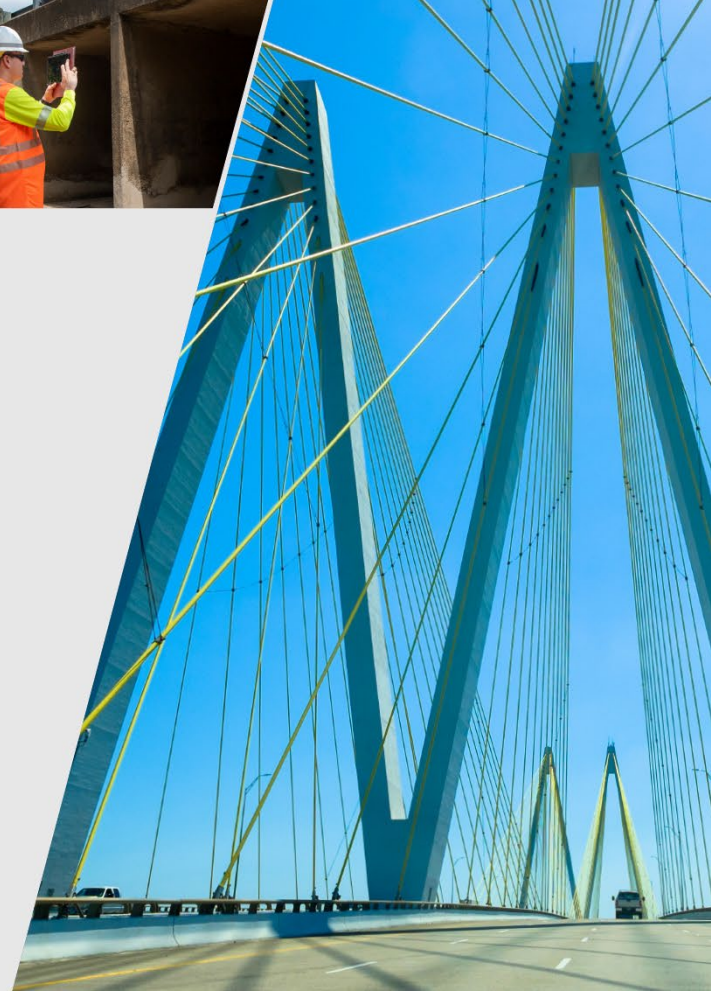




Bridge Maintenance and Management for Local Governments

Steven Austin, TxDOT Bridge Division

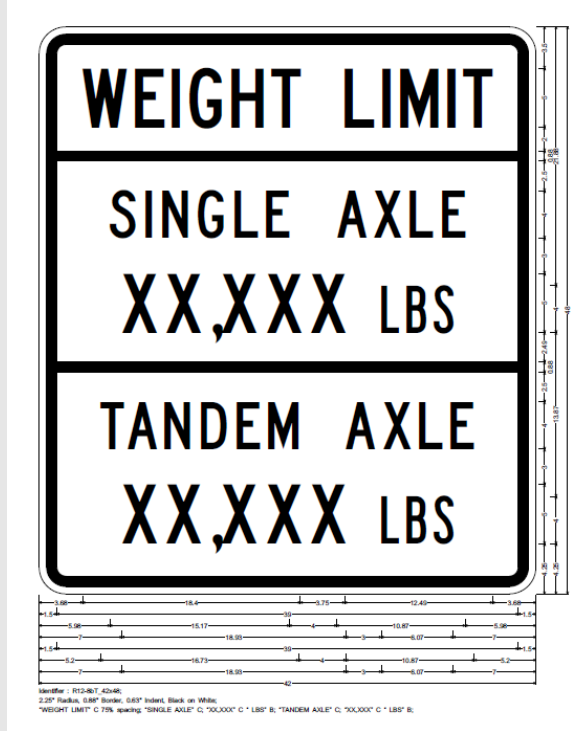
Abraham Ramirez, FHWA Texas Division



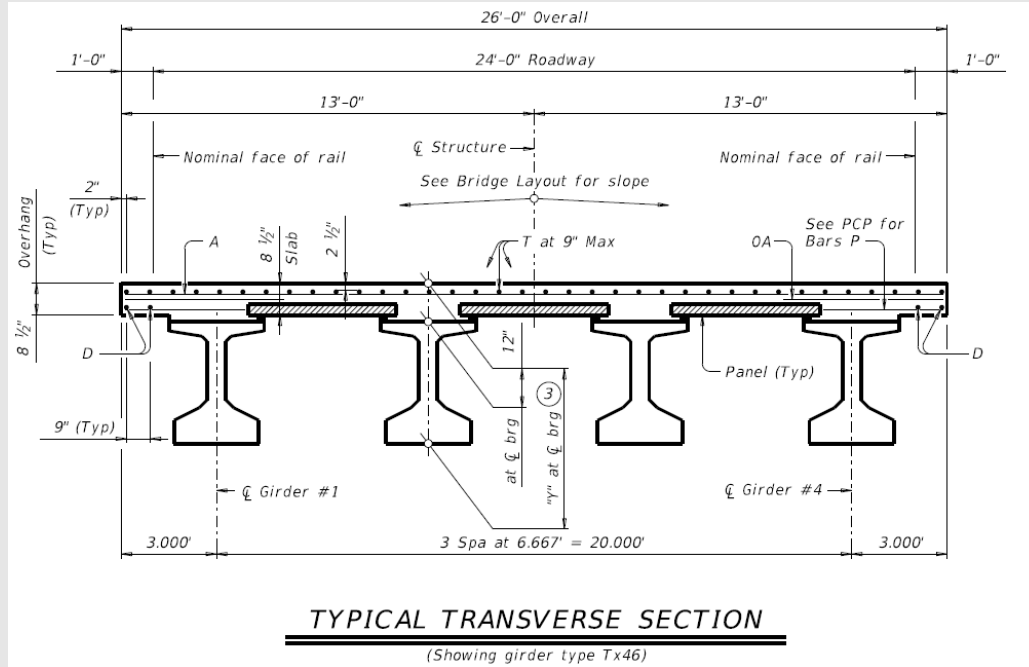
What Are Critical Findings?



