



MDOT
Michigan Department of Transportation

Michigan DOT Best Practices

Identifying Maintenance Needs & Properly Addressing




2017 CTT Michigan Bridge Workshop



Region Support

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Highway snow removal in 1937

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[MDOT](#) / [ABOUT MDOT](#) / [FIELD SERVICES](#) / [OPERATIONS FIELD SERVICES](#)

Bridge Field Services

Our Mission

The Bridge Field Services section serves as a statewide resource to achieve and maintain alignment on all field related bridge issues, and provides technical guidance on structures related specifications, construction and maintenance practices, equipment, and around-the-clock responses to high-load hit and other emergency bridge situations around the state.

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Bridge Field Services Strategic Measurables Quarterly Reports

The Bridge Field Services Strategic Measureables are areas within the Bridge Field Services section, where productivity, customer service, centers of excellence, and statewide support

Quick Links

- [Title VI Nondiscrimination](#)
- [Tribal Governments](#)
- [Twitter Facebook YouTube](#)
- [MI Drive](#)
- [State Map](#)

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Region Support

- Maintenance Resource
- Develop Standards and Specifications
- Provide Technical Support
- Develop Contracts
- Investigate New Materials and Methods
- Design and Detail Complex Repairs
- Liaisons with Industry Partners

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Region Support - ReachAll

- Underbridge Inspection Aerial Unit
- Emergency Response
- Support Bridge Inspection



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Aaron Porter
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Region Support – Statewide Signs

- Sign Fabrication
- Technical Support for Sign Construction
- Emergency Response

Sign Fabrication Rates for FY 2017 - External

Sign Type	Total Cost Cost (\$/SFT) - Proposed
.040 Aluminum, Overlay Blanks W/O Sheeting	\$1.31
.040 Aluminum, Overlay, Diamond GRD / Diamond GRD	\$14.71
.040 Aluminum, Overlay, Diamond GRD / EC Film	\$13.14
.040 Aluminum, Overlay, Hi-Intensity / Diamond GRD	\$13.25
.040 Aluminum, Overlay, Hi-Intensity / EC Film	\$11.68
.040 Aluminum, Overlay, Engineer GR / Engineer GRD	\$11.39
.081 Aluminum, Blanks W/O Sheeting	\$2.57
.081 Aluminum, Blanks W/O Sheeting (Cut)	\$3.19
.081 Aluminum, Diamond GRD / Diamond GRD	\$15.97
.081 Aluminum, Diamond GRD / EC Film	\$14.40
.081 Aluminum, Diamond GRD / Screened	\$11.87
.081 Aluminum, Hi-Intensity / Diamond GRD	\$14.51
.081 Aluminum, Hi-Intensity / EC Film	\$12.94

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Region Support – Material Evaluation

Region Structure Support Material Evaluation

Product Reference

Product Trade Name					NTPEP Certification		
Manufacturer							
Address							
	Street		City		State	Zip	
Vendor Rep. Name				Title			
Phone	()		Email				
Vendor Reference Name				Title			
Phone	()		Email				

Planning Checklist

Ensure that the following items are completed. Check the box when complete.

- ☐ Pictures have been taken of pre-installation.
- ☐ Coordination has been initiated with MDOT Maintenance and Region Support.
- ☐ TDS has been obtained and reviewed.
- ☐ SDS has been obtained and reviewed.
- ☐ PPE Requirements have been reviewed.
- ☐ MDOT Standards and Specifications cover this product in _____ section.
- ☐ MDOT Special Provision _____ covers this product.



Region Support – Product Database

Seal and Repair Strip Seal Expansion Joints

Belzona SR Elastomer Gland Repair Kit

Belzona 9111 Cleaner Degreaser

Belzona 2311 Elastomer

Belzona 2911 Conditioner

Deck Patching

QPL 703 Prepackaged Hydraulic Fast Set Mortar

Chip Deck to 3/4" Behind Bar

BASF 10-60 Rapid Mortar extended with MDOT 6A aggregate per TDS

Grade C-L Concrete

Grade D Concrete

Cold Weather

International Roadway Research - Instant Road Repair

Transpo - Castek - T-17

Transpo - Castek - T-41s Primer

Shallow Spalls

Transpo - Castek - T-17

Transpo - Castek - T-41s Primer

Full Depth

Grade D Concrete - Preferred, time permitting

BASF 10-60 Rapid Mortar extended with MDOT 6A aggregate per TDS



Region Support - FUSPs

- 12SP-602G-01 – Pressure Relief Joint
- 12SP-602H-01 – E3 Joint Sealant
- 12SP-706B-05 – Sealing Localized Cracks
- 12SP-706H-01 – Polyurethane Joint Sealant for Structures
- 12SP-707D-01 – Metal Mesh Panels
- 12SP – 710B-01 – Penetrating Healer Sealer on Bridge Decks
- 12SP – 710C-01 – Substructure Horizontal Surface Sealer

