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Bridge Preservation a Sustainable Path Forward for Infrastructure




TSP2 Bridge Preservation Partnership

Presented to: 2021 NYSCHSA Summer Conference
Presented by: Eric Thorkildsen, P.E.
Date: Wednesday, August 25th, 9:30-10:30AM

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Local Agency Outreach Working Group

- Local Agencies own approx. 50% of all bridges in the US.
- Increase preservation of Local Infrastructure Assets.
- Provide education & outreach to Local Agencies.
- 40+ members composed of DOTs, County and City Engineers, FHWA, LTAPs, Academia and Industry.




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Overview

- The TSP-2 Bridge Preservation Partnerships
- Asset Management and How Preservation Fits In
- Identifying Preservation Candidates
- Developing and Funding Bridge Preservation Projects
- Developing a Bridge Preservation Program
- Bridge Preservation Activity Review & Resources

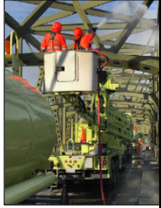


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FHWA : Asset Management Plan

- A **strategic** and **systematic** process of operating, maintaining, and improving physical assets.
- Focus on both engineering and economic analysis based on quality information.
- Identify a structured sequence of maintenance, preservation, repair, rehabilitation, and replacement actions.
- The goal is to achieve and sustain a desired state of good repair over the life cycle of the assets at a **minimum practicable cost**.



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AASHTO TSP-2 Bridge Preservation Program

Principal mission is to serve as a clearinghouse with comprehensive and up-to-date information on efficient and effective preservation measures that enhance highway performance and extend useful life.



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For Bridge Asset Management 3 Categories of Bridge Actions




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Bridge Replacement

- Most expensive of possible bridge actions
- Funding is limited to the worst bridges in the inventory
 - This leads to the “worst-first” approach
 - Cost to replace or perform major repairs = \$164 Billion¹
- Disruptive to the traveling public
- Long timeline: funding process, design and construction




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Bridge Preservation

- Benefit - easy to understand but can be difficult to quantify
- Key challenge - activities don't typically improve the condition of the bridge
- Intent- delay how long it takes the bridge to deteriorate
- Effectiveness depends on many factors (climate, structure type, current condition, preservation treatment, etc.)




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Bridge Rehabilitation

- Large scale projects required to restore the structural integrity of a bridge
- Typically reserved for bridges that have one component with significant deterioration, but the rest of the structure is worth saving
- High cost of rehabilitation can lead to full replacement & vice-versa




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Car Analogy

Preservation <ul style="list-style-type: none"> • Oil Changes • Washing • Tire Rotation • Transmission Service 	Rehabilitation <ul style="list-style-type: none"> • Engine Rebuild • Body work and Painting • Tire Replacement • Transmission Replacement
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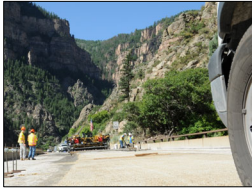


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Bridge Preservation

- Actions or strategies that prevent, delay, or reduce deterioration of bridges
- Keep bridges in good or fair condition to avoid or delay the need of costly rehabilitation or replacement
- Least expensive bridge actions
- Performed under short term traffic control




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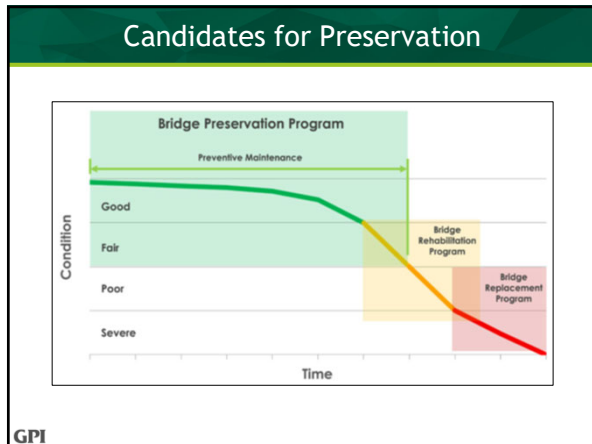
Candidates for Preservation