How Many Days Do We Have to Install Load Posting Signs?



How Many Days Do Local Governments Have to Submit Plans to TxDOT?





- Notable Bridge Failures and Importance of Bridge Maintenance
- Texas Bridge Inventory
- Bridge Maintenance and Preservation Actions
- Resources Available for Bridge Preservation and Bridge Repairs
- Highway Bridge Program
- Requirements for New Bridges



NOTABLE BRIDGE FAILURES AND IMPORTANCE OF BRIDGE MAINTENANCE

Notable Bridge Failures



- 1967 – Silver Bridge Collapse
 - US 35 - Ohio River between WV & OH
 - Bridge was found to be poorly maintained
- 1968 – Federal-Aid Highway Act - Established National Bridge Inspection Standards



Notable Bridge Failures



- 1983 – Mianus River Bridge Collapse
 - IH 95 in Connecticut
 - Bridge was found to be poorly maintained





- 1987 – Schoharie Creek Bridge Collapse
 - New York State Thruway
 - Record rainfall resulted in scour



Notable Bridge Failures



- 2007 – Minneapolis Bridge Collapse (IH 35 W)



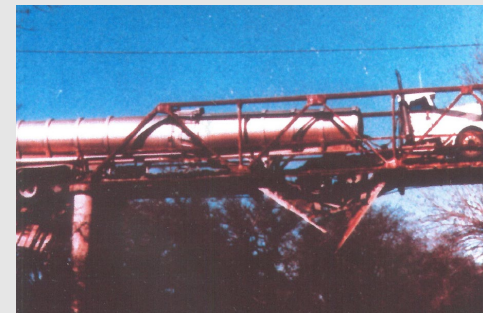
Notable Bridge Failures



- 2019– River Tarn Suspension Bridge – France (November 2019)



1988 – CR 137 in WAC





TEXAS BRIDGE INVENTORY AND STATISTICS



- +55,000 Bridges in Texas
- 35% of bridges are owned by local governments
- +50% of bridges in Texas are over 40 years old
- Texas Department of Transportation administers the statewide Bridge Inspection program and oversees inspection of all* bridges on public roadways in Texas



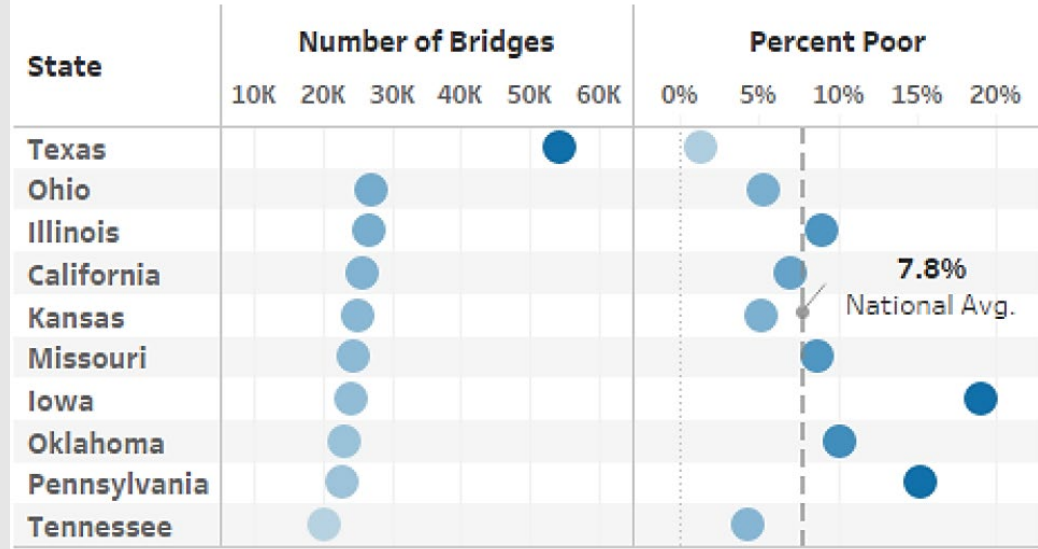
*Excluding Federally Owned Bridges



- Federal Highway Administration (FHWA) evaluates states through National Bridge Inspection Standards (NBIS)
- Texas is one of the top performers in terms of meeting the federal metrics, and...
- We have the lowest percentage of “Poor” bridges (e.g. Structurally Deficient)

Out of **55,000** Bridges in Texas

Only **787 (1.4%)** are in **Poor Condition**—much lower than the national average.





BRIDGE MAINTENANCE AND PRESERVATION ACTIONS

Bridge Maintenance and Preservation



- Change oil in our cars
- Replace roofs on our homes
- We do maintenance on our roadways
- Why not bridges?

