities associated with reservoirs may also require special attention.

Culverts are closed conduits, usually with fixed flow lines, that can operate either under pressure or with a free surface flow. Bridges, as opposed to culverts, are not considered closed conduits. The flow line of a bridge is rarely fixed and the material along the flow line of a bridge is usually the same as the stream it crosses. Hydraulic considerations for bridges are discussed in Chapter 8 of the Hydraulic Design Manual. Preliminary design criteria for bridges over streams are discussed in Preliminary Design Features -- Features Based on Bridge Location, in Chapter 3 of this manual.

All culverts are designed similarly regardless of whether they exceed the 20-ft. length along the roadway centerline that causes them to be classified as bridges. Hydraulic considerations for culverts are discussed in Chapter 7 of the Hydraulic Design Manual. Acceptable types of culverts include the following: cast-in-place concrete box, precast concrete box, full-circle or elliptical pipe, pipe arch, structural plate, or approved long span culverts. Material for pipe, pipe arch, and elliptical shapes include steel, aluminum, aluminized steel, and concrete. Materials for structural plate and long span culverts may be galvanized steel or aluminum. General design criteria for culverts are discussed in Preliminary Design -- Features Based on Bridge Location in Chapter 3, of this manual.

Bridges and culverts are vulnerable to damage from flood related causes. To minimize the risk of damage, recognize and consider the hydraulic requirements of a stream crossing in all phases of project development, construction, and maintenance. Hydrologic and hydraulic analyses, including a scour analysis, are required for all new bridges over waterways, bridge widening, bridge replacement, and roadway profile modifications that may adversely affect the flood plain, even if no structural modifications are necessary. See Title 23 Code of Federal Regulations (CFR) Subpart C in conjunction with FHWA Technical Advisory T 5140.23, Scour at Bridges, for more information on this federal policy.

Hydrologic and hydraulic analyses typically include the following:

- An estimate of peak discharge. Complete runoff hydrographs may also be required.
- Water surface profiles of existing and proposed conditions used for design.
- Flood conditions.
- Potential for stream stability problems.
- Maximum predicted scour depth.

The thoroughness of a hydrologic and hydraulic study will depend upon the nature of the stream. After the study is completed, each district maintains the complete hydrologic and hydraulic design data for all waterway crossings. The scour report should also be added to the Bridge Inspection Database under the corresponding National Bridge Inventory (NBI) number. This complete file could include the following:

- Location
- Structure data
- Photos
- Cost estimates
- Runoff investigations
- General statements concerning historical high water
- Vicinity maps

- United States Geologic Survey quadrangles
- History of performance of existing structures
- Information on upstream control structures
- Pump station design, etc.
- Scour study (maximum predicted scour depth)

Show pertinent hydrologic and hydraulic design data for bridges, culverts, and storm sewers in the plans rather than on separate calculation sheets submitted with the plans, specifications, and estimates (PS&E) in order to facilitate review of the PS&E and assure a permanent record. Minimum requirements for these data can be found in the Hydraulic Design Manual. Bridge layout requirements of hydrologic and hydraulic design information can be found in the Preliminary Layout Approval Process in Chapter 5 of this manual.

Highway-Railroad Grade Separations

Highway structures that carry vehicular traffic over railroad traffic are referred to as railroad overpasses. Conversely, railroad underpasses are structures that pass vehicular traffic under railroads. Some concerns when planning a railroad overpass or underpass include the selection of the structure type, the horizontal and vertical clearance to the centerline of the track, the available right-of-way, drainage, train movements, skew angle, and the time required in coordinating with the railroad company.

The selection of the type of structure, either overpass or underpass, usually depends on the existing topographical conditions. Railroad underpasses present drainage problems, sometimes requiring the use of pump stations. Pump stations are very expensive and require maintenance for the life of the facility. Accordingly, avoid pump stations unless absolutely necessary. Railroad underpass construction also requires railroad shoofly construction to temporarily move the tracks while the bridge construction is completed. Shoofly construction is expensive and should be used only when necessary. Underpasses also reduce the flexibility to widen the roadway in the future. This construction type can be complex and increase the review time by the railroad. The timeframe for an overpass agreement to be executed is generally 12 to 18 months. An underpass agreement will take a minimum of 24 months.

Proper clearances are an important consideration in the early planning phase. In order to determine vertical clearance, it is important to determine the top of the highest rail elevation on the track for approximately 1,000 ft. in each direction from the roadway and for a greater distance if a change in railroad grade is proposed. If the railroad is on a curve, take the profile along the highest rail elevation on the track for overpasses, and along the lowest rail elevation on the track for underpasses. Include this information in Railroad Exhibit A, described below.

Railroad Exhibit A is included in the agreement that must be negotiated between TxDOT and the railroad company. Requirements for the preparation of Railroad Exhibit A, as well as the policy and practices concerning highway-railroad grade separation structures, can be found in the Rail-Highway Operations Manual. Some railroad companies may have additional requirements for Railroad Exhibit A. The railroad company reviews Railroad Exhibit A for its preliminary review of the bridge project. The Traffic Operations Division's Rail Safety Section (TRF-RSS) is the sole point of contact and Office of Primary Responsibility for all matters relating to agreements with the railroad companies. Submittal of all Exhibits needed in the execution of the various types of railroad agreements, including Exhibit A drawings for structures, must be coordinated through TRF-RSS. The District office submits Railroad Exhibit A drawings to TRF-RSS at least 12 months prior to the scheduled contract letting date to allow adequate time for negotiations and processing with the railroad company. Exhibits B are only needed for Railroad Underpass projects.

Examples of PS&E and Exhibit A and B submittals can be found at the following location: www.txdot.gov/inside-txdot/division/traffic.html and http://crossroads/org/TRF/_includes/documents/5-Sample_Exhibit_B.pdf, respectively. If you need assistance accessing the second link, which is internal to TxDOT, please contact the TxDOT District office with which you are working, or the Bridge Division project manager.

Railroads can have significant effects on a project, from design to construction. Railroad companies may require spans to be long enough to span the entire right-of-way to avoid adversely affecting train movements, and lack of usable right-of-way may necessitate stage construction. When possible, span the entire railroad right-of-way to alleviate railroad concerns regarding effects on train movements.

Railroad companies may object to the use of their right-of-way if it adversely affects train movements, which can have significant effects on project design. Spans may need to be long enough to span railroad right-of-way, and staged construction may be required due to the lack of usable right-of-way. In addition, special design requirements may be required to prevent runoff from draining onto railroad right-of way. Train movements can also affect the construction process. Address construction schedule and construction crew safety during the preliminary design phase. When possible, span the entire railroad right-of-way.

Pedestrian Bridges

Pedestrian bridges carry pedestrian traffic over an obstacle, usually vehicular traffic. The need for a pedestrian crossing is the major preliminary consideration. Consider preliminary design features such as vertical and horizontal clearance as well as pedestrian ramp approaches. Pedestrian bridges may be constructed of structural steel, reinforced concrete, prestressed concrete, or other suitable materials. Aesthetics are especially important in these structures because they are subject to public view from all sides and are usually unique within a neighborhood area.

Pedestrian structures under the roadway are discouraged unless the highway lanes are on a fill of 15 ft. or more. This type of structure presents problems of drainage and lighting and creates a condition where policing is difficult.

Additional information on Americans with Disabilities Act (ADA) and Texas Accessibilities Standards (TAS) requirements can be found in Chapter 2 of the Roadway Design Manual. However, always refer to the current Americans with Disabilities Act Accessibility Guidelines (ADAAG) and Texas Accessibility Standards for complete ADA and TAS requirements.

Historically Significant Bridges

Historically significant bridges are listed or eligible to be listed in the National Register of Historic Places. These bridges can be either on-system or off-system. Projects involving historic bridges involve many issues that must be resolved. These issues are discussed in further detail in the Historic Bridge Manual.

Contact the Bridge Division project manager as early as possible when historic bridge projects are involved. Some important considerations concerning historic bridge projects include coordination with other divisions, coordination with federal and state agencies, and the project letting schedule. TxDOT is required to allow the State Historic Preservation Officer (SHPO) of the Texas Historical Commission 30 days to review the final plans, specifications and estimates (PS&E) for all projects involving historic structures. Therefore, allow additional processing time for historic preservation projects. Contact the Environmental Affairs Division early in the process to give architectural historians time to schedule and perform surveys. Keep in mind that these projects can be environmentally cleared and approved for letting only after all SHPO comments have been addressed and incorporated into the final PS&E package.

TxDOT has developed minimum design criteria for off-system historically significant bridges. TxDOT also has developed specific procedures for the coordination of projects concerning historic bridges. These procedures can be found in the Historic Bridge Manual.

International Bridges

Consider the following aspects when planning an international bridge:

- The Texas Transportation Commission must approve an international bridge application.
- A Presidential Permit must be acquired.
- The International Boundary and Water Commission must approve the project.
- Coordination is necessary with Mexican governmental agencies, designers, and contractors.

Section 201.612 of the Texas Transportation Code requires an entity authorized to construct or finance the construction of an international bridge over the Rio Grande to obtain approval from the

Texas Transportation Commission (Commission) prior to seeking a Presidential Permit for construction. Title 43 TAC, Sections 15.70-15.76, specifies the process by which applicants submit an application.

Departmental Procedures. In order to comply with the rules requiring approval by the Texas Transportation Commission of an international bridge prior to requesting a Presidential Permit and to provide the 120-day response time required by legislation, TxDOT has designated the Transportation Planning and Programming Division (TPP) as the department liaison for international bridge applications. TPP has responsibility for providing findings and recommendations to the Commission. Aiding TPP in this responsibility will be the Bridge Division, the Environmental Affairs Division, the Financial Management Division, the Right-of-Way Division, and TPP's Freight Plan/International Trade Section. They will assist TPP in determining if an application is complete and provide subject matter expertise in analyzing the applications and providing recommendations to the Commission.