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Region Support – FUSPs - Cont

- 12SP-712B-01 – Thin Epoxy Polymer Bridge Deck Overlay
- 12SP-712C-01 – Performance Warranty, Thin Epoxy Polymer Bridge Deck Overlay
- 12SP-712D-01 – Removal of Thin Epoxy Polymer Bridge Deck Overlay

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Region Support – SP's

- 12TM712(A355) – Bridge Cleaning

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Additional Resources (NHI)



U.S. Department
of Transportation
Federal Highway
Administration

FHWA-NHI Course No. 130108

Publication No. FHWA-NHI-14-050
May 2015

Bridge Maintenance Reference Manual



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Additional Resources (NHI cont)

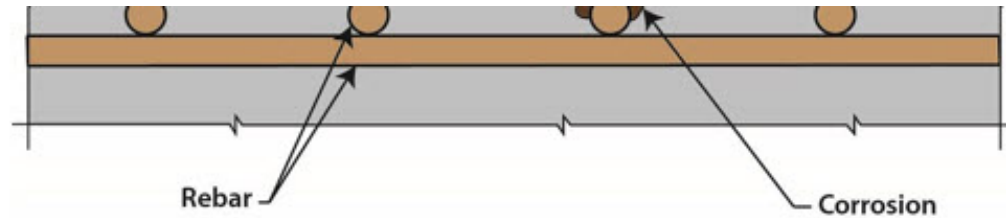


Figure 7.1 Typical Reinforced Concrete Deck and Slab Deterioration

Sealing the bridge deck cracks and overlaying the surface with dense materials will slow the rate of deterioration by limiting the water and salts that reach the reinforcing steel. If a significant amount of chlorides have already reached the reinforcing steel, cathodic protection may be used to stop corrosion from progressing. This section presents various aspects of concrete bridge decks and slabs and the related bridge maintenance activities.



What To Look For

- Cracks
- Spalls
- Leaks on underside of deck
- Efflorescence in edges or underside of deck
- Accumulated debris on deck
- Evidence of ponding on deck

7.2.2 Deck Protection Methods

Proactive deck protection is the best way to preserve the life of any concrete bridge deck or



Additional Resources (NHI cont)



Suggested Procedure

Concrete Spall Repair

1. Identify the deck or slab location to be repaired.
2. Hammer sound or chain the area around the spall to identify and mark adjacent unsound concrete. Mark off square areas outside the limits of the unsound concrete.
3. Combine patches closer than 1 foot into larger patches.
4. Sawcut to a depth of at least 3/4 to 1 inch in a geometric pattern marked in the previous step. Be careful not to cut through reinforcing steel (see Figure 7.16 and Figure 7.17).
5. If the patch is full depth, protect the area under the work area from falling debris. This can be done by placing wooden or metal forms attached to the girders or soffit of the bridge (see Figure 7.18). Forms may be suspended from reinforcing steel by wire ties for areas of less than 3 square feet. In the case of larger openings, forms shall be supported from below by blocking to ensure the form can support the wet concrete weight.
6. Use a lightweight chipping gun (maximum weight of 30 pounds) to chip the concrete out between the edge of the spall and the sawcut lines. Pneumatic hammers shall be worked at an angle of 45 to 60 degrees to the plane of the concrete being removed. Chip the concrete out max aggregate plus 1/4 inch below the top mat of reinforcing steel or any

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Additional Resources (TSP2)

- AASHTO Technical Services Program (TSP2)



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Additional Resources (TSP2 cont)

- Downloadable Repository
 - Presentations
 - Special Provisions
 - Research Reports
 - Performance Measures

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Additional Resources (TSP2 cont)