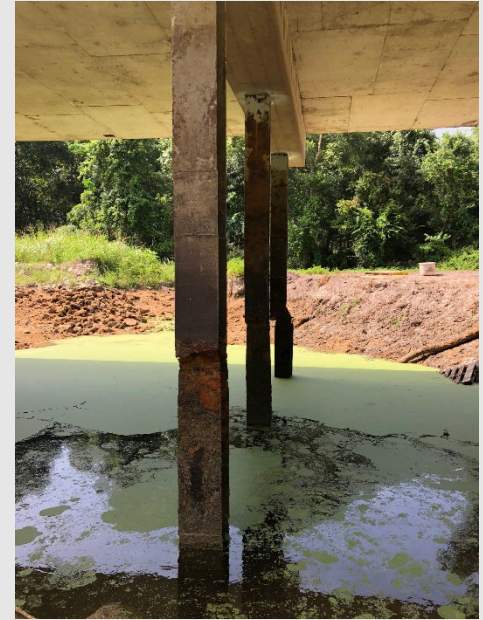


Bridge Inspection Findings and Related Preservation Actions





- Bridge closed after public reported a bump in the road





- Bridge Deck Deterioration
- Keep Joints Sealed and Free of Debris





- Concrete Distress
 - Minor Repairs (Neat Epoxy)
 - Intermediate Spall Repairs
 - Major Spall Repairs
- Bridge Deck Repairs



Section 4 — Bridge Deck Repair

Description

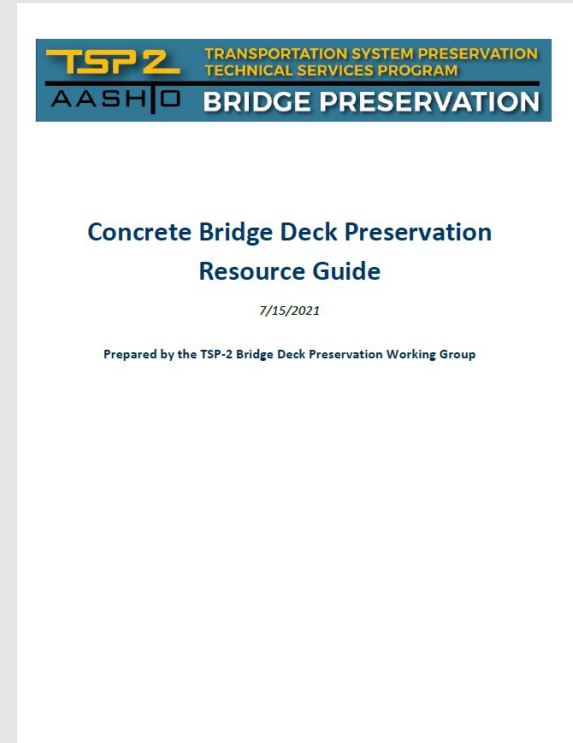
This section covers bridge deck repairs over relatively small areas. Large-scale deck repair or replacement work should typically include project-specific plans and be in accordance with Item 422, "Concrete Superstructures." The primary use of this section is to address unanticipated localized bridge deck damage that typically must be repaired quickly.

The work covered here can be categorized in two ways. First, by depth: (1) partial depth deck repairs, (2) deck repair over precast deck panels (PCP), and (3) full-depth bridge deck repair. Second, by speed: (1) ultra-rapid, (2) rapid, (3) accelerated, and (4) normal.

- Defining Bridge Deck Repairs by Depth:
 - Partial-depth bridge deck repairs are typically performed on full-depth cast-in-place bridge decks. Damage in the top of the deck only (not progressing full depth) is due to initial slab defects such as improper consolidation or insufficient concrete clear cover over the reinforcing steel; abrasion; wear; or top reinforcing mat steel corrosion.
 - Distress can also occur in the cast-in-place sections of deck above precast concrete panels (PCP's). Regardless of the severity, when performing deck repairs in such cases the cast-in-place portion should be removed to expose the top of the PCP, which then becomes the bonding interface for the repair material. When spalling is occurring above a precast panel, the underside of the panel should be checked for distress. If there is substantial staining on the girder side faces indicating roadway drainage passing through the haunch concrete, panels likely should be replaced with a full depth repair.
 - When damage extends into the PCP portion of the deck, exhibited by visible cracking on the panel soffit, then it should be treated as a full-depth deck repair.
 - Full depth repairs are typically performed when partial depth distress has gone untreated and has progressed to full depth distress as discussed in the commentary of this section and when required to perform expansion joint replacement.
- Defining Bridge Deck Repairs by Speed (Required Return to Service):
 - Often, the factor that trumps all others in bridge deck repair work is the need to return a structure to service quickly. Bridge deck failures and consequent lane closures can have hugely detrimental impacts on traffic, particularly in urban environments. Over the years, repair material suppliers and contractors have become accustomed to the need for extraordinarily quick turnaround, and have catered their services around that need. However, it has been observed that re-repair of previously repaired decks occurs frequently when the rapid strength gaining materials are used. This is further expanded upon in the commentary of this section.



- Bridge Deck Preservation Actions
 - Clean & Sweep Bridge Decks
 - Sealing Bridge Decks with Silanes
 - Thin Polymer or Epoxy Overlay
 - Multilayer Polymer Overlay (3/8")
 - Polyester Polymer Concrete Overlay (3/4" or greater)
 - Concrete Overlays (~2")



Bridge Inspection Findings and Related Actions



- Debris accumulation at top of substructure elements
- TxDOT Special Specification 7212 Bridge Substructure Cleaning





- Debris accumulation in streams and channels increases potential for embankment washout, foundation undermining, and piping around culverts.
- All bridges over waterways require a scour evaluation. Bridges determined to be scour critical require plans of action developed in conjunction with local owners.