TPP provides the application form to applicants when requested. TPP then, immediately upon receipt of an application and the requisite 20 copies, date-stamps the application and copies; forwards one copy of the application to the designated points of contact in the Bridge Division, Environmental Affairs Division, Financial Management Division, Right of Way, and TPP's Freight Plan/International Trade Section; and sets a ten-working-day deadline from the date stamp for the division points of contact to determine if the application is complete.

NOTE: All subsequent references to "the date stamp" refer to the TPP date stamp specified in the preceding sentence.

If the application is incomplete, TPP will return all copies with a written response specifying deficiencies. When it determines that an application is complete or that a resubmitted application is no longer deficient, TPP will notify the applicant and the Governor's Office in writing that the application meets the requirements of Title 43 TAC, Section 15.74 and begins the analysis.

Division Responsibilities. TPP will take the following actions:

- Send a copy of the application to the Department of Public Safety, the Texas Commission on Environmental Quality (TCEQ), the Department of Agriculture, the Historical Commission, the Alcohol Beverage Commission, the Department of Commerce, and local government entities (county and municipal) where applicable, requesting comments be returned within 20 working days from receipt at the Governor's Office.
- Send a copy of the application to the Governor's Office, requesting comments be returned within 20 working days from receipt at the Governor's Office.
- Request analysis and the written results of that analysis from each division and special office named above within 45 days of the date stamp.
- Send an application to and request analysis and the written results of the analysis from the appropriate district(s) and metropolitan planning organization(s) (MPOs). Application and

results of analysis must be returned to TPP within 20 working days of receipt at the district or organization.

- Coordinate with the Office of General Counsel (OGC) to schedule, advertise, and conduct public hearings within 45 days of the date stamp.
- Compile and summarize public hearing comments within 65 days of the date stamp.
- Analyze compliance with the state transportation plan and, if appropriate, with the regional transportation plan developed by the MPO having jurisdiction over the project within 65 days of the date stamp.
- Compile and summarize responses from state agencies, divisions, district(s), MPOs, and local government entities within 65 days of the date stamp.
- Prepare and send staff response, along with recommendation for the Transportation Commission action, to the executive director through the deputy executive director/chief engineer.
- Coordinate with OGC to prepare documents and include on the Transportation Commission meeting agenda recommended action no later than 120 days from the date stamp (the Commission must act within 120 days of the date stamp).
- Notify the applicant and Governor's Office in writing of the Transportation Commission action within two working days after the Commission meeting.

The Bridge Division will:

- Provide a primary and an alternate point of contact for analyzing international bridge applications.
- Upon receipt of an application from TPP, screen applicable sections for completeness and respond in writing to TPP no later than ten working days from the date stamp.
- Upon receipt of TPP request, analyze the design portion of the application to ensure bridge and roadway are designed to accepted standards and specifications.
- Provide written analysis and recommendations to TPP no later than 45 days from the date stamp.
- Assist TPP in preparing for the Transportation Commission meeting.
- Coordinate with the Design Division.

The Financial Management Division will:

- Provide a primary and an alternate point of contact for analyzing international bridge applications.
- Upon receipt of an application from TPP, screen applicable sections for completeness and respond in writing to TPP not later than ten working days from the date stamp.
- Upon receipt of TPP request, analyze the financial portion of the application.

- Provide written analysis and recommendations to TPP not later than 45 days from the date stamp.
- Assist TPP with preparing the Transportation Commission meeting.

The Environmental Affairs Division will:

- Provide a primary and an alternate point of contact for analyzing international bridge applications.
- Upon receipt of an application from TPP, screen applicable sections for completeness and respond in writing to TPP not later than ten working days from the date stamp.
- Upon receipt of TPP request, analyze the environmental portion of the application to ensure environmental considerations have been addressed or mitigated.
- Provide written analysis and recommendations to TPP not later than 45 days from the date stamp.
- Assist TPP with preparing for the Transportation Commission meeting.

The Right of Way Division will take the following actions:

- Provide a primary and an alternate point of contact for analyzing international bridge applications.
- Upon receipt of an application from TPP, screen applicable sections for completeness and respond in writing to TPP not later than ten working days from the date stamp.
- Upon receipt of TPP request, analyze the design portion of the application to insure right-of-way issues have been adequately addressed.
- Provide written analysis and recommendations to TPP not later than 45 days from the date stamp.
- Assist TPP with preparing for the Transportation Commission meeting.

TPP's Freight Plan/International Trade Section will:

- Provide a primary and an alternate point of contact for administrative and protocol coordination with Mexican officials and entities concerning international bridges and for analyzing international bridge applications.
- Provide to divisions the review, comment, and analysis of any politically sensitive issues, protocol considerations, or other factors related to any Mexican documents or data submitted as part of an application.
- Upon receipt of TPP request, analyze the written commitments from Mexican federal, state, and local jurisdictions concerning their abilities to provide necessary transportation infrastructure.

- Provide a written analysis and recommendations to TPP not later than 45 days from the date stamp.
- Assist TPP with preparing for the Transportation Commission meeting.

Bridges with Adjacent States

In crossings of the Red River and the Sabine River where they form the boundaries between Texas and Oklahoma, Arkansas, Louisiana, or New Mexico, the Bridge Division project manager serves as negotiator for necessary agreements between the states.

The design, construction, and maintenance of each bridge are the responsibility of Texas or the bordering state. The responsible state for each bridge is shown in Table 4.1.

Table 4-1: Responsibility for Bridges with Adjacent States

Responsible State	Location	Highway	TX District	AR District	LA District	OK District
Texas	New Boston/Forman	TX 8/AK 41	ATL	03		
Texas	Joaquin/Logansport	US 84	LFK		04	
Texas	Toledo Bend Reservoir	TX 21/LA 6	LFK		08	
Texas	Burkville/Burr Ferry	TX 63/LA 8	BMT		08	
Texas	Orange/Vinton	IH 10	BMT		07	
Texas	Sabine Lake	TX 82/LA 82	BMT		07	
Texas	Oklaunion/Davidson	US 183	WFS			05
Texas	Burkburnett/Randlett	IH 44/US 277/281 NB	WFS			07
Texas	Gainesville/Marietta	US 77 NB & SB/IH 35	WFS			07
Texas	Denison/Durant	US 75 NB & SB	PAR			02
Texas	Clarksville/Idabel	TX 37	PAR			02
Texas	Illinois Bend/Courtney	TX FM 677/OK SH 89	WFS			07
Texas	Dekalb/Harris	US 259	ATL			02
Arkansas	Texarkana/Ashdown	US 59 SB	ATL	03		
Louisiana	Newton/Merryville	US 190	BMT		07	
Louisiana	Deweyville/Starks	TX 12/LA 12	BMT		07	
Oklahoma	Quanah/El Dorado	TX 6/OK 6	CHS			05
Oklahoma	Burkburnett/Randlett	IH 44/US 277/281 SB	WFS			07
Oklahoma	Clay/Waurika	TX 79/OK 79 (Main) TX 79/OK 79 (Relief)	WFS			07

Table 4-1: Responsibility for Bridges with Adjacent States

Responsible State	Location	Highway	TX District	AR District	LA District	OK District
Oklahoma	Ringgold/Terral	US 81	WFS			07
Oklahoma	Whitesboro/Madill	US 377	PAR			02
Oklahoma	Vernon/Altus	US 283	WFS			05
Oklahoma	Bonham/Durant	TX 78/OK 78	PAR			02
Oklahoma	Paris/Hugo	US 271 NB & SB	PAR			02
Oklahoma	Grayson/Bryan	Carpenter's Bluff (Off)	PAR			
Oklahoma	2.8 mi N of FM 680	Hollis Rd (Off)	CHS			

NB = Northbound
SB = Southbound
Off = Off-System

Although each state is responsible for a specific bridge, the costs for design, construction, and maintenance are shared between the two states. The cost of the bridge approaches, however, is the responsibility of the state in which they are located.

The responsible state prepares the PS&E, processes the letting of the project for construction, and provides routine and major maintenance for the bridge after it is constructed. Each state shares in 50% of the cost of design, construction, and major maintenance expenses.

Planning a bridge project with an adjacent state requires the following actions in this sequential order:

General Information. The project must meet federal requirements if federal funds are used to finance the project.

- The project must be on the State Transportation Improvement Plan (STIP) of each state.
- The project must be on the Unified Transportation Program (UTP).
- A Commission minute order authorizing the State of Texas to enter into an agreement with another state is necessary whenever a bridge is constructed on new location, when a bridge is being replaced, or when a major rehabilitation project (such as redecking or widening) is planned.

Agreement. An agreement between the responsible state and the partner state is required prior to beginning planning for construction of a new bridge at a new location, for replacing an existing bridge, or for conducting a major rehabilitation such as redecking or widening. No agreement is required for maintenance contracts. The responsible state for each bridge located on the border between Texas and another state is defined in Table 4-1.

- The Bridge Division project managers coordinate the negotiations with the other state and prepare and process the agreement for execution when Texas is the responsible state.
- As stated in the TAC Title 43, Part 1, Chapter 15, Subchapter E, Rule 15.55, for off-system bridges, local cost participation is not required for a bridge connecting Texas with a neighboring state.
- The governor of Texas must execute all bridge project agreements between Texas and another state.

Plan Development. The responsible state (Table 4-1) will prepare preliminary and final plans, specifications, and estimates of cost subject to the approval of the State of Texas and FHWA.