High Value/High Volume Bridges



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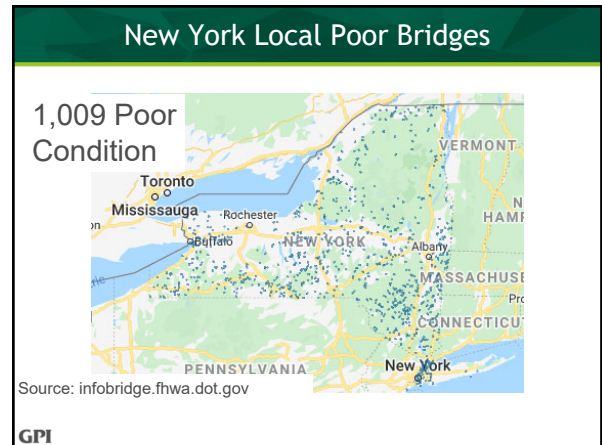
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How to Identify Good Candidates

- National Bridge Inspection (NBI) Data
 - Use available NBI data
 - Element level data provides far more information than the Deck, Superstructure and Substructure general condition rating
 - Element level inspections provide great information for planning work
 - Defects are assigned to elements and can be a useful for planning preservation work

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Developing Bridge Preservation Projects


- Determine whether the work will be completed in-house, or with contracted forces
- For contracted work, bundle several bridges with similar work to attract competitive bids

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Funding Bridge Preservation

The Moving Ahead for Progress in the 21st Century Act (MAP-21) and the Fixing America's Surface Transportation (FAST) Act recognized the benefits of preservation and identify preservation actions as eligible for Federal Funding



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Local Preservation & Funding Survey

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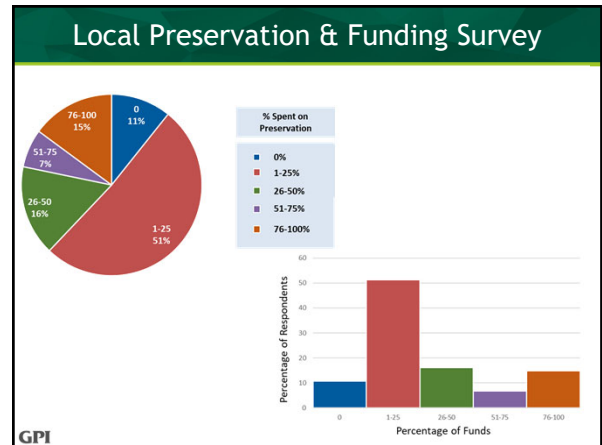
Activities Eligible for Federal Funding

Cyclical Maintenance Activity	Bridge Component
Clean/Wash Bridge	Deck and/or Super/Substructure
Clean and Flush Drains	Deck
Clean Joints	Deck
Deck/Parapet/Rail Sealing and Crack Sealing	Deck
Seal Concrete	Super/Substructure

Examples of Condition-Based Maintenance Activity	Bridge Component
Patch/Repair Substructure Concrete	Substructure/Culvert
Protective Coat/Concrete/Steel Substructure	Substructure/Culvert
ECE/CP	Substructure/Culvert
Spot/Zone/Full Painting Steel Substructure	Substructure
Pile Preservation (jackets/wraps/CP)	Substructure
Channel Cleaning / Debris Removal	Channel
Scour Countermeasure (installation/repair)	Channel

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Activities Eligible for Federal Funding

Examples of Condition-Based Maintenance Activity	Bridge Component
Drains, Repair/Replace	Deck
Joint Seal Replacement	Deck
Joint Repair/Replace/Elimination	Deck
Electrochemical Extraction (ECE)/Cathodic Protection (CP)	Deck
Concrete Deck Repair (see halo effect below) in Conjunction with Overlays, CP Systems or ECE Treatment	Deck
Deck Overlays (thin polymer epoxy, asphalt with waterproof membrane, rigid overlays)	Deck
Repair/Replace Approach Slabs	Approach
Seal/Patch/Repair Superstructure Concrete	Superstructure
Protective Coat Concrete/Steel Elements	Superstructure
Spot/Zone/Full Painting Steel Elements	Superstructure
Steel Member Repair	Superstructure
Fatigue Crack Mitigation (pin-and-hanger replacement, retrofit fracture critical members)	Superstructure
Bearing Restoration (cleaning, lubrication, resetting, replacement)	Superstructure
Movable Bridge Machinery Cleaning/Lubrication/Repair	Superstructure

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Funding Availability

- Although Federal Funding is available for preservation, the project selection process tends to favor rehabilitation or replacement.
- Even state funds tend to go towards rehabilitation or replacement.
- Thus, Replacement or Rehabilitation projects tend to be prioritized over Preservation projects.**

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Bridge Preservation Program

Figure 15. Steps for establishing a bridge preservation program.