Bridge Inspection Findings and Related Actions



- Missing, Illegible, or Improper Load Posting Signs (common critical findings)



ABL – 1996 (12,500 lb Posting / 54,000 lb GVW)



YKM – 1998 (16,000 lb Posting)

Bridge Inspection Findings and Related Actions



- TxDOT has a document to explain weight restrictions



BRIDGE WEIGHT RESTRICTION GUIDE

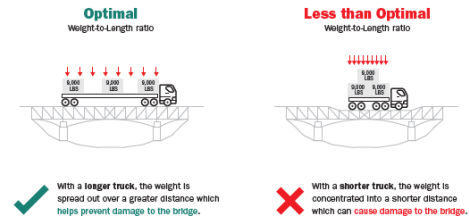


This guide explains bridge weight restriction information, signage, and provides additional resources for those in the trucking industry and law enforcement.

Why are bridge weight restrictions important?

Distributing a vehicle's weight across more axles and having more distance between axles and axle groups, spreads weight across more of a bridge. This helps prevent damage to Texas bridges and reduces possible early replacement costs. By following information in this guide you are doing your part to ensure Texas bridges stay in good condition for travelers and commercial trucking.

The example below illustrates optimal and less than optimal length-to-weight ratios (long trucks vs short trucks).
















RESOURCES AVAILABLE FOR BRIDGE PRESERVATION AND BRIDGE REPAIRS



<https://www.dot.state.tx.us/insdtdot/orgchart/cmd/cserve/standard/bridge-e.htm#WORKINGDRAWINGS>

WORKING DRAWINGS			
Rev Date	Std Name	Description	File Name
08-22		Index Sheet of Working Drawings	 WD-Table-22.dgn
BRIDGE REPAIRS			
Rev Date	Std Name	Description	File Name
08-22		Bridge Deck Overlay Notes	 WD-BDON-22.dgn
08-22		Cleaning and Sealing Bridge Joints (Pan Girders)	 WD-CSBJ(PG)-22.dgn
08-22		Cleaning and Sealing Bridge Joints	 WD-CSBJ-22.dgn
08-22		Precompressed Foam Expansion Joint Seal	 WD-PFEJ-22.dgn
08-22		Elastomeric Bearing Replacement (Concrete)	 WD-EBR(C)-22.dgn
08-22		Elastomeric Bearing Replacement (Steel)	 WD-EBR(S)-22.dgn
08-22		Prestressed Concrete Beam Repair	 WD-PCBR-22.dgn
08-22		Bridge Protective Beam Wrap	 WD-BPBW-22.dgn
08-22		Steel Beam Repair	 WD-SBR-22.dgn
08-22		Pile Encasement	 WD-PED-22.dgn



JOINT WITH SILICONE SEAL
(Used without ACP overlay)

See Detail "A"

Interior bent

Concrete slab and girder (pan form)

Cap

Clean all debris from joint extending down to the top of the cap. Fill void below backer rod with extruded polystyrene foam.

JOINT W/ HOT-POURED RUBBER SEAL
(Used with ACP overlay)

See Detail "B"

Two-course surface treatment
ACP overlay

Interior bent

Concrete slab and girder (pan form)

Cap

Clean all debris from joint extending down to the top of the cap. Fill void below backer rod with extruded polystyrene foam.

FIXED JOINT
(Used with ACP overlay)

See Detail "C"

Interior bent

Concrete slab and girder (pan form)

Cap

SHOWN AT STEEL RAIL

SHOWN AT BARRIER RAIL

SHOWN AT CURB

JOINT SEALANT TERMINATION DETAILS

① Use Class 7 joint sealant. Prepare joint in accordance with Item 436, "Cleaning Joints."

② Provide backer rod 25% larger than joint and compatible with the sealant. Use all joints to create a backer rod cross section. Top of backer rod must be as shown.

③ Use Class 3 joint sealant. Prepare joint in accordance with Item 436, "Cleaning Joints."

④ Backer rod may be omitted if existing; it is less than 1" W.

⑤ Backer rod must be compatible with the rubber sealant and rated for a minimum

JOINT WITH SILICONE SEAL
(Used without ACP overlay)

See Detail "A"

Interior bent

Concrete slab and girder (pan form)

Cap

Clean all debris from joint extending down to the top of the cap. Fill void below backer rod with extruded polystyrene foam.

GENERAL NOTES:

Cleaning existing joint opening (if all depth grinding and placing backer rod, saw-cutting overlay, and sealing joint is paid for by the and Sealing Joints and measured by the in.

Obtain approval for all tools, equipment, techniques proposed to clean and seal the joint.

Provide Class 7 joint sealant in accordance with "Joint Sealants and Fillers" for joints in air.

Provide Class 3 joint sealant in accordance with "Joint Sealants and Fillers" for joints in air.

Backer rod must be placed in a manufacturer's specifications.

NOTE TO DESIGNER:

This drawing shows three options for resealing existing joints on pan girder bridges. For other bridge types and joint sealing applications, please use the companion drawing, MD-C583-22-001.

Use Item 436-6004 when specifying Class 3 joint sealant.

Use Item 436-6004 when specifying Class 7 joint sealant.

This sheet may not be used without modification. In all cases, details and notes not required must be crossed out or eliminated and the phrase "Not to be used as a standard" must be removed. Sheet must be signed and sealed.

PROCEDURE FOR CLEANING AND SEALING EXISTING CONCRETE GIRDER JOINT WITH SILICONE SEAL:

- Clean joint opening of an existing expansion material/silicones, dirt, and all other deleterious materials in accordance with Item 436, "Cleaning and Sealing Joints." Clean joint out full depth of the joint.
- Obtain approval of cleaned joint prior to proceeding with joint sealing operation.
- Fill void with extruded polystyrene foam.
- Place backer rod into joint opening 1" below the top of concrete.
- Seal the joint opening with a Class 7 joint sealant. recess seal W below top of concrete in travel lanes and W below top of concrete in shoulders.