- Each state will pay one-half of the cost of the bridge, as well as the full amount of its respective approach roadway costs on its respective side of the state line.
- A separate control-section-job (CSJ) number for the bridge and each approach (three total) is required.
- For federally funded projects with state oversight, a Federal Project Authorization and Agreement (FPAA) must be signed before obligation of preliminary engineering funds.
- Each state will, at no cost to the other state, secure necessary right-of-way, relocate all utilities, and identify and remove all known hazardous materials to accommodate that portion of the project on the respective side of each state.
- Bank protection, jetties, or similar work required to protect the bridge or its approaches or to hold the river channel to its present course will be considered as a part of maintenance of each bridge, whether such work may be located wholly in one state or the other.
- The project must be environmentally cleared.

Letting. The responsible state (Table 4-1) prepares the PS&E, processes the letting of the project for construction, and provides routine and major maintenance for the bridge after it is constructed.

- For federally funded projects with state oversight, a Federal Project Authorization and Agreement (FPAA) must be signed before obligation of project funds. In addition, a state Letter of Authority (LOA) must be signed before letting. For federally funded projects with federal oversight, each state must obtain its own LOA from Federal Highway Administration (FHWA) and provide participating adjacent states with a copy at least three weeks before letting.
- Any prospective bidder who is qualified under the requirements of either state will be considered by the other state as being qualified and eligible to bid on the project and will be provided with proposals upon request.
- At a time to be agreed upon by the parties, and subject to the approval of FHWA, the project shall be publicly advertised for bids. The project must be advertised in accordance with federal requirements as well as the laws of both states. Each state shall issue public notice of advertisement that bids are to be received on the project. The responsible state shall provide the adjacent

state with a copy of the legal advertisement the number of days specified in the agreement prior to the proposed letting date for publishing in the state official journal.

- Copies of the bid tabulations for all bids received shall be provided to the adjacent state for review.
- Both the Texas Transportation Commission and the highway authority of the other state must approve award of the contract.

Construction. The responsible state (Table 4-1) prepares the PS&E, processes the letting of the project for construction, and provides routine and major maintenance for the bridge after it is constructed.

- The adjacent state will reimburse the responsible state for the design costs and engineering costs for the adjacent state's share on a monthly progressive estimate basis expressed in certified invoices furnished by the responsible state.
- All invoices received by the TxDOT will be directed to the respective TxDOT Area Engineer (AE) for review of work progress.
- The responsible state will transmit to the State of Texas appropriate documentation of the services provided by the responsible state. Funds requested from the State of Texas for services provided by responsible state shall be made available within 30 days from receipt of the request.
- Once approved by the TxDOT AE, the invoice will be sent to the Financial Management Division for processing.
- The construction contract and required personnel for all construction engineering and supervision will be administered by the responsible state.
- Final acceptance of the project shall be subject to both states.

Post-Construction. After completion of the project, it shall be operated and maintained by both states for use by the public without charge or toll.

- Each party shall maintain the roadway approaches to its respective end of the bridge.
- Each state shares in 50% of the cost of design, construction, and major maintenance expenses, except that each state is 100% responsible for costs associated with design, construction, and maintenance of the respective bridge approaches of each state. The responsible state provides routine maintenance at no cost to the other state. "Routine maintenance" is defined as maintenance cost that is less than $5,000. "Major maintenance" is defined as maintenance cost that is $5,000 or more; or as defined in the agreement. The responsible state must contact the other state for its concurrence before performing any major maintenance work.

Federally Funded Off-System Bridges

As a rule, off-system bridge projects administered by TxDOT have federal fund participation. Most of these projects consist of replacement or rehabilitation of structurally deficient or functionally obsolete deficient bridges funded with a combination of federal-local or federal-state-local funds, with the federal funds from the Highway Bridge Program. However, TxDOT does administer a relatively small number of other off-system bridge construction projects with federal funding from the Surface Transportation Program (STP).

Coordinate with the local government when planning off-system bridge projects, particularly when using funds from the Highway Bridge Program. An appropriate agreement between the State and local government must be executed before any work can be performed on an off-system project funded from the Highway Bridge Program. In addition to specifying the responsibilities of the two parties in the performance and funding of the work, the agreement provides for advance payments by the local government of its share of the project funding responsibilities. The agreement also allows a local government to use equivalent-match projects as payment toward its share of project funding.

The current standard agreements may be obtained from the Contracts and Purchasing Division's standard contracts web page at the following link (internal to TxDOT): http://crossroads/org/GSD/Contract%20Services/Standard%20Contracts/default.htm. If you need assistance accessing this web page, which is internal to TxDOT, please contact the TxDOT District office with which you are working, or the Bridge Division project manager. Title 43 TAC, Sections 15.52 and 15.55 provides more information about the Off-State System Highway Bridge Program agreements and cost participation.

Off-system bridges with adjacent states are funded 100% by a combination of federal and state funds, or 100% by state funds. No local government contribution on the Texas side of the bridge is required.

See Chapter 3 of this manual for more information regarding the administration of off-system bridge projects.

Interchanges

An interchange is a system of connecting roadways, including one or more grade separation structures, which allows uninterrupted movement of traffic between two or more roadways, generally highways.

Planning considerations concerning interchanges include those considered for highway grade separation structures. The type of interchange to use is also a major consideration. Selection of interchange type is a matter of roadway design and is influenced by factors such as the existing terrain, availability of right of way, cost, and roadway classification, among other considerations.

Common types of interchanges, as well as suggestions on their use, are covered in Chapter 3 of the Roadway Design Manual. AASHTO's "A Policy on Geometric Design of Highways and Streets" also discusses interchanges.

Additional time is required to review plans for interchange projects because of the complicated features, which can include aesthetics. In order to ensure that the preliminary bridge layout contains the appropriate level of detail, and to maintain the letting schedule, always refer to the Preliminary Bridge Layout Review Process in Chapter 5 for bridge layout information and the Table 6-1 Submission Schedule in Chapter 6 for appropriate lead times.

Overhead Sign Supports

Do not locate overhead sign supports on bridges, if possible. If such location is required, indicate on the bridge layouts a cantilever-type overhead sign support (COSS) founded on a bent cap or on an isolated concrete column on drilled shaft, or an overhead sign bridge (OSB) attached directly to the bridge superstructure. The location of any overhead sign support on bridges requires special design by the Bridge Division.

If overhead support for a dynamic message sign (DMS) is required, determine the appropriate DMS type and its attachment details before completing the detailed project design. Consider whether walkways or light fixtures are required. Configure the DMS on the truss to minimize the horizontal offset between the DMS and the truss. Mount the DMS on a Balanced Tee-type COSS or on an OSB. Do not mount the DMS on a single cantilever-type COSS. Mounting a DMS on an OSB requires a special OSB design by the Bridge Division in addition to the attachment design required if the DMS is to extend over a bridge.

Position sign support brackets for retrofit of signs along existing rails at bridge overpasses such that the bottom edge of the sign panel and support bracket do not encroach on the existing vertical clearance of the bridge.

Do not mount a closed circuit television (CCTV) on a tube protruding from an OSB or a COSS because of wind or traffic-induced vibrations. These vibrations may be more pronounced when the OSB or COSS is mounted directly to a bridge superstructure.

Utility Structures

Interstate Highways. Where it would be more economical to carry utility lines across a freeway in a tunnel or on a bridge rather than in separately trenched and encased crossings, provide a separate structure for the utility crossing. Such a structure may serve a joint purpose as a utility and pedestrian facility and/or sign support. In providing a utility tunnel or bridge, the following conditions should be met:

- Isolate mutually hazardous transmittants, such as fuels and electric energy, by compartmentalizing or by auxiliary encasement of incompatible carriers.
- Conform the utility tunnel or utility bridge structure design, appearance, location, bury, earthwork, and markings to the culvert and bridge practices of the department.
- Where a pipeline on or in a utility structure is encased, the casing must be effectively opened or vented at each end to prevent possible build-up of pressure and to detect leakage of gases or fluids.
- Take additional protective measures where a casing is not provided for a pipeline on or in a utility structure, such as employing a higher factor of safety in the design, construction, and testing of the pipeline, than would normally be required for cased construction.
- Communication and electric power lines must be suitably insulated, grounded, and preferably carried to a manhole located beyond the backwall of the structure. Insulate carrier and casing pipe from electric power line attachments.
- Install shut-off valves, preferably automatic, in lines at or near ends of utility structures unless segments of the lines can be insulated by other sectionalizing devices within a reasonable distance.
- Utility companies must agree that any maintenance, servicing, or repair of the utility lines will be their responsibility.

Non-interstate Highways. If utility lines have their own easement and it would be more economical to the department, adjust the lines across a highway by use of a utility tunnel or bridge. Where the utility lines are on a public right-of-way by sufferance and the adjustment of the utility is the sole responsibility of the private or public utility company, the department may permit the provision of a utility structure without cost to the department provided the same conditions outlined for Interstate Highways and all other pertinent requirements are met. If a structure is to serve as a joint utility-pedestrian crossing or a joint utility-sign support structure, the department will participate to the extent necessary for accommodation of pedestrians and highway signs only.

Section 3 — Agreements and Permits

U.S. Army Corps of Engineers

Section 10 of the Rivers and Harbors Act of 1899 (33 USC 403) empowers the Corps of Engineers (COE) to regulate all work on structures other than bridges or causeways that affect the course, condition, or capacity of navigable waters of the United States. This term includes those waters defined as navigable by the U.S. Coast Guard (USCG) but may also include rivers that were historically navigable or that with modification may be available for future use to transport interstate commerce. The determination of navigability will be made by each COE district engineer and is available upon request.