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Michigan Case Study of Preservation

Deterioration Rate Statewide Trunkline Bridges

Year

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Establish Agency Rules to Achieve Goals

- Cyclical Maintenance Example for Bridge Decks in Good condition (NBI > 6)

Preservation Activity	Interval Years
Deck Sweeping/Washing	1 to 2
Crack Sealing	3 to 5
Deck Sealing	3 to 5
Polymer Overlay	8 to 12
Polymer-Modified Asphalt Overlay	12 to 15

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Typical Preservation Actions

- Bridge Washing
- Deck Treatments (Sealers & Overlays)
- Bridge Joint Maintenance
- Painting Steel Structures
- Concrete Patching








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Measure the Benefit of Actions

Figure 17. A comparison of bridge condition over time with and without bridge preservation.

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Bridge Cleaning & Washing

Benefits:

- Flushing and washing reduces the potential of chloride intrusion in deck.
- Essential for proper joint and bearing movement.
- Extend the life of steel coating systems.


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Bridge Cleaning & Washing

Elements to Wash:

- Decks, joints, curbs and rails
- Abutments, beam seats and bearings
- Beam ends, trusses and end diaphragms




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Penetrating Sealers (Silanes, Siloxanes & Siliconates)

- Penetrating water repellents protect from moisture and chloride penetration into the concrete
- Achieves a depth of penetration into the concrete that seals and protects without impacting slip/skid resistance
- Does not fill visible cracks in concrete
- Reapplied on a 5-to-10-year cycle




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Bridge Cleaning & Washing

Things to Consider:

- Follow state and federal regulations. (Some debris may be hazardous)
- Sweep and collect large debris for disposal.
- Flush during high water flow to minimize environmental impact.
- Clean on regular cycle of avoid large build-up with hand removal




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Bridge Deck Crack Fillers Flood Coat Application

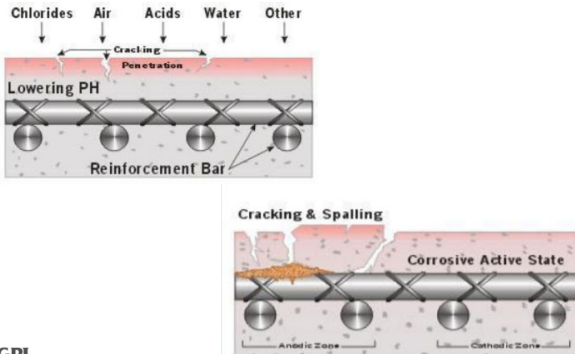
- Seals cracks in the bridge deck concrete to prevent the intrusion of moisture, de-icing chemicals and other damaging environmental affects
- Most effective when placed early, after initial shrinkage cracking and prior to exposure to de-icing chemicals



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Concrete Sealing




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Thin Polymer Overlay System

- Ultra low permeability to protect the deck concrete from the intrusion of moisture, de-icing chemicals and degradation
- Provide a protective, durable, skid-resistant wearing course for a concrete bridge deck





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Thin Polymer Overlay System

- Most cost effective when installed prior to concrete spalling caused by corrosion of steel reinforcing
- Costs are low compared to other protective deck overlay systems
- Can easily be installed with maintenance crews


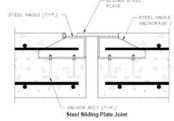
- Install the second lift just as done on the 1st lift.
- 2nd lift will require more resin and aggregate.
- Final overlay thickness is approximately 3/8".

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Joint Systems - Lots of Different Types

- Asphaltic Plug Joints
- Compression and Bonded Seal Joint
- Pourable Joints
- Open/Sliding Plate/Butt Joint
- Strip Seal/Armored Joints






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Asphalt Overlays

- Spray Applied Membranes
- Rolled Membrane

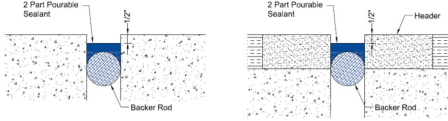

Rolled Membrane Installation

- Overlap and offset seams per manufacturer recommendations
- Have laps splices going downhill

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Example - Pourable Joint

Reference: NCHRP12-100

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Joint Systems - Preservation

A bridge expansion joint is designed to:

- Provide a gap to accommodate longitudinal and transverse movements of a bridge superstructure
- Protect the superstructure and substructure elements below the bridge deck from water runoff, adverse chemicals, and debris buildup

Preservation actions generally include:

- Repair or remove & replace deteriorated or damaged sections of joint systems, may include surrounding concrete header repairs





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Bridge Maintenance Painting

- Paint systems protect the steel.
- Spot/Zone painting is an important tool to extend the service life of existing bridge coating.