PROCEDURE FOR CLEANING AND SEALING EXISTING CONCRETE GIRDER JOINT WITH HOT-POURED RUBBER SEAL:

- Saw cut through the asphalt at the centerline of joint. Make multiple saw cuts to create a W minimum joint opening or notch in the existing joint opening. Clean joint opening of all old expansion material/silicones, deleterious materials, dirt, grease and all other deleterious materials in accordance with Item 436, "Cleaning and Sealing Joints." Clean joint out full depth of the joint.
- Obtain approval of cleaned joint prior to proceeding with joint sealing operation.
- Fill void with extruded polystyrene foam.
- Place backer rod into joint opening 1" below the top of concrete.
- Seal the joint opening with a Class 7 joint sealant. recess seal W below top of concrete in travel lanes and W below top of concrete in shoulders.

PROCEDURE FOR CLEANING AND SEALING EXISTING FIXED JOINTS:

- Remove existing seal and debris from crevice.
- Abrasive blast clean existing surfaces where silicone seal is to be placed.
- Obtain approval of cleaned joint prior to proceeding with joint sealing operation.
- Place backer rod into joint opening 1" below the top of concrete.
- Seal the joint opening with a Class 7 joint sealant. recess seal W below top of concrete in travel lanes and W below top of concrete in shoulders.

DETAIL "A"

Grind W" R

W" Shoulder

W" Sealant

W" Sealant

Concrete slab and girder (pan form)

Foam

Field verify

DETAIL "B"

Saw cut lines on working

W" Shoulder

W" Sealant

W" Sealant

Concrete slab and girder (pan form)

Foam

Field verify

DETAIL "C"

Grind W" R

W" Shoulder

W" Sealant

W" Sealant

Concrete slab and girder (pan form)

Foam

Field verify

PRELIMINARY

P.E. SEAL REQUIRED

SUBJECT TO REVISION

This document is released for review purposes under the authority of the TxDOT.

It is not to be used for final design, permit, bidding, or construction purposes.

CLEANING AND SEALING EXISTING BRIDGE JOINTS (PAN GIRDER BRIDGES)

(Not to be used as a standard)

NBI: XX-XXX-XXX-XX-XXX

NO.	REVISION	DATE	BY	CHKD.	APP'D.
1	ISSUED				
2					
3					
4					



PLAN
(Example only)

ELEVATION
(Example only)

TABLE OF ESTIMATED QUANTITIES			
ITEM	DESCRIPTION	UNIT	QUANTITY
D788-6001	CONCRETE BEAM REPAIR (CFRP)	EA	
D788-6002	CONCRETE BEAM REPAIR (CFRP)	EA	
D788-6003	CONCRETE BEAM REPAIR (STRAND SPLICE & CFRP)	EA	

1 Item 788-6001, "Concrete Beam Repair"
2 Item 788-6002, "Concrete Beam Repair (CFRP)"
3 Item 788-6003, "Concrete Beam Repair (Strand Splice & CFRP)"

Note: If strand is not engaged, drill and epoxy grout #3 bar anchors 3" into sound concrete.

NOTE TO DESIGNER:
 This drawing is to be used as a guide for repairs to prestressed concrete beams damaged by overheight impacts.
 CFRP notes and details are only valid for Items D788-6002 and D788-6003.
 Contact Bridge Division for guidance on number of strands that may need to be spliced.
 Plan, elevation, and photos shown as example only. Designer to modify as needed.
 As-built images of plan and elevation from as-built plans highlighting damage locations are acceptable.
 This sheet may not be used without modification. In all cases, details and notes not required must be crossed out or eliminated, and the phrase "not to be used as a standard" must be removed. Sheet must be signed and sealed.

MATERIAL NOTES:
 Submit detailed concrete repair procedure for approval prior to beginning work.
 Choose a FRP system prequalified for Structural Member Protection that meets the requirements of DMS 2200.
 Externally Bonded Fiber Reinforced Polymer (FRP) System for Repairing and Strengthening Concrete Structure Members.
 Perform CFRP pull-off test according to Item 786, "Carbon Fiber Reinforced Polymer" in the presence of the Engineer.
 Use concrete repair materials listed on the current Material Producer List for DMS 6033 with a minimum 3-day compressive strength of 3,000 psi and a 28-day compressive strength of 6,000 psi for the repairs as approved by the Engineer.

GENERAL NOTES:
 Verify impact damage locations and extents prior to starting work.
 Immediately notify the Engineer if any discrepancies are noted between the plans and actual conditions.
 Refer to TxDOT's Concrete Repair Manual, Chapter 3, Section 5 for details on Epoxy Injection.
 All work for repairing and protecting the beam is paid for in accordance with Item 786, "Concrete Beam Repair".
 The strand-splice assembly and dimensions depicted in the repair detail are for the GRAB-IT Cable Splice system as sold by Prestress Supply, Inc. Contractor may propose other strand-splice systems to Engineer for approval.
 Damage locations and quantities are based on field assessment performed on ~~XXXX~~. Verify extent of damage and repairs prior to proceeding. Immediately notify Engineer if any discrepancies are noted between the plans and actual conditions.
 Submit detailed repair procedures, including proposed proprietary materials, for approval prior to beginning work.
 Perform work in accordance with the TxDOT Concrete Repair Manual, Item 786, "Concrete Beam Repair", and the details shown in the plans.

PHOTOS OF DAMAGED BEAM
(Example only)

Examples only, replace with pictures relating to the actual bridge needing repairs. Include disclaimer stating date photos were taken, and "current conditions may differ from those shown."