Typical activities for which a project might require authorization under this law include the following:

- Stream modifications to achieve better bridge alignment
- Dredging
- Bank stabilization
- Spur dikes
- Piling
- Dolphins
- Piers
- Haul roads

Additionally, other structures not directly associated with a bridge but affecting a navigable waterway as defined by the COE may also require authorization under this law.

The COE also regulates the discharge of dredged or fill material into all waters of the United States including adjacent wetlands under Section 404 of the Clean Water Act (33 USC Section 1344). The term “waters of the United States” includes all components of a surface tributary system as well as any additional waters or wetlands the loss or degradation of which could affect interstate commerce. See 40 CFR 230.3 for a definition of “waters of the United States.” For waters or wetlands not part of a tributary system, determination of jurisdiction by the appropriate COE district engineer may be needed. The COE may also provide the location and limits of any wetland affect by planned projects. Note that bridges, even though approved by the Coast Guard, require authorization under Section 404 if dredged or fill material is to be discharged in their construction. Some Section 404 permits that are commonly required include Nationwide Permits, General Permits, and Individual Permits.

Certain federal-aid projects may be classified as categorical exclusions and permitted by a special Nationwide Section 404 Permit issued to the Federal Highway Administration (FHWA). These permits are subject to special conditions and management practices. Further information can be obtained from Bridge Division project managers. Most bridge projects, including rehabilitation and replacement projects, fall into this classification.

Normally TxDOT obtains the Section 404 Permit for the bridge itself. The contractor may also need a permit depending on the method of construction. On projects where it is anticipated that the contractor's construction method may require a permit, it may be desirable to include the work in TxDOT's application. For example, fill required for a temporary construction road can be included as part of the individual permit. This procedure may save both time and expense during construction.

The Environmental Affairs Division coordinates the Navigable Waterway and Section 404 Permit application processes as required by the COE. Thus, it is crucial to have Environmental Affairs Division involved in the early planning stages to identify the necessary permits and begin the application process.

U.S. Coast Guard

Section 9 of the Rivers and Harbors Act of 1899 empowers the United States Coast Guard (USCG) to regulate the construction of bridges and causeways within or across navigable waterways as determined by that agency. This regulation includes the approval of plans and the issuance of permits. FHWA, however, has the authority to determine if a USCG permit is not required.

In the state of Texas the principal navigable waterways involved include:

- Gulf of Mexico bays
- Gulf Intracoastal Waterway
- Trinity River from the Gulf of Mexico to Fort Worth
- Several ship channels serving the Gulf of Mexico

Most rivers and streams entering the Gulf of Mexico are technically navigable for a specified distance inland from their mouth. If a project is planned for any of these principal waterways, it is important to have both FHWA and the USCG involved early in the planning process.

For all crossings of these navigable waterways, observe the following procedures:

- Determine clearances and general features affecting the waterway for both new structures and modifications to existing structures with USCG.
- Obtain a formal permit to construct a highway facility from the proper USCG district.

- The TxDOT district will prepare permit applications and transmit the original tracings of these applications to the Environmental Affairs Division for handling with the USCG.

The USCG web page has vertical and horizontal clearances for specific waterways. Contact the Environmental Affairs Division for further information on US Coast Guard permits, including permit requirements and procedures.

Environmental Protection Agency

The Environmental Protection Agency (EPA) administers and issues permits for non-point source pollutants associated with industrial activities (construction) and Municipal Separate Storm Sewer Systems (MS4) permits. For further information, contact ENV for details on requirements for permits and the most current agreements.

Railroad

The Traffic Operations Division's Rail Safety Section (TRF-RSS) is the Department's Office of Primary Responsibility for railroad issues, and it works closely with the District and Bridge Division project manager in preparation of state-railroad agreements involving structures.

TRF-RSS works closely with the Bridge Division project manager regarding negotiations with the railroad companies in connection with the preparation of agreements and securing force account estimates often required with the following types of projects and agreements:

- Highway-railroad grade separation agreements
- Spur track agreements
- Automatic warning system agreements
- Agreements for relocation of existing highway-railroad protective devices
- Construction and reconstruction of culverts under railroad tracks and other drainage improvements
- Drainage system agreements and common ditch agreements
- Agreements or permits for the interconnection of highway traffic signals with railroad flashing light signals
- Agreement for replacement of highway-railroad grade crossing, including any adjustment of track grade
- Railroad force account agreements for new highway or highway reconstruction projects including planking, pole line adjustments, relocation of existing highway-railroad warning systems and State's right to cross railroad property
- Agreement to enter railroad company right of way for surveying and/or drilling soil borings

International Boundary and Water Commission

The International Boundary and Water Commission (IBWC) has jurisdiction along the boundary between the United States and Mexico. Submit work proposed within the flood plain and adjacent to the main channel of the Rio Grande where it forms the international boundary between the United States and Mexico to IBWC for its review and approval before any work is done. Submit preliminary notifications and plans of proposed work and facilities at appropriate times to the Bridge Division project manager for processing with the IBWC. Licenses or agreements will be prepared when appropriate for highways crossing or encroaching upon the IBWC flood control facilities along the Rio Grande.

Natural Resources Conservation Service

The Natural Resources Conservation Service (NRCS) can construct reservoirs that may affect our highways. The NRCS always operates with a local sponsor, and where the floodwater-impeding structures built by this agency affect our highways, the local sponsor bears the cost of raising, relocating, or protecting our highways in accordance with the following policy:

- If a highway or road operated by TxDOT will be inundated at less than the calculated fifty-year frequencies by construction of a floodwater-impeding structure, NCRS or one of its cooperating agencies usually provides funds necessary to raise or relocate the road above the water surface elevation that might be expected at fifty-year frequency intervals.
- If a highway or road operated by TxDOT will not be inundated by floods of less than a fifty-year calculated frequency, TxDOT will underwrite this hazard for the general welfare of the state and continue to operate the road at its existing elevation until such time as interruption and inconvenience to highway travel necessitates raising the grade.

The Bridge Division project manager, assisted by the district, will negotiate for a satisfactory settlement.

Navigation Districts, Water Districts, Irrigation Districts, Water and River Authorities

Where the State, Navigation District, Water District, Irrigation District, or Water and River Authority undertake construction that affects the rights of another, the Bridge Division project manager negotiates a satisfactory agreement setting forth the financial responsibility and commitments of each party involved.

Local Government Agencies

For bridges within the boundaries of a local government yet under the jurisdiction of TxDOT (on-state system), the two entities must negotiate a Municipal Maintenance Agreement to determine and fix the respective responsibilities of the department and the local government for maintenance,

control, supervision, and regulation of these designated state highways. Municipal Maintenance Agreements are coordinated through the Maintenance Division. If the project has an advanced funding agreement (AFA) addressing these issues, a Municipal Maintenance Agreement is not necessary.

When a local government is responsible for providing financial assistance for a highway improvement project, TxDOT and the local government will enter into an agreement. Standard AFAs can be obtained from the Contracts and Purchasing Division web page.

Contact the Financial Management Division Letting Section to request a control-section-job (CSJ) number prior to the initiation of any agreement. The Contracts and Purchasing Division's Negotiated Contracts Policy Manual establishes procedures for negotiating, preparing, executing, administering, and closing out the agreement for the bridge project and describes the responsibilities of the districts and the divisions involved in the project.

Agreements between the State and a local government are also necessary when dealing with historically significant bridges. Examples of such agreements can be found in the Historic Bridge Manual. Historic bridge amendments and agreement templates can be obtained from the Contracts and Purchasing Division web page.

Louisiana, Arkansas, Oklahoma, New Mexico

Where either Texas or an adjoining state undertakes construction along the Texas border that affects the rights of the other, the Bridge Division project manager negotiates a satisfactory agreement setting forth the financial responsibility and commitments, including maintenance and liability, of each party involved. Additional information can be found in Advanced Planning -- Considerations Based on Bridge Location, in Chapter 4 of this manual.

Mexico

Presidential Permits are required to convey permission for construction and maintenance of facilities connecting the United States with Mexico. Although TxDOT has no direct interaction with Mexico that involves agreement negotiation, several TxDOT divisions are involved in the Presidential Permit process. Further information on Presidential Permits, and the application process, can be found in the paragraph titled Advanced Planning -- Considerations Based on Bridge Location, in Chapter 4 of this manual.

Interaction and coordination with the International Boundary and Water Commission occurs when proposed work falls within the flood plain and adjacent to the main channel of the Rio Grande, where it forms the international boundary between the United States and Mexico.

Section 4 — Utility Attachments

Overview

To every extent possible, do not attach utility lines to bridges and separation structures because the proliferation of such lines and their maintenance constitutes a hazard to traffic and complicates widening or repair. Attaching utility lines to a highway structure can materially affect the structure, the safe operation of traffic, the efficiency of maintenance, and the overall appearance.

Where other arrangements for a utility line to span an obstruction are not feasible, the department may consider the attachment of such line to a bridge structure. Any exceptions that are permitted will be handled in accordance with the conditions set forth in Title 43 TAC, Section 21.35 and 21.37 (relating to utility structures) and other pertinent requirements contained therein. Each such attachment will be considered on an individual basis and permission to attach will not be considered as establishing a precedent for granting of subsequent requests for attachment.

The Bridge Division is the Office of Primary Responsibility for all utility attachments. The executed attachment agreements will be housed in the Bridge Inspection Database under the corresponding structure number.

TxDOT enters into agreements for utility attachments to on-system bridges only. Utility attachments to off-system bridges are handled by the owner of the bridge, usually a county or city government.

Guidelines

The following guidelines govern attachment of utilities to bridges.