- Bridge Preservation Blog

[Home](#) > [Interview](#) > A Conversation with Pete Weykamp about LTAP

A Conversation with Pete Weykamp about LTAP

Posted on [December 9, 2016](#) by [AASHTO TSP2 Bridge Blog](#) — [No Comments](#) ↓

Author: Lorella Angelini, Angelini Consulting Services, LLC

After leading the bridge preservation program with New York State DOT, Pete Weykamp has put his knowledge and experience at the service of the Local Technical Assistance Program (LTAP). Together with Ed Welch, Bridge Preservation Engineer for the



Recent Posts

- [A Conversation with Bill Oliva, Chief of Structural Development for Wisconsin DOT](#)
- [Is the Practice of Bridge Preservation Heroic?](#)
- [A Conversation with Nancy Huether Transportation Engineer with North Dakota Department of Transportation](#)
- [A Conversation with Pete Weykamp about LTAP](#)

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Outline

- Maintenance Tracking
- Approaches
- Bridge Cleaning
- Brush
- Deck Patching
- Substructure Patching
- Culverts
- Timber Bridge

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Capital Preventive Maintenance

Capital Preventive Maintenance (CPM)

Work activities that restore element integrity. CPM activities prevent “fair” structures from becoming “poor” structures.”

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Capital Preventive Maintenance

- These are the activities that maintain “fair” bridges as “fair” or return them to “good”
- These activities could be the primary reason you are at the bridge.

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Capital Scheduled Maintenance

Capital Scheduled Maintenance (CSM)
Work activities that maintain the existing serviceability, and reduce deterioration rates on bridge.

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Capital Scheduled Maintenance

- These are activities that keep “good” bridges “good”
- These activities may also be secondary

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Maintenance Tracking



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Welcome Jason Deruyver

Jurisdiction: MDOT - Region - Statewide

Administration

Bridge Management

Assignments

Dashboards

Reports

STR 34

Information Summary and Current Status

B03-02011



Facility
US-41

Feature
HUBER CREEK

Location
9.4 MI NW OF TRENARY

Region / County
Superior(1) / Alger(2)

Latitude / Longitude
46.2701 / -87.1135

Length / Width / Spans
37.7 / 46.6 / 1

Built / Recon. / Paint / Ovly.
1987 / / /

Material / Design
5 Prestressed Concrete / 05 Multiple Box Beam

MDOT Structure ID
02102011000B030

Owner
Region: Superior(1)

TSC
Newberry(22)

Last NBI Inspection
05/05/2015 / 1Y10

Structure Condition
Good Condition(7)

Operational Status
A Open, no restriction(A)

Scour Evaluation
8 Stable Above Footing



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[Inspections / Reports](#)

[Load Ratings](#)

[Work Recommendations](#)

[Work History](#)

[Documents](#)

Work History Data

[Print All](#)



Feature still under construction



Maintenance Tracking

Structure ID:		Date:	
Lead Worker Name:			

Deck Patching

SFT Partial Depth QTY: _____
SFT Full Depth QTY: _____
Qty Anodes QTY: _____
LFT Epoxy Reinforcement QTY: _____
☐ Product Trial

Concrete Mixture

☐ BASF – 10-60 Rapid Mortar ☐ MDOT -7 Sack Latex Patching Concrete C-L
☐ MDOT - Concrete Grade D ☐ Castek - T17
☐ MDOT -9 Sack High Early Latex Patching Concrete - C-L-HE ☐ Other - MDOT QPL

Equipment:

--

Material:

Cost:

--	--

Personnel:

Hours:

--	--

Comment:

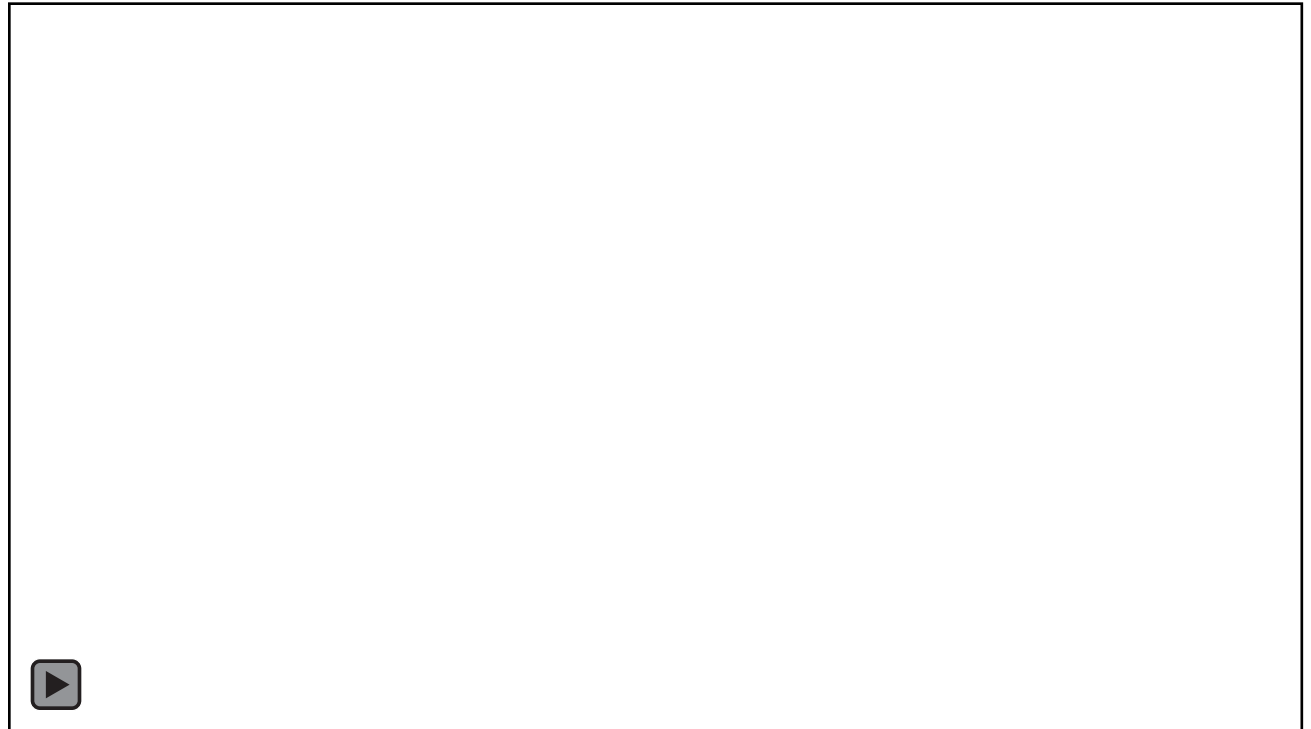
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Bridge Approach

- Provide Smooth Transition from Roadway to Bridge Deck



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Approach – Primary Concern

- Settlement – Impacting Vehicles Accelerate Tailspan Deterioration



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Bridge Approach

Structure ID:		Date:	
Lead Worker Name:			

Approach Repair

- | | | |
|---|--|---|
| <input type="checkbox"/> Bit Wedge | <input type="checkbox"/> Concrete Patch | <input type="checkbox"/> Mud Jack |
| <input type="checkbox"/> Replacement | <input type="checkbox"/> Shoulder Washout Repair | <input type="checkbox"/> Catch Basin Cleanout |
| <input type="checkbox"/> Guardrail Repair | <input type="checkbox"/> Other | <input type="checkbox"/> Product Trial |

Equipment:

--

Material:

Cost:

--	--

Personnel:

Hours:

--	--

Comment:

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Bridge Approach - Replace

- \$16/SFT
- Takes the longest of all options.