SHEET 1 OF 4

Texas Department of Transportation

PRESTRESSED CONCRETE BEAM REPAIR DETAILS

(Not to be used as a standard)

NBI: XX-XXX-XXXX-XX-XXX

Bridge Division

REV	BY	DATE	CHK	APP	DATE										
01	RD-PBR-22jpp														
02	AGP	April 2022													
<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 20%;">DATE</td> <td style="width: 20%;">BY</td> <td style="width: 20%;">CHK</td> <td style="width: 20%;">APP</td> <td style="width: 20%;">DATE</td> </tr> <tr> <td> </td> <td> </td> <td> </td> <td> </td> <td> </td> </tr> </table>						DATE	BY	CHK	APP	DATE					
DATE	BY	CHK	APP	DATE											



Rehab work improved condition rating.



Substructure Condition
Rating went from 5 to 7

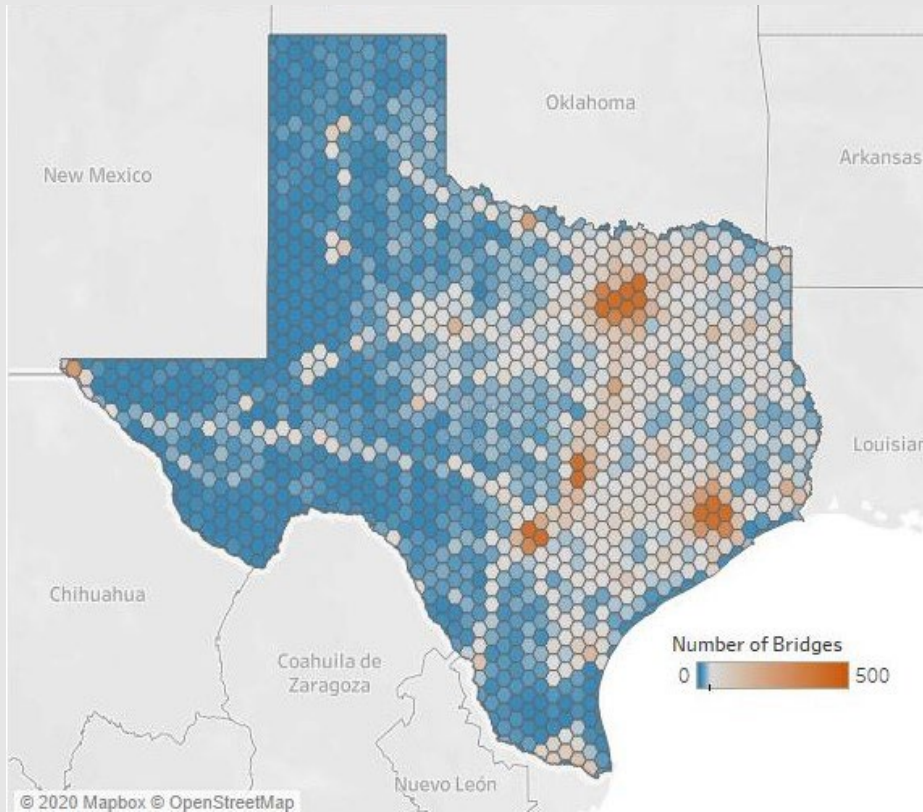
Estimate Summary Piling Rehabilitation:

- Condition Survey Paint Est: \$31,200
- Low Bid : \$53,000, \$6,625/pile,
(\$118/SF)
- \$2,000/pile for Concrete Encasement

- 7 Damage Inspection 4/16/2022: Concrete collars have been installed on all piles (see photo).
2. New concrete collars have been added to all steel piles for interior bent. Exposed portion of steel piles were not repainted, however these piles show little to no loss of protective coating or surface corrosion at this time (see photo).



HIGHWAY BRIDGE PROGRAM

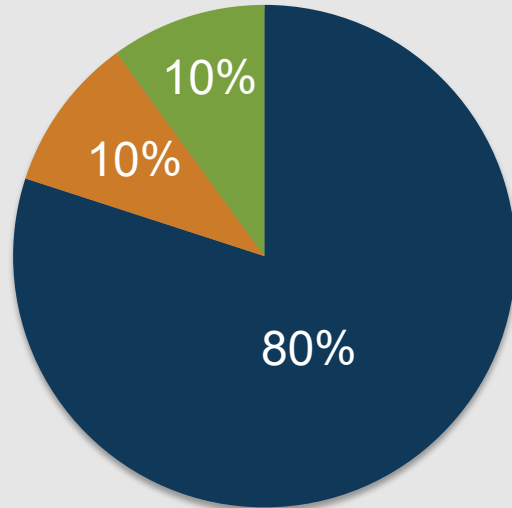


- Highway Bridge Program (HBP)
 - Established in 1978
 - Goal to increase safety
 - Maintain Inventory (On & Off System)
- Project Programming – 4 Year Cycle
 - September New Call
- Group Effort
 - FHWA
 - TxDOT
 - County & City