Communication Lines. When it is impractical to carry a self-supporting communication line across a stream or other obstruction, department policy permits the attachment of the line to its bridges. On existing bridges the State generally requires that the line be enclosed in conduits and located on structures such that it does not interfere with stream flow, traffic, or routine maintenance operations. When a request is made prior to construction of a bridge, suitable conduits will be provided in the structure if the utility company bears the cost of all additional work and materials involved.

When a line is attached to a bridge, the State will enter into an agreement with the utility company.

In urban areas where it is the State's responsibility to provide for the adjustment of communication lines or conduits to accommodate the construction of a highway and the adjustment provides for the placement of communication conduits in a highway grade separation structure, the department will allow a reasonable number of spare communication conduits in the structure provided the spares

are placed at the time of construction and the communication company bears the cost of these spare conduits.

Where highway construction makes it necessary to relocate communication conduits and the proper adjustment, in the opinion of the department, provides for the placement of communication conduits in the highway grade separation structure, the department will permit the communications company to install replacement conduits and a reasonable number of spares in the structure provided such conduits are placed at the time of construction and provided the company bears any extra structure cost occasioned by the presence of the communication conduits.

Gas or Fuel Lines. No gas or liquid fuel lines may be attached to a bridge or grade separation structure without the specific approval of the TxDOT Executive Director.

Power Lines. Power lines are not permitted on bridges under any condition with the exception of low-voltage distribution lines where the cost of independent facilities to carry these lines would be prohibitive. For this requirement, low-voltage lines must carry 600 volts or less.

Utility Pipelines. When a municipality or utility company requests permission to attach a pipeline to a proposed bridge prior to construction, and the added load is sufficient to require an increase in the strength of the structure or use of more costly materials or type of construction, the utility owner is required to pay for the increase in cost.

When a utility company requests permission to attach a pipeline to an existing bridge, sufficient information should be furnished to allow a stress analysis to determine the effect of the added load on the structure. Other details of the proposed attachment as they affect safety and maintenance should also be presented. If the bridge structure is not of adequate strength to carry the increased weight or forces within a factor of safety, permission will not be granted.

Temporary Water Lines or Saltwater Pipelines. Temporary water lines are sometimes requested to be attached to bridges by companies in the oil and gas industry. When a company requests permission to attach a temporary water line to an existing bridge, sufficient information should be furnished to perform a stress analysis to determine the effect of the added load on the structure. Other details that affect safety and maintenance of the proposed attachment should also be presented. Details of the proposed attachment to the bridge should be signed and sealed by a Texas registered professional engineer. If the bridge structure is not of adequate strength to carry the increased weight or forces within a factor of safety, permission will not be granted.

Requests for Attachments. All requests for attachments to bridges or structures should originate from the utility company with an application to the appropriate district engineer.

For attachments to structures within active projects, the district engineer should forward requests for attachment along with recommendations to the Bridge Division project manager for review and concurrence. Adequate justification, including details and an estimate for an independent utility crossing, should accompany the submission. If the attachment is allowed, the Bridge Division proj-

ect manager will prepare a suitable agreement and forward it to the district for partial execution with the utility company. Modification of the structural details to accommodate the utility and the responsibility of cost will be developed by the utility's engineer. Where applicable, the Bridge Division project manager will coordinate the submission with the district. In addition, use and occupancy agreement forms will be required as cited in Title 43 TAC, Section 21.52 (relating to Forms–General) and Title 43 TAC, Section 21.54 (relating to Use and Occupancy Agreement Forms).

Attachment Locations. Recommended attachment locations are on the overhang, as close as possible to the outside beam, or behind the outside beam. Behind the outside beam is preferred. Hanging lines on the outside of the beams is not aesthetically pleasing and may be subject to vandalism. Attachments to water crossing structures should be placed on the downstream side where exposure to high water is less likely.

Bridge attachments should not be made to any bridge rail or rail hardware, including anchor bolts. This will eliminate the need to get the owner of the attachment involved when bridge rail repair is performed.

Do not hang lines from the bottom of beams. This decreases freeboard and increases the likelihood of damage.

It may be beneficial to carry lines across an obstruction using a utility structure rather than an attachment to a structure.

Coordinating the Agreement

The district engineer can approve a utility attachment and submit the request, with district recommendation, directly to the Bridge Division project manager. The Bridge Division project manager coordinates the request with assistance from the Design Section and the Right of Way Division. The Design Section conducts a structural review and a review of the details. The Bridge Division project manager handles the negotiations and prepares the agreement.

The Federal Highway Administration (FHWA) has specified that on-system projects must adhere to the Utility Accommodation Policy (UAP) codified as Title 43 TAC Sections 21.31-21.56. Sometimes full compliance with the UAP is unattainable. In such cases an exception must be certified by the district director of Transportation Planning and Development and authorized by the Right of Way Division director using the form entitled Certification for Utility Accommodation. Requests for exceptions will be considered only when it is shown that extreme hardship or unusual conditions provide justification and when compensating or alternative measures can be taken in keeping with the intent of these sections. All exception requests made to the districts must be fully documented with design data, cost comparisons, and other pertinent information. Off-system projects should comply with the UAP when possible; however, off-system projects may utilize local codes, policies, and customary practices when representing the public's best interests. If local codes, poli-

cies, or practices are used instead of the UAP, a Utility Accommodation Policy Declaration form must be completed and included with the utility agreement.

Although there is no initial fee or rental charge, attachments will be made at no cost to the state. All expenses will be the responsibility of the utilities. Any additional cost due to modification of the bridge structure to accommodate the attachment must be borne by the utility company. This cost or method of determining the cost will be established in advance and shown in the agreement.

Exhibits attached to the request should include drawings showing location, type, size, and weight of the line, attachment details, and safety features. Exposed portions of an attachment must be of non-corrosive material or must be protected from corrosion by an acceptable method such as hot-dipped galvanizing, if appropriate. Pipelines and conduits must not impede the flow of water through a structure or the movement of traffic, either pedestrian or vehicular, and must be located so as not to interfere with routine maintenance operations.

Maintenance of utility attachments to a bridge is the responsibility of the utilities. Installation and maintenance of utility attachments will be conducted so as not to inconvenience or interfere with highway traffic and will comply with governing laws and TxDOT regulations and policies. During attachment installation or maintenance, all traffic controls should comply with the Texas Manual on Uniform Traffic Control Devices for Streets and Highways.

Exhibits submitted by the district to the Bridge Division project manager should include the following:

- Details on how the line is attached to the bridge -- (Utility Attachment Exhibit A)
  - Show proposed location of attachment on elevation view of bridge layout
  - Show specific detail of attachment to bridge with appropriate notes to the contractor
  - The Utility Attachment Exhibit A must be signed and sealed by a licensed professional engineer
- Identification of control, section, and original job number of the bridge if possible
- National Bridge Inventory (NBI) number of bridge
- Copies of bridge layout and pertinent details of existing bridge as-built plans (if available)
- Once the agreement has been executed by the utility company, the TxDOT district bridge engineer will forward the 2 signed copies including the request and attachment detail sheets to TxDOT's Bridge Division project manager for processing. Both copies will be signed by the TxDOT Bridge Division director for full execution. The Bridge Division is the Office of Primary Responsibility for all utility attachments. The executed attachment agreements will be housed in the Bridge Inspection Database under the corresponding structure number.

United States Geologic Survey -- Gauging Stations

The Bridge Division project manager must approve requests by the United States Geologic Survey or other public or private agencies for gauging stations to be located on or near highway stream crossing bridges. These requests are handled by permit after approval is received from the district. A stipulation of the agreement is that the gauging equipment will be removed upon 30 days' notice when it is necessary to widen, repair, or reconstruct the bridge. Notify the bridge project manager of any proposed work that will require removal or relocation of a gauging station.

Accordingly, the only reasons that USGS would not be granted access would be special situations such as pending maintenance, widening, repair, or removal of the structure which would also negatively affect the gauging station. The proper procedure for requesting a location agreement is:

- USGS selects a gauge location and then determines whether or not the location is on TxDOT ROW. County, city, and private roads are not TxDOT controlled; USGS must contact the entity that owns the structure.
- USGS determines which TxDOT district is responsible for the structure by going to the TxDOT website (www.txdot.gov) or contacting the TxDOT Bridge Division's project manager for assistance.
- USGS contacts the TxDOT district office with information identifying the structure. The contact at the TxDOT district office should be either the district bridge engineer or the district hydraulics engineer. The TxDOT engineer will contact the appropriate area engineer and maintenance supervisor for coordination.
- The TxDOT district office will provide USGS the as-built drawings of the respective bridge within 10 working days of USGS's request at no charge.
- USGS supplies the details for attachment of a gauging station to the selected TxDOT structure. The detail sheets shall be signed and sealed by a Texas licensed professional engineer. Proof of insurance is neither required nor requested because USGS is a function of the U. S. Government Department of the Interior.
- The TxDOT district bridge engineer will forward the request and attachment detail sheets to the Bridge Division project manager for processing. A copy of the agreement, signed by the TxDOT Bridge Division director, will be forwarded to USGS for its files within 10 working days of receiving the respective district's approval of the attachment details.
- The Bridge Division is the Office of Primary Responsibility for all USGS bridge attachments. The executed attachment agreements will be housed in the Bridge Inspection Database under the corresponding structure number.

These procedures apply to any attachment by USGS to any TxDOT structure or within its ROW, regardless of how minor the attachment may be. TxDOT must review and approve all attachment methods and designs to insure that they do not compromise the structural integrity of the bridge or the intended function of the guard fence, and are not located in such a manner as to interfere with

the traveling public or cause a safety concern. TxDOT is responsible for the safe design, installation, and maintenance of everything located within state highway ROW.