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Approach Repair - Bit Wedge

- Cheapest
- Lowest Life Expectancy



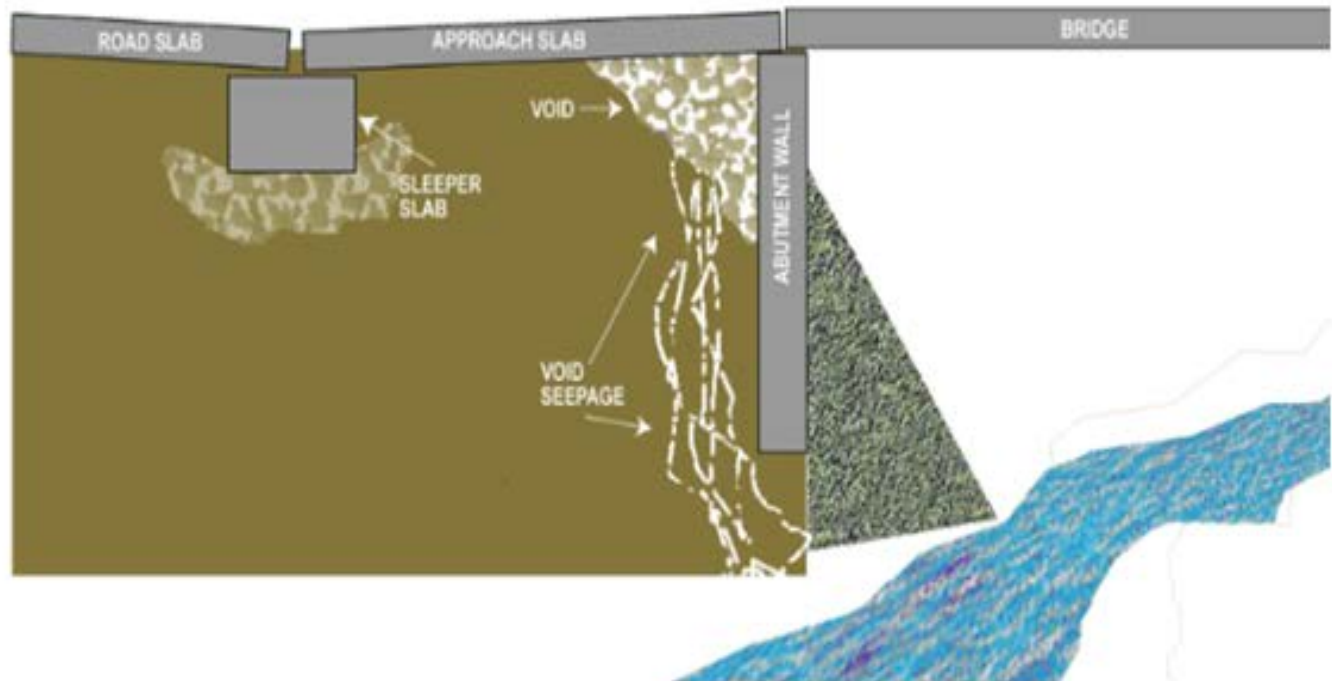
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Approach Repair - Injecting

BEFORE

BRIDGE APPROACH



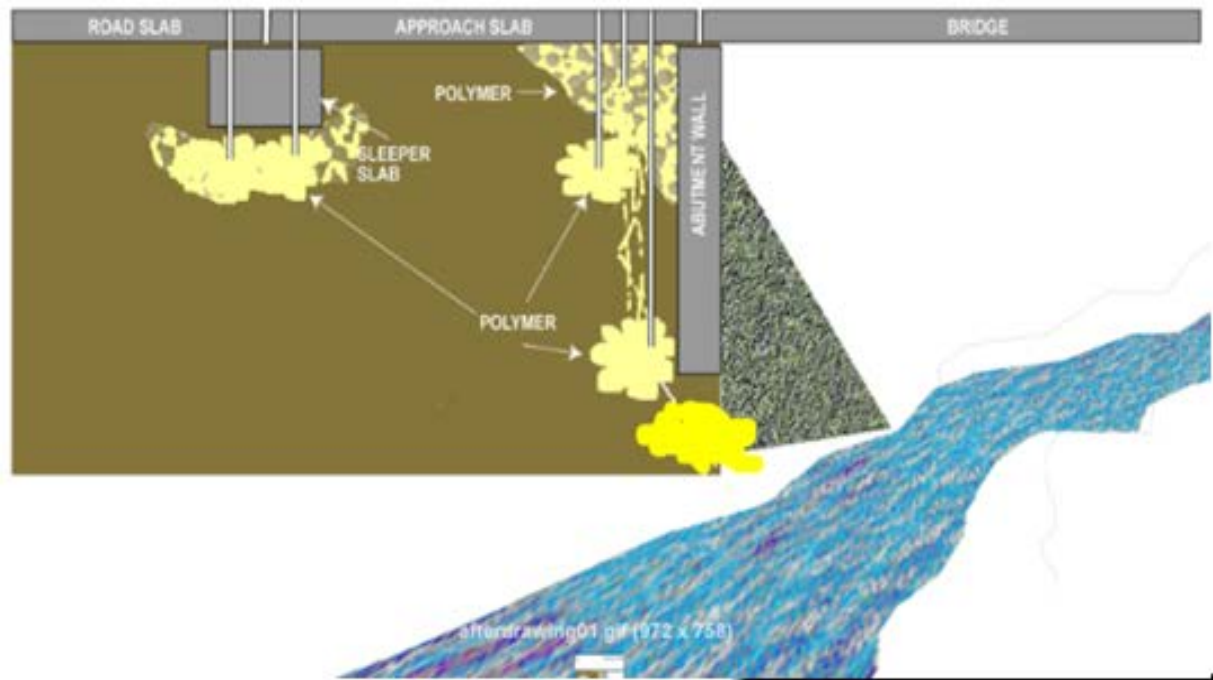
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Approach Repair - Injecting