Corrosion of Beam End, Cross Frame and Bearing



Inter-Coat Failure

- Surface preparation is the key for success.
- Pay close attention to worker safety and environmental regulations

Source: NCHRP Project 14-30

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Concrete Patching



- Concrete spalling and scaling
- Concrete delaminations
- Concrete joint repairs

[This work may include some rebar installation]

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AASHTO TSP-2 Bridge Preservation Program





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Concrete Patching Materials

- Patching materials replace damaged concrete
- Considerations
 - Service Conditions
 - Causes of Deterioration
 - Compatibility of Materials
 - Application Conditions
 - Finish Requirements



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AASHTO TSP-2: Pocket Guides

A User's Guide to
Concrete Bridge Deck Patching

A User's Guide to
Repair of Bridge Concrete Substructure Elements

A User's Guide to
Spall Zone and Overlapping Existing Bridge Coatings

A User's Guide to
BRIDGE CLEANING

A User's Guide to
Thin-Polymer Bridge Deck Overlay Systems

A User's Guide to
Removal and Replacement of Bridge Coatings

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Concrete Patching Preparation

- Traffic Control
- Time Consideration
 - Mark Area to Repair that can be completed in Lane Closure
- Adequate Tools, Power, and PPE
- Demolition
 - Saw-cut edges (Clean Slurry)
 - Remove unsound concrete
 - Replace damaged rebar
 - Primers/SSD






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AASHTO TSP-2 Pocket Guides

Checklist Format

- Installation guidelines
- Equipment and tools
- Limitations & restrictions
- Avoiding potential failure mechanisms
- Recommended training
- Required technical support
- Recommended QA/QC

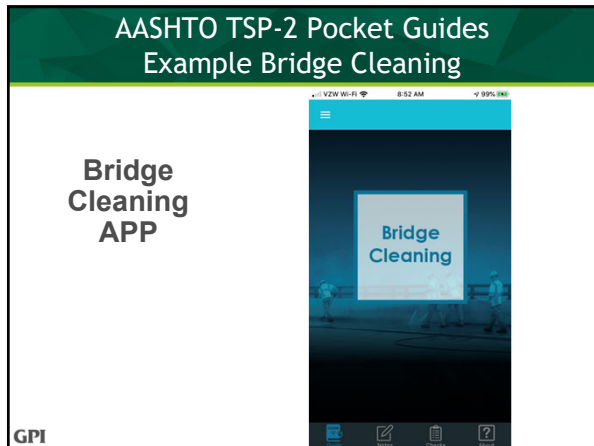


Now available for iPhone or Android phones

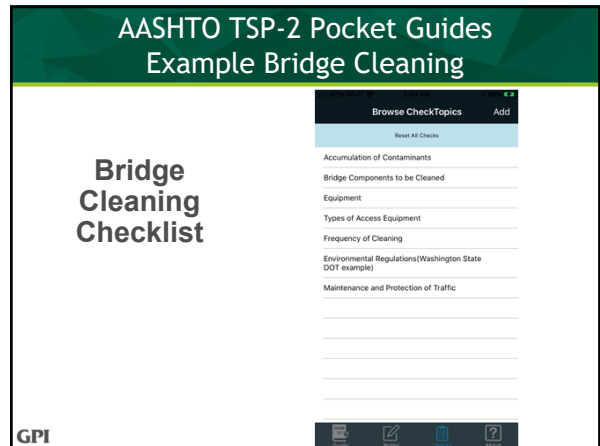
Search
"Bridge Pocket Guide"