Texas Water Development Board

The Bridge Division project manager must review and approve requests by the Texas Water Development Board for water quality stations to be located on or near highway stream crossing bridges. These requests are handled by permit after approval is received from the district. A stipulation of the agreement is that the station will be removed upon 30 days' notice when it is necessary to widen, repair, or reconstruct the bridge. Notify the Bridge Division project manager of any proposed work that will require removal or relocation of a Texas Water Development Board water quality station.

Counties and Municipalities

When either the state or a local government wishes to place an attachment to a structure within the other's right of way, the Bridge Division project manager will coordinate the agreement process with assistance from the Bridge Division Design Section and the Right of Way Division. A satisfactory agreement will set forth the financial responsibility and commitments, including maintenance and liability, of each party involved.

Chapter 5 — Bridge Plan Review Processes

Contents:

Section 1 — Preliminary Bridge Layout Review

Section 2 — Bridge PS&E Review

Section 3 — Bridge Cost Information Review

Section 1 — Preliminary Bridge Layout Review

Overview

Preliminary bridge layout review (PBLR) and approval is required for **all bridges**, regardless of funding type, before any detail work is performed. The review typically takes two weeks from the date of submittal. The layout is reviewed by the following:

- The Design Division's Field Operations Section reviews the layout for roadway items, such as:
  - roadway width
  - compliance with approved schematic
  - vertical and horizontal curvature
  - Americans with Disabilities Act (ADA) requirements
- The Design Division's Hydraulics Branch reviews the layout for hydraulic items, such as
  - design frequency
  - Federal Emergency Management Agency (FEMA) requirements
  - hydraulic methodologies used
- The Bridge Division's Geotechnical Branch reviews the layout for geotechnical items, such as
  - types of foundations
  - soil borings
  - retaining walls
  - scour analysis (including the calculation for scour depth)
- The Bridge Division's Design Section reviews the layout for structural items, such as
  - beam types
  - span lengths
  - crash-tested railings
- A Bridge Division project manager keeps a record that the layout was submitted, should further questions arise during plan development.
- The Federal Highway Administration (FHWA) requires review and approval of the preliminary bridge layout when they have oversight.
- If a railroad is involved, the layout (Railroad Exhibit A of the railroad agreement) is sent to the railroad company for their review and approval.

If the bridge is programmed for Category 6 funding, verify that it is eligible for one of the four funding programs listed in Chapter 2 of this manual.

During the final Bridge Cost Information (BCI) review, the Bridge Division project managers verify that all design and funding issues identified during the preliminary bridge layout review have been resolved so that the project can proceed to letting. If the bridge is not eligible for the funding category or is not CONSTRUCT-authorized, the project cannot be let for construction. If there is a design problem requiring redesign of the bridge, the project may need to be pulled from the letting if there is not enough time to correct design issues. Avoid jeopardizing project letting dates by resolving all outstanding issues at the time of the preliminary layout review and not during the PS&E stage.

Refer to the Bridge Detailing Guide for Preliminary Bridge Layout criteria, Completed Bridge Layout criteria, and typical layouts. Complete and submit the Information Sheet for Structural Design (Form 2252) with all preliminary layouts for projects to be designed by the Bridge Division or their consultant pool.

The preliminary bridge layout submittal process is as follows:

1. The district bridge engineer must approve preliminary layouts prior to submission.
2. The layout is submitted to the Bridge Division's PS&E Review Branch for approval.
   a. Email the submittal of PBLR folder link in ProjectWise to BRG_PD_PSE@txdot.gov
   b. Email Subject: PBLR, CSJ, County
3. The layout is approved when Division review comments are resolved.

Begin work on bridge detail sheets only after receiving final approval of the bridge layouts from the Bridge Division.

Layout Approval Information

In addition to the requirements shown in the Bridge Detailing Guide, the following information is necessary for layout approval.

Stream Crossings. Submit the scour analysis envelope and calculated scour depth with the preliminary bridge layout.

Bridge Widenings. For bridge widenings, include the following in the layouts:

- Existing bridge widths and lengths
- Width of existing bridge to remain and width of widening shown on plan view and typical section
- Existing foundations and extents of scour
- Appropriate thickness of asphalt level-up coarse shown on the transverse section, if applicable

If stage construction is required, refer to stage construction requirements below.

Stage Construction. Show stage construction geometry and sequence on the bridge layouts, including proposed lane widths and temporary rail locations for each stage. Include existing bridges and foundation locations on the layouts. Use additional sheets if necessary.

Railroad Overpasses/Underpasses. For railroad overpasses or underpasses, submit the preliminary bridge layout to the Bridge Division, and submit Railroad Exhibit A to the Traffic Operations Division's Rail Safety Section (TRF-RSS). Exhibit A includes the preliminary bridge layout and additional plan sheets required to obtain railroad company approval. See "Railroad Exhibit A Submission Requirements" later in this chapter for additional information. The preliminary bridge layout should place emphasis on the following items:

- Location of railroad tracks and right-of-way
- Intersecting mileposts of railroad and stations of roadway center lines
- Railroad milepost marker and Department of Transportation crossing identification number
- Elevation at top of rail
- Vertical and horizontal clearances from center line of track
- Railroad track profile
- Direction of increasing railroad milepost
- Proper title block indicating Railroad Exhibit A
- Indication if grade-separation structure eliminates a highway-railroad at-grade crossing with active warning signals
- Location of crashwalls, if required
- The Railroad Requirements for Bridge Construction sheets

Interchanges and Complex or Unusual Projects. Provide accurate geometric information on the plan and profile for roadways beneath structures for complicated designs such as braided ramps or interchanges. This information is vital to structural design because the types of bents required, such as straddle, single column, offset columns, etc., depend on the geometry of underlying roadways.

Retaining Walls. Preliminary layouts for retaining walls are required when the maximum height exceeds 25 ft. Submit preliminary layouts for walls and slopes undergoing certain types of ground-stability improvement measures for review. Such measures include the following:

- Removing and replacing more than 5 ft. of soil.
- A requirement for earth reinforcements exceeding 70% of the wall height.
- Use of dynamic compaction, wick drains, stone columns, geopiers, surcharging, or other measures to improve ground below walls or embankments.

Include justification in the preliminary submission for ground improvement, including soil testing and analysis leading to the decision to use ground-improvement techniques, as well as analysis of the ground improvement itself.

Bridge Division Submission Requirements

Submit all structures to be let under a single project as one submittal to ensure uniformity of design and eliminate duplication of standards. Submittal requirements for typical bridge layouts and those involving a railroad are listed below.

The transmittal e-mail from the District to the Bridge Division's PS&E Review Branch must contain the following information:

- District (both letting district and designing district, if different)
- County
- CSJ
- Facility and feature crossed
- Ready-to-let date and proposed letting date
- Project type (new construction, rehabilitation, replacement, widening, etc.)
- Bridge designer (district, division, consultant)
- Point-of-contact information
- Request for review
- Any relevant information that the division may need to complete its review
- Preliminary bridge layout
- Typical sections sheet
- Construction sequence sheet
- Hydraulic plan sheets that include hydrology and hydraulics for simpler hydraulic models
- Hydraulic reports and HEC RAS models for more complex hydraulic models
- The hydraulic report and scour analysis for all span bridges over a stream crossing. Also include the total calculated scour depth.
- Plan and profile sheets showing the project limits and the completed original of Form 1002 (p. 3 of 3) for all projects funded by Category 6.
- A map view of the project illustrating the relationship of the roadways if the project is an interchange or an interchange exists within the vicinity
- The Railroad Exhibit A plan sheets, if applicable. Exhibit A must also be submitted to the Traffic Operations Division's Rail Safety Section.

Federal Compliance Submission Requirements

The Federal Highway Administration (FHWA) requires TxDOT to submit preliminary structural layouts to FHWA for review and approval as follows.

The Bridge Division submits to the FHWA Texas Division for approval all preliminary structural layouts for all bridges, major geotechnical features and major hydraulic structures on projects for which FHWA has retained oversight. A list of these projects is available from the Design Division.

For all other projects, the FHWA Texas Division and the FHWA Headquarters Office of Bridge Technology approve preliminary documents for unusual bridges and structures, including the following:

- Difficult or unique foundations
- New or complex designs with unique operational or design features
- Bridges with span lengths greater than 600 ft.
- Cable-stayed or suspension bridges
- Bridge types that deviate from AASHTO specifications
- All vehicular tunnels
- Bridges with major supporting elements of ultra-high strength materials
- Geotechnical structures featuring new or complex wall systems or ground improvement systems
- Hydraulic structures involving complex stream stability measures
- Designs or design techniques that are atypical or unique

Include the following items in the preliminary documents for unusual bridges and structures submitted by TxDOT to FHWA:

- Description of structure-related environmental concerns and suggested mitigation
- Studies of bridge types and span arrangements
- Approach span-bridge layout plans and profile sheets
- Controlling vertical and horizontal clearance requirements
- Roadway geometry
- Design specifications used
- Special design criteria
- Special provisions
- Cost estimates

- Hydraulic and scour design studies and reports showing scour prediction and related mitigation
- Geotechnical studies and reports and information on substructure and foundation types

Railroad Exhibit A Submission Requirements

If a railroad is involved, Railroad Exhibit A is sent to the railroad company for preliminary review and approval of the bridge project. Railroad Exhibit A is included in the agreement that must be negotiated between TxDOT and the railroad company. The Traffic Operations Division's Rail Safety Section (TRF-RSS) is the sole point of contact and Office of Primary Responsibility for all matters relating to agreements with the railroad companies. They are responsible for the submittal of all Exhibits needed in the execution of the various types of railroad agreements, including Exhibit A drawings for structures. The District office submits Railroad Exhibit A drawings to the TRF-RSS at least 12 months prior to the scheduled contract letting date to allow adequate time for negotiations and processing with the railroad company.