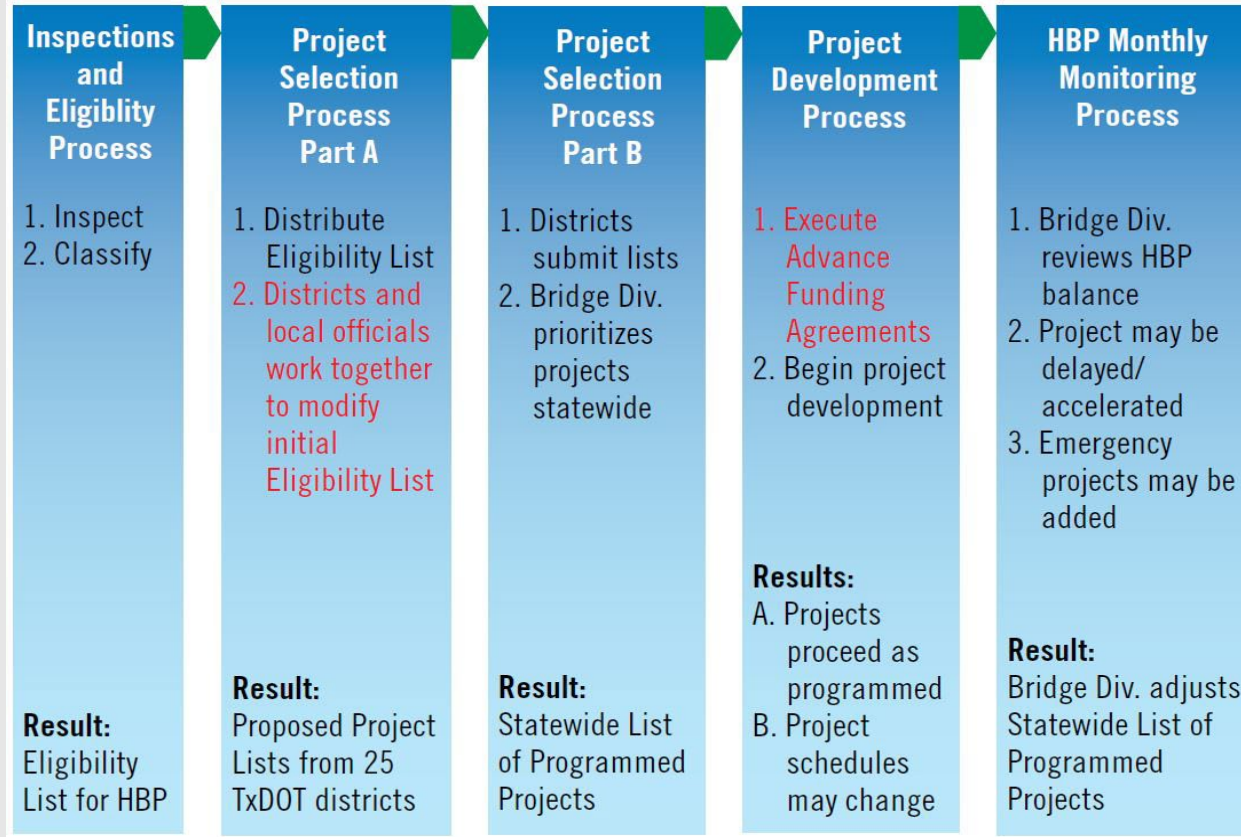
Funding Sources

■ FHWA ■ TxDOT ■ Local



- Highway Bridge Program - Category 6
 - Maintain existing bridge conditions
 - Bridge must be on inventory 10 years
- Funding Sources
 - 80% Federal, 10% State, 10% Local
 - Or
 - 80% Federal, up to 20% State
- Assistance Programs

Overview & Selection Process



- TxDOT Partner
- Handouts
- Ongoing Process



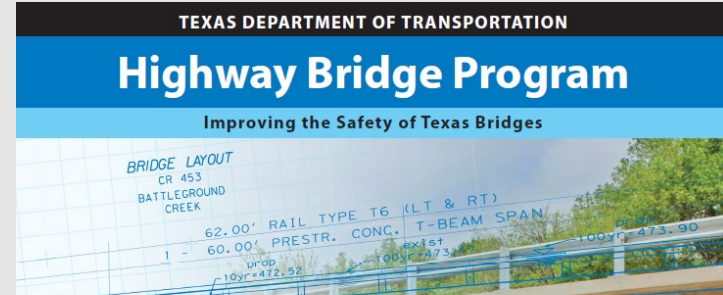
- A rating of 'Poor' indicates that deterioration has significantly affected structural capacity, but can result from either widespread or isolated issues
- Repair may be a more cost-effective option for isolated issues
- Consider using bridges with isolated issues as Equivalent Match Projects (EMPs)



Highway Bridge Program – Equivalent Match Work



- Eligible work types:
 - Channel armoring
 - Steel beam repairs
 - Concrete beam repairs
 - Bridge deck repairs
 - Other...