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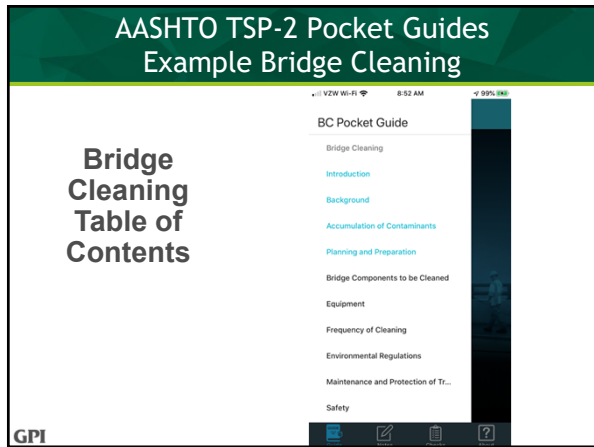
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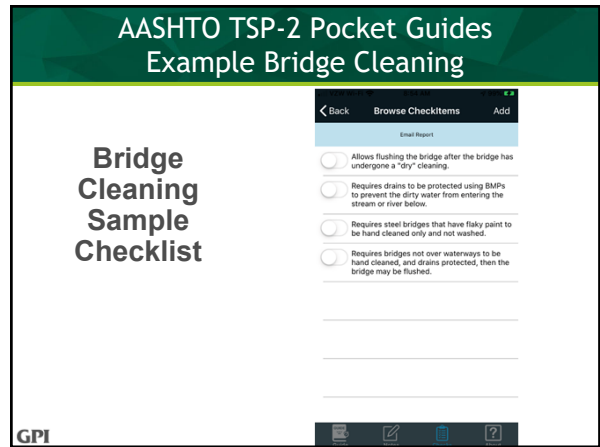
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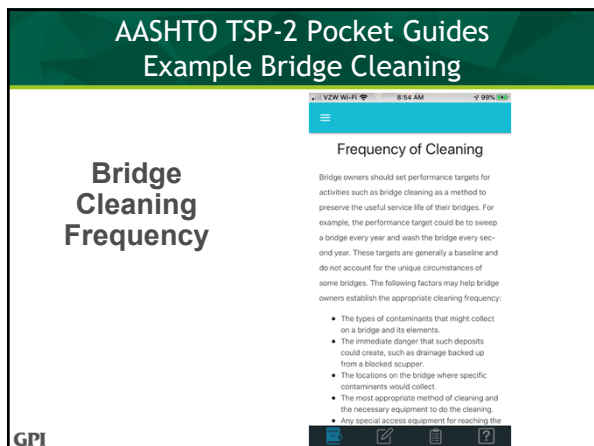
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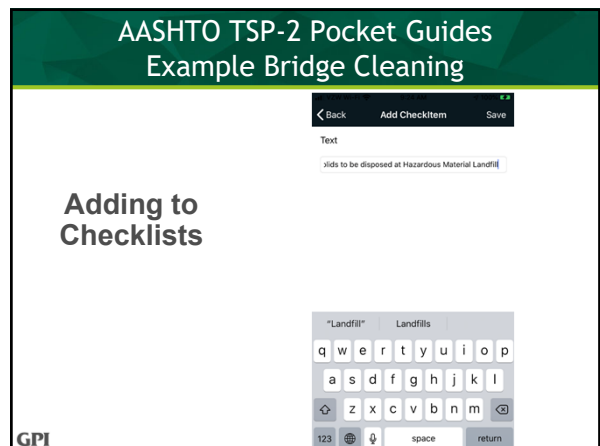
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AASHTO TSP-2 Bridge Preservation Program Innovative Products: Maintainable Weep-Hole

- Relieves hydrostatic pressure
- Installs through the front of the wall
- Geotextile fabric to stop erosion
- Accessible & Maintainable
- Simple Installation & Easily Cleaned



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Question #2

Multiple Choice:
Which of these statements does not typically describe Bridge Preservation activities/actions?

- A. Keep bridges in good or fair condition
- B. Need extensive design plans and lots of permits
- C. Are performed under short term traffic control
- D. Are the most least expensive activities/actions

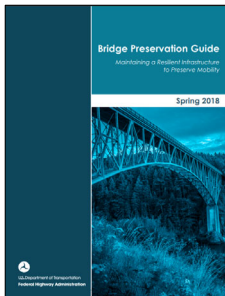
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FHWA - Bridge Preservation Guide

Preservation Guide

- Defines bridge preservation terms and common practices.
- Guidance to State, Locals and other owners on establishing or improving bridge preservation programs.
- [FHWA Bridge Preservation Guide \(dot.gov\)](https://www.fhwa.dot.gov/bridge/preservation/guide/)



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Question #3

Multiple Choice:
Approximately what percentage of the nations 600,000+ bridges are owned and maintained by local owners (counties, municipalities, towns, etc.)?

- A. 25%
- B. 50%
- C. 75%
- D. None of the above

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Question #1

True or False:
Bridge Preservation activities/actions are eligible for Federal Funding.

- True
- False

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Question #4

True or False:
Before you can perform Bridge Preservation activities / actions, you must have an Asset Management Plan.

- True
- False

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Question #5

Multiple Choice:
Which of these is a good source of information for Bridge Preservation activities/actions?

- A. AASHTO TSP2 Bridge Preservation Partnerships
- B. New York State DOT
- C. FHWA's Bridge Preservation Guide
- D. All of the above

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Questions?

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