Requirements for the preparation of Railroad Exhibit A, as well as the policy and practices concerning highway-railroad grade separation structures, can be found in the Rail-Highway Operations Manual.

Examples of Exhibit A submittals are located at the following link: www.txdot.gov/inside-txdot/division/traffic.html

Section 2 — Bridge PS&E Review

Overview

As of September 2013, the Bridge Division will provide a 30, 60, 90, 95, and/or 100% review of any bridge project at the request of the Districts. A bridge project is defined as any project which includes structural items in the PS&E. Structural items include the 400 Standard Specification Series and the 4000 Special Specification Series. The 400 Items are contained in Part II, Construction Details, Division IV, Structures, of the Standard Specifications for Construction and Maintenance of Highways, Streets and Bridges. The 4000 Items are statewide, district-wide, and project-specific items pertaining to structures not covered in the standard specifications.

The Bridge Division review typically takes two weeks from the date of submittal. The submitted PS&E is reviewed by the following branches, as applicable at the given percentage of the PS&E development:

- The Bridge Division's PS&E Review Branch reviews the PS&E for the following:
  - proper format of estimate
  - inclusion of all bid items in estimate
  - inclusion of all needed specifications
- The Bridge Division's Construction/Maintenance/Fabrication Branch reviews the PS&E for structural items, such as:
  - proper material application
  - proper use of specifications
  - bridge repair details
  - constructability
- The Bridge Division's Geotechnical Branch reviews the PS&E for geotechnical items, such as:
  - soil borings
  - foundations design
  - retaining wall design
  - scour mitigation details
- The Bridge Division's Design Section reviews the PS&E for structural items, such as:
  - bridge details
  - appropriate use of standards
  - revisions to standards
- A Bridge Division project manager reviews the PS&E for Category 6 eligibility, if applicable.

The Bridge Division PS&E submittal process is as follows:

1. The district bridge engineer must approve PS&E prior to submission.
2. The PS&E is submitted to the Bridge Division PS&E Review Branch for review.
   a. Email the submittal to the lead PS&E Review Engineer.
   b. Email Subject: XX%, PS&E, CSJ, County
3. Division review comments are sent to the Districts for their consideration.

The current fiscal year's PS&E schedule is available on the Bridge Division's internal Project Development web page. The current fiscal year's Letting schedule is located on both TxDOT's external web page and the Bridge Division's internal Project Development web page.

NOTE: *Access to the internal website is available only to TxDOT personnel. If you need assistance accessing these internal documents, please contact the District with which you are working, or the Bridge Division project manager.*

It is essential to prepare proper plans, specifications, and estimates (PS&E) in order to prevent delayed letting dates. For information on projects with no bridge bid items, refer to the PS&E Preparation Manual, which contains general requirements for PS&E. Requirements specific to projects containing structural items are provided below to further assist in PS&E preparation.

Plans

For projects with bridge plans, follow these preparation guidelines.

- Obtain preliminary bridge layout approval prior to any percent PS&E submittal. Include preliminary retaining wall layouts with this submittal when necessary. See Section 1 of this chapter for more information.
- Include bridge plan sheets prior to submitting final PS&E for review.
- Ensure information on the title sheet corresponds with information on Design and Construction Information System (DCIS).
- Include the most current standards. All standards used must be clearly listed on the index of sheets even if unavailable at the time of submission.
- All modified (MOD) and special (SPL) standards must be signed and sealed by the responsible engineer. Include a brief description of the modifications, typically shown in the Revisions area of the title block.
- Show all hydraulic documentation correctly in the final plans as required by the Hydraulic Design Manual. Hydraulic comments based on the preliminary submissions must be addressed prior to submitting final PS&E.

- For projects involving a highway-railroad grade separation, an executed railroad agreement is required prior to letting. On federal oversight projects, send a copy of the agreement to the Federal Highway Administration (FHWA). Further information concerning railroad agreements can be found in Chapter 4 of this manual.

Specifications

For projects with bridge specifications, follow these preparation guidelines.

- List approved names and addresses of manufacturers of proprietary designs included in a project.
- For projects involving a railroad agreement, it may be necessary to add a fiber optics note when required by the executed railroad agreement. The Traffic Operations Division's Rail Safety Section will specify the requirement for the fiber optics note during the PS&E review process.
- Special provisions and special specifications must be in Rich Text Format and in the appropriate template. See the following link for templates: http://www.txdot.gov/inside-txdot/division/construction/txdot-specifications.html
- **New special specification or special provision.** After determining that standard specifications and any approved existing special provisions (SP) or special specifications (SS) do not cover the specific work item required in a bridge project, request a proposed new SS or SP. See the Memo dated July 15, 2015 on the Bridge Division's internal Project Development web page for more information.

NOTE: Specification Item 6 contains general information on how to handle hazardous materials.

Estimates

Prepare an estimate using the following guidelines and methods described in the Project Development pages of the Bridge Division's internal website.

All bid items pertaining to each bridge or bridge-class culvert must be broken out and listed separately.

- **Estimate items.** Show the following items on the estimate:
  - Items participating and not participating in federal aid
  - Include the new NBI number in the estimate.
  - Reference existing NBI numbers so that the appropriate costs of each existing bridge can be captured.
- **Bid items.** Cost estimates for bridge work are shown on the DCIS P4 screen. Bridge items, including bridge-class culvert structures, are broken-out separately from roadway items. This

break-out arrangement provides information requirements for the reporting of bridge construction cost information to the Federal Highway Administration, Legislature, Commission, Administration and users within the department, and other public agencies.

- **New bid codes.** A new bid code may be requested if there is no existing bid code that covers the specific work item required in a bridge project. See the memorandum dated July 15, 2015 on Bridge Division's internal Project Development web page for more information.
- **Alternate bid items.** Contact the Bridge Division plan review engineer for preparing estimates with alternate bid items.

Final PS&E

The Districts are responsible for the preparation, final review, and submission of the ready-to-let bridge PS&E package. Once the District Engineer has signed and sealed the bridge project, the plans will be submitted to the Design Division to process for letting.

It is imperative to enter information on the BCI screen and P3B screen correctly so that staff can calculate the unit cost data for all bridge projects and to ensure federal reimbursement on any federally participating bridge projects. Section 3 of this chapter provides the information needed to enter this data into DCIS accurately. Please contact the Bridge Division's PS&E Review Branch if you have any questions.

For bridge projects with Federal Highway Administration (FHWA) oversight, the District will submit the final (100%) PS&E for FHWA's review a minimum of six weeks prior to letting.

If a bridge project crosses railroad ROW, the District will submit a final (100%) set of railroad approved plans to the Traffic Operations Division a minimum of six weeks prior to letting for inclusion in the Exhibit B set of PS&E in the railroad agreement. Exhibit B railroad agreements are only needed for Railroad Underpass projects. Examples of railroad PS&E and Exhibit B submittals are located on the TxDOT internal website here: http://crossroads/org/TRF/_includes/documents/5-Sample_Exhibit_B.pdf

For assistance accessing these or other internal website documents, please contact the District with which you are working, or the Bridge Division project manager.

Section 3 — Bridge Cost Information Review

Overview

As of September 2013, the Bridge Division performs the Bridge Cost Information (BCI) review for all projects with bridge-class structures. The review is conducted just prior to the Financial Management Division's submittal for the Federal Project Authorization and Agreement (FPAA) for construction.

As noted in Form 1002, Districts should submit final bridge layout sheets and an estimate of all bridge structures to the Bridge Division's PS&E Review Branch for all projects with bridge structures, including bridge-class culverts. For projects using Category 6, also include final Plan and Profile sheets.

The BCI data is used to determine the cost per square foot (unit cost) of the bridge. This break-out arrangement provides information requirements for the reporting of bridge construction cost information to the Federal Highway Administration, Texas Legislature, Texas Transportation Commission, TxDOT Administration and users within the Department, and other public agencies. The FHWA requires each state to report the average unit cost for bridges constructed each year and uses this information to determine how much bridge funding each state receives annually.

The Bridge Division review will typically take one week from the date of submittal. The BCI information is reviewed by the following branches:

- The Bridge Division's PS&E Review Branch reviews the BCI submittal for items such as
  - proper format of estimate
  - accurate entry of the BCI and P3B screen in DCIS
- The Bridge Division project manager reviews the BCI submittal for items such as
  - PBLR approval
  - Category 6 eligibility and approval for the applicable funding program

The Bridge Division BCI submittal process is as follows:

1. The District Bridge Engineer must approve final PS&E prior to submission of the BCI review.
2. The BCI is submitted to the Bridge Division's PS&E Review Branch for review.
   a. Email the submittal to the lead PS&E review engineer.
   b. Email Subject: BCI, CSJ, County
3. Approval of the bridge project funding is sent to the Financial Management Division.

NOTE: *The internal website is available only to TxDOT personnel. For assistance with accessing this site, please contact the District with which you are working, or the Bridge Division project manager.*

Guidelines for BCI Screen Entry

Cost estimates for bridge and bridge-class culvert work are shown on the DCIS P4 screen. The BCI data is used to determine the cost per square foot (unit cost) of the bridge. This information is also used to determine the unit cost for a particular type of bridge, which is used by bridge designers to select the type of superstructure most economical for a particular location, and to prepare estimates for similar bridge projects.