AFTER

BRIDGE APPROACH



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Approach Repair - Injecting



Injection inside steel reinforced, plexi-glass box
so material flow could be observed

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Approach Repair - Injecting



**Stabilized soil mass was free-standing
after box removed**

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Approach Repair - Injecting

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Vertical load applied using an excavator



Approach Repair - Injecting



Soil mass would not crush, but
excavator was lifted 11 inches

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Approach Repair - Injecting

- I-94 over the St Joe River
- Inject expansive, high strength, polymer.
- 3 Lanes EB – 2” Settlement - \$14,750
- 3 Lanes WB – 3” Settlement - \$16,300
- Life expectancy – 10 years
- 2 Nights

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Bridge Cleaning

Bridge Washing

☐ Wash Superstructure

☐ Wash and Sweep Deck

☐ Clean out Joint

☐ Wash Bearings

☐ Bridge Drain / Scupper Cleanout

☐ Grease Bearings

☐ Product Trial

Equipment:

--

Material:

Cost:

--	--

Personnel:

Hours:

--	--

Comment:

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Bridge Cleaning

- New Template Special Provision
- Potable Water
- Remove & collect materials such as dirt, nests, bird excreta
- Use sufficient water pressure
- Flush Drains

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Bridge Cleaning - Tips

- Engage your local Fire Department
- What about Birds?
- 12SP-107D-02 – Migratory Bird Protection
- **Use** in bridge projects over water where the bottom of the structure is at least 3 feet above the water surface and other bridges where inspection determines it is needed.