Bridge Replacement



- Replacement – Engineered, resilient, documented, lower maintenance needs





REQUIREMENTS FOR NEW BRIDGES



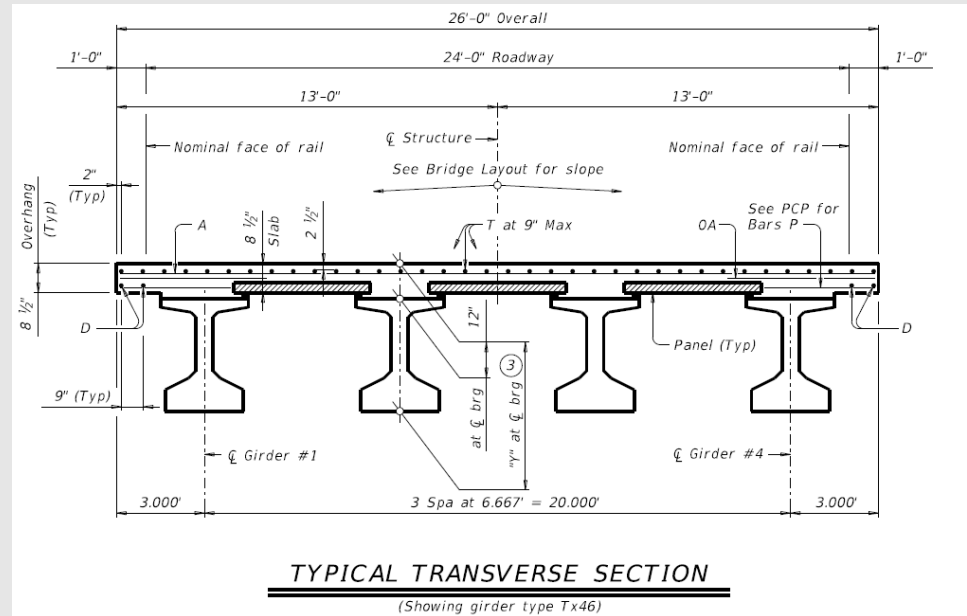
- Texas Transportation Code – Title 6, Subtitle A, Chapter 201, Section 201.804
 - **All government entities, authorized to either construct a bridge or issue a permit for the construction of a bridge are required to submit a copy of the structural plans for the bridge before the 31st day after construction (or rehabilitation) of a bridge is completed.**
- As-Builts are critical for future reference especially with respect to foundations and capacity of bridges.
- Submit design notes and scour analysis (for bridges over water) with plans to your TxDOT District Bridge Engineer



- TxDOT Bridge Standards

<http://www.dot.state.tx.us/insdtdot/orgchart/cmd/cserve/standard/bridge-e.htm>

- Rails
- Retaining Walls
- Culverts and Drainage
- Prestressed Beams
- Steel Beams
- Cast-in-place slab and girders
- Various widths and skews





- FHWA Policy - Technical Advisory 5140.23
 - **Every bridge over a waterway**, whether existing or proposed, should be evaluated as to its vulnerability to scour in order to determine the prudent measures to be taken for its protection.
- National Bridge Inspection Standards - Code of Federal Regulations (23 CFR 650 Subpart C)
 - Federal requirements for bridge inspection
 - Flood protection requirements/measures
 - **Monitor scour at existing bridges**
 - **Plan of Action (POA) to address scour critical bridges**
- Design new bridges for scour to avoid adding a scour critical bridge to inventory



- **TxDOT Bridge Project Development Manual**
 - Hydrologic & Hydraulic analyses, including a scour analysis, are required for all new bridges over waterways, bridge widening, bridge replacement...

- **TxDOT Local Government Projects Policy Manual**
 - Applicable to local governments developing transportation projects
 - Local Government is responsible for performing scour analyses in accordance with TxDOT guidelines



- Guidelines for H&H, Scour analyses
 - TxDOT Hydraulic Design Manual
 - TxDOT Scour Evaluation Guide
 - FHWA HEC-18: Evaluating Scour at Bridges
 - FHWA HEC-20: Stream Stability at Highway Structures



Questions?

Steven Austin

Bridge Field Operations Section Director

TxDOT Bridge Division

Steven.Austin@txdot.gov

737-701-4020

Abe Ramirez, P.E.

Assistant Bridge Engineer

FHWA - TX Division

abraham.ramirez@dot.gov

512-536-5928



What Are Critical Findings?



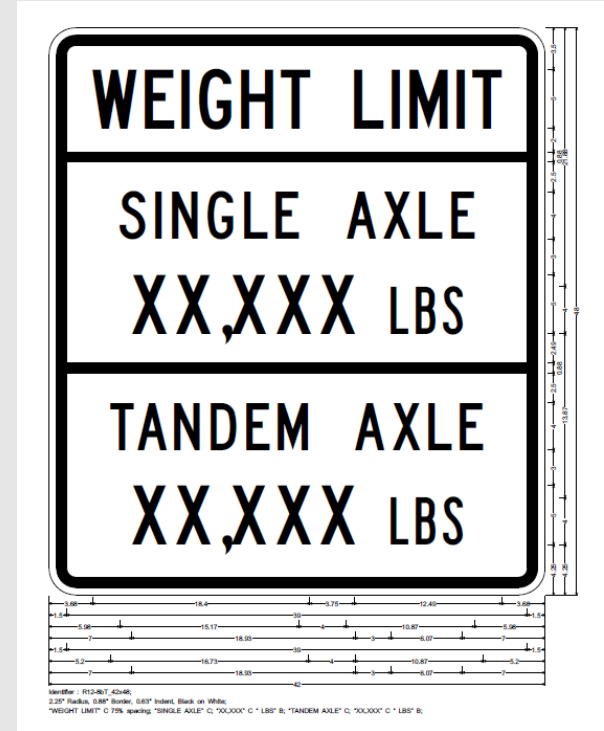
- Critical findings are generally safety concerns identified (usually by an inspector) and require immediate follow-up inspection or action.
- Beyond immediate actions required to address safety concerns, a plan for corrective actions is required within 30 days.
- Tracked by TxDOT and FHWA.



How Many Days Do We Have to Install Load Posting Signs?



- “as soon as possible but not later than 30 days after a load rating determines a need for such posting.”
- Counties have success with applying Sec 251.159 of the TTC, authorizing the county engineer or other county employee authority to function as the commissioners court to facilitate timely installation of load posting signs.
- Non-compliance with sign installation could result in withholding Federal Funds.
- TxDOT has discontinued approval of Federal and State funded projects in counties unwilling to comply with FHWA’s load posting requirements.



How Many Days Do Local Governments Have to Submit Plans to TxDOT?



- 30 Days
- As-Builts can help to investigate issues in the future.
- Include design notes and scour analysis (for bridges over water)