As mentioned above, the BCI is important data that is used to ensure bridge funding and provide good estimates for funding allocations; therefore, it is important that the BCI data is accurate. For more detailed information about how to enter this data, please use the pertinent memoranda on the internal Bridge Division Project Development web page: http://crossroads/org/brg/PD/index.htm.

The following information is required on the BCI screen for all bridge projects

- Type of bridge work (replacement, widening, rehabilitation, maintenance, repair, and new)
- National Bridge Inventory (NBI) number. Include the existing NBI for replacement projects.
- On or off state system
- Type of bridge
- Deck area
- Cost percentage
- Bridge length

Detailed step-by-step instructions can be found on the internal Bridge Division Project Development web page.

Assessment of Bridge-Class Structure Deck Area

Enter the deck area into the mainframe BCI estimate for every bridge-class structure. TxDOT must be able to calculate the unit price of various bridge-class structures in order to seek adequate reimbursement from FHWA. To achieve this accuracy, BRG has developed a uniform method for all Districts to follow when calculating the deck area (sq. ft.) of a bridge-class structure. These instructions demonstrate how to enter the bridge deck area into the Bridge Cost Information (BCI), card type 12, so that only the relevant bridge item costs are attributed to the bridge portion of the project.

Examples of bridge deck calculations are available here on the Bridge Division's internal Project Development web page.

Roadway Items Excluded from Bridge Item Estimate

To calculate the unit cost of a bridge project accurately, the bid items need to be divided in the appropriate manner. FHWA's memorandum (HIBS-30) dated February 9, 2016, provides the proper breakout of bridge items from roadway items. Below are the roadway items that should be excluded from the bridge item estimate.

Do not include the following items in the bridge item section of the estimate:

- Mobilization
- Demolition of existing structure (Item 496)
- Bridge approach slabs (only include in the bridge items if the approach slab is integral with the abutment)
- Stream channel work such as riprap, slope paving
- Earthwork relating to channel excavation
- Clearing and grubbing
- Retaining walls not attached to, or not for the protection of, the abutments
- Guardrail transitions to bridges
- Maintenance and protection of traffic
- Detour costs
- Signing and marking
- Lighting
- Electrical Conduit
- Inlet frames and grates
- Field office
- Construction engineering items
- Training
- Right-of-way
- Utility relocations
- Contingencies

Include the following item with the bridge items section of the estimate:

- Riprap if needed for abutment protection *only*

The most current federal requirements can be found on the Bridge Division internal Project Development web page at http://crossroads/org/brg/PD/index.htm

If you need assistance accessing any of the internal website documents referenced in this chapter, please contact the District with which you are working, or the Bridge Division project manager.

Chapter 6 — Bridge Project Development Reference Information

Contents:

Section 1 — Bridge Project Development Submission Schedules

Section 2 — Requests for Development of Bridge and Geotechnical Work

Section 3 — Other Relevant Information

Section 1 — Bridge Project Development Submission Schedules

Submission Schedules

The estimated duration for the submission of preliminary bridge layouts and project development is provided in the table below. This table assists with ensuring the project is completed in time for scheduled letting.

Table 6-1: Typical Bridge Project Development Submission Schedule

Work Type	Typical Overpass	Typical Stream Crossing	Railroad Overpass	Railroad Underpass	Widenings/ Rehabs	Interchanges
Condition survey, load rating calculation, deck cores, etc.					3 months	
Division PBLR review	2 weeks	2 weeks	2 weeks	2 weeks	2 weeks	2 weeks
FHWA PBLR review	1 month	1 month	1 month	1 month	1 month	2 months
Railroad Exhibit A approval			12 months	24 months		
Bridge plan preparation and scheduling	3 months	3 months	3 months	4-5 months	3-5 months	7-12 months
District review and comments	1 month	1 month	1 month	1 month	1 month	1 month
PS&E processing	3 months	3 months	3 months	3 months	3 months	3 months
Total lead time required before letting	8 months	8 months	20 months	33-34 months	11-13 months	13-18 months

Table 6-2: Specific Geotechnical Project Development Schedule

Work Type	Small Scale	Large Scale	Specialty/Other
Borings: Bridge	All bridge lengths - 4 months		
Borings: Retaining Wall	All bridge lengths - 4 months		
Foundation Design#	L < 400 ft.; 1 Month	L > 400 ft.; 2 Months	L > 400 ft. Single Column Bents, Designed for Lateral Loading, Etc.; 3 to 4 Months
Slope Stability Analysis**	L < 150 ft.; 1-2 Months	L > 150 ft.; 2-4 Months	

Table 6-2: Specific Geotechnical Project Development Schedule

Work Type	Small Scale	Large Scale	Specialty/Other
Retaining Wall Design*	H < 20 ft.; L < 350 ft.	H < 20 ft.; 350 ft. < L < 1000 ft.	
◆ MSE Wall	1 Month	1.5 Months	2 Months
◆ Concrete Block Wall	1 Month	1.5 Months	2 Months
◆ Sheet Pile	2 Months	2 Months	2 Months
◆ Soil Nail	1.5 Months	2 Months	3 Months
◆ Tie-Back	2 Months	2.5 Months	3 Months
◆ Drilled Shaft	2 Months	2.5 Months	3 Months

Legend:

- After borings and the layout have been submitted

* - After borings, layout, survey, and cross sections have been submitted

** - After borings, layout, survey, and cross sections have been submitted

Example: Total Time for Retaining Wall Detail Sheets = Retaining Wall Borings + Wall Design = 4 Months + Wall Design Time

Section 2 — Requests for Development of Bridge and Geotechnical Work

Design Detail Requests

Submit all structures to be let under a single project as one submittal to ensure uniformity of design and eliminate duplication of standards. Submittal requirements for typical bridge layouts, and bridge layouts involving a railroad, are listed below. See Section 1 of this Chapter for the typical bridge project submission schedule.

The transmittal e-mail from the District to the Bridge Division project manager must contain the following information:

- District (both letting district and designing district, if different)
- County
- CSJ
- Facility carried and feature crossed
- Ready-to-let date and proposed letting date
- Project type (new construction, rehabilitation, replacement, widening, etc.)
- Point-of-contact information
- Pertinent, completed e-form:
  - For bridge details, complete Form 2252 “Information Sheet for Structural Design.”
  - For bridge rail details, complete Form 2448 “Information Sheet for Bridge Railing Upgrades, Retrofits & Repairs.”
  - For geotechnical details, complete Form 2627 “Information Sheet for Geotechnical Design.” The geotech form includes requests for borings, retaining walls, slope failures, and foundations.
- Approved preliminary bridge layout
- Soil boring data (either on layout or separate sheet)
- Typical sections sheet
- Construction sequence sheet
- A map view of the project illustrating the relationship of the roadways if the project is an interchange or an interchange exists within the vicinity
- Existing bridge as-builts if relevant

Section 3 — Other Relevant Information

National Bridge Inventory (NBI) Number

The NBI number is a 15-digit number that uniquely identifies each bridge and contains information about the location of the bridge, the route carried, and the facility crossed. The last three digits of the NBI number make up the permanent structure number (PSN). The significance of other digits that make up the NBI number is described below.

On-system numbers. NBI numbers for on-system bridges are developed from the following information: a two-digit district number, a three-digit county number, a zero, a four-digit control number, a two-digit section number, and the three-digit permanent structure number. The zero is a placeholder required for national inventory purposes. A typical NBI number is 14-150-0-0289-07-026.

Each new, replaced, rehabilitated, or widened bridge structure will have a unique NBI number and must have separate bid items. The Bridge Division's internal Project Development web page has instructions on the proper use of the Bridge Cost Information (BCI) Screen in DCIS.

A new permanent structure number (PSN) is assigned when a new structure is being constructed or an existing structure is being replaced. Bridges that are being widened or rehabilitated retain their PSNs. Contact the Bridge Division's Inspection Branch to obtain new PSNs for new construction or when an existing bridge is being replaced.

When two or more bridges (generally box culverts) are widened such that they combine to form one bridge, contact the Bridge Division's Inspection Branch to obtain the PSN that will be assigned to the combined bridge.

Off-system numbers. NBI numbers for off-system structure numbers are developed from the following information: a two-digit district number, a three-digit county number, a zero, a four-digit control number, a two-digit section number, and a three-digit unique bridge number. For new off-system bridge locations, contact the Transportation Planning and Programming Division (TPP) by email at TPP-GIS@txdot.gov with location information to receive the off-system county road (or city street) control and section.

For existing off-system bridge replacements, use the control and section identification numbers of the existing bridge.Off-system bridges that are being replaced receive a new unique number. The District assigns and maintains the structure ID number for off-system bridges.

For a new or replaced off-system bridge, the unique ID number should be the next available sequence numeral with regard to all bridges located within the limits of the control section under review.

For off-system bridges, notify the Bridge Division's Inspection Branch so that pertinent information regarding structure type, completion date, etc., can be updated in the Bridge Inspection Database. If the local entity replaces the bridge, then the Bridge Inspection Database should be updated and the bridge should be removed from the off-system Highway Bridge Program prioritization. Notification and updates to the Bridge Inspection Database are essential.

Guidelines for P3B Screen Entry

Existing NBIs must be entered on the P3B screen in DCIS. Federal funds expended on the project may not be reimbursed to TxDOT if the correct existing and/or old NBI numbers are not entered. The following information is required on the P3B screen for all bridge projects.

- National Bridge Inventory (NBI) number. Include the existing NBI for Replacement projects.
- Type of bridge work (removal, replace, widen, rehabilitation, and maintenance or repair)

More detailed information about how to enter this data is located on the BRG Project Development web page at http://crossroads/org/brg/PD/index.htm.