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Bridge Cleaning

- Clean Joints



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Bridge Cleaning

- Clean Joints



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Bridge Cleaning

- Clean Toe of Barrier Wall



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Bridge Cleaning

- Clean Toe of Barrier Wall



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Bridge Cleaning

- Vacuum Excreta

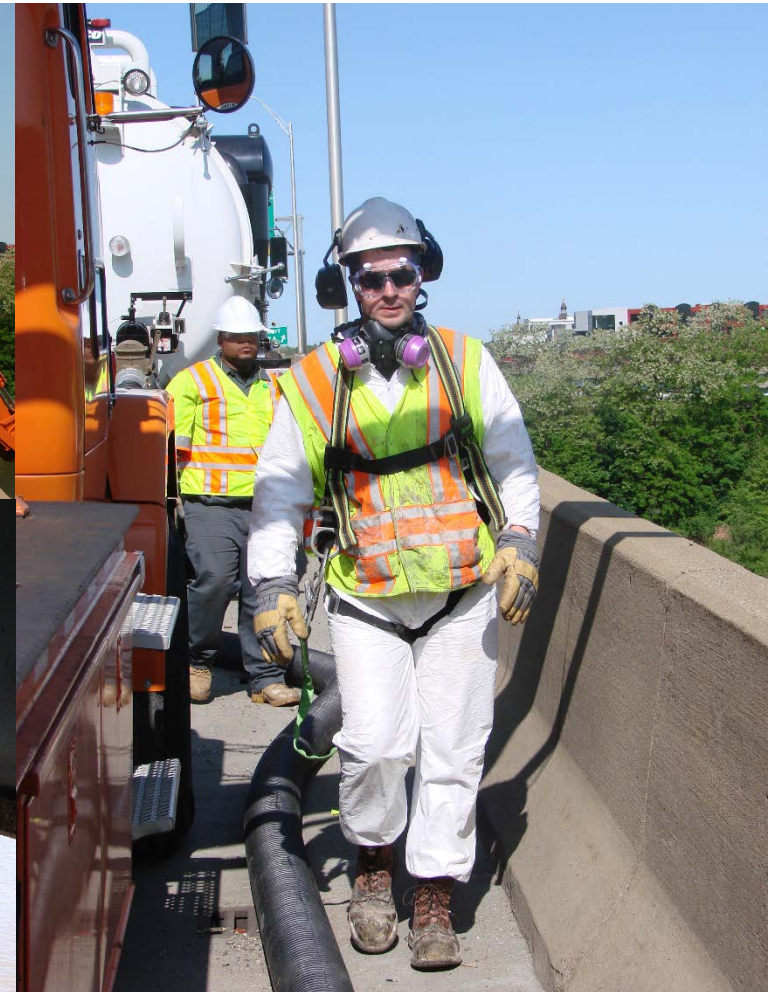


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Bridge Cleaning

- Vacuum Excreta



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Bridge Cleaning

- Vacuum Excreta



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Bridge Cleaning



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Bridge Cleaning

- Benefits
- Reduced Deterioration and Corrosion Rates
- Difficult to determine cost benefit
- Washington DOT Research Reports
 - WA-RD 811.1
 - WA-RD 811.2

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Bridge Cleaning Side Note



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Brush Cut

Brush Cut

☐ Northwest Quadrant

☐ Northeast Quadrant

☐ Southwest Quadrant

☐ Southeast Quadrant

Equipment:

Material:

Cost:

Personnel:

Hours:

Comment:

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Benefits to Properly Maintained Vegetation

- Safety
- Cost
- Environmental
- Aesthetics



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Safety

Improve Line of Sight to Obstacles Rigid and Mobile

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Safety

- Inspector access
- Visibility
- Trapping of moisture on structural elements
 - Beams
 - Deck Fascias
 - Paint Systems



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Safety

Remove Hazardous Trees, Tree Limbs, Brush and Poison Ivy

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Safety

Reduce Standing Water on Roadways
Full Sun Exposure Speeds De-Icing Efforts



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Safety

Reduces Fire Potential



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Cost

Vegetation Management Reduces Maintenance Costs and Protects Highway Assets

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Deck Patching

Deck Patching

SFT Partial Depth QTY: _____
SFT Full Depth QTY: _____
Qty Anodes QTY: _____
LFT Epoxy Reinforcement QTY: _____
☐ Product Trial

Concrete Mixture

☐ BASF – 10-60 Rapid Mortar ☐ MDOT -7 Sack Latex Patching Concrete C-L
☐ MDOT - Concrete Grade D ☐ Castek - T17
☐ MDOT -9 Sack High Early Latex Patching Concrete - C-L-HE ☐ Other - MDOT QPL

Equipment:

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Material:

Cost:

--	--

Personnel:

Hours:

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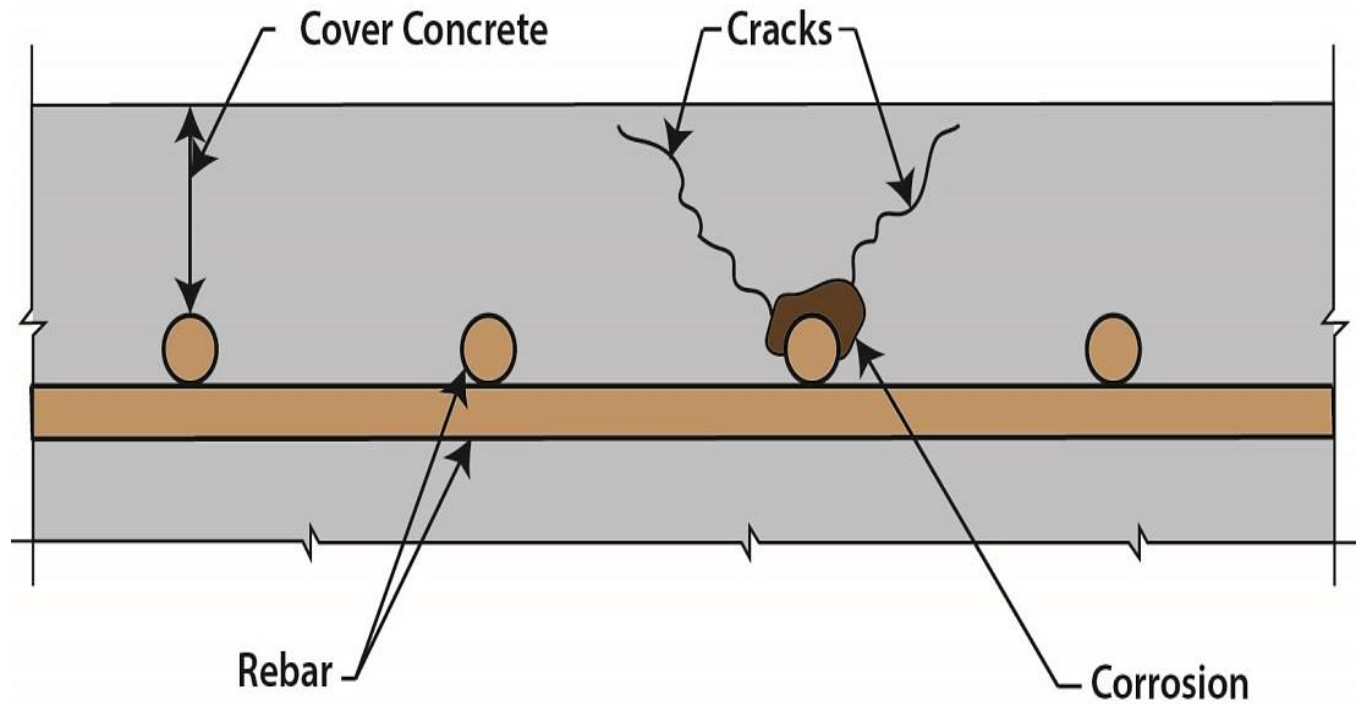
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Deck Patching



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Deck Patching

- Sound the Deck



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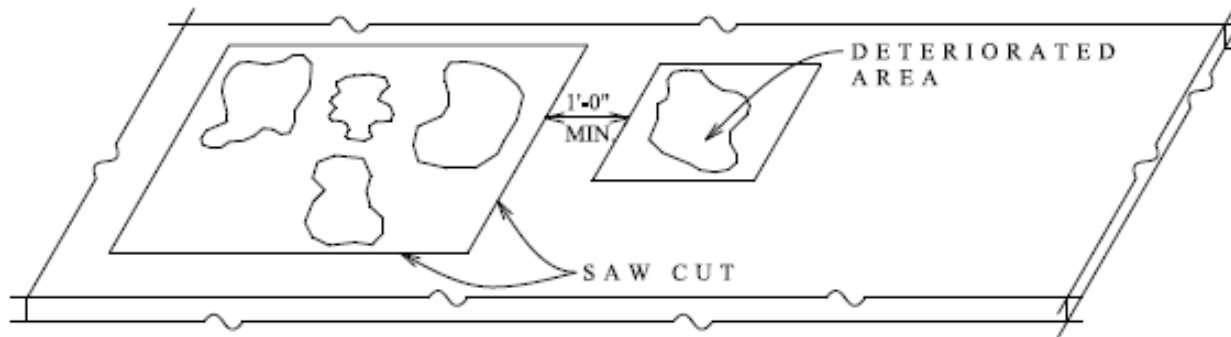


Deck Patching

- Mark limits of removal
 - Mark Patches Square
 - Combine Patches Within 1 foot of adjacent patch
 - Mark patches a minimum of 3" beyond edge of delamination
- Saw Cut
 - 1" Depth
 - 1" Beyond Corners

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Deck Patching



STEP 1

1. SOUND DECK. MARK DELAMINATED, SPALLED AND/OR DETERIORATED AREAS.
2. MARK LIMITS OF REMOVAL TO ENCOMPASS DETERIORATED AREA PLUS 3" MINIMUM ON ALL SIDES. PATCHES SHALL BE AS SQUARE AS POSSIBLE. COMBINE PATCHES THAT ARE WITHIN 1' OF ADJACENT PATCHES.
3. SAW CUT THE DECK TO A DEPTH OF 1" ALONG THE LIMITS OF REMOVAL. EXTEND SAW CUT 1" BEYOND INTERSECTION LINES.



Deck Patching



Minimize corners. Combine patches.

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Deck Patching

- Remove Concrete to $\frac{3}{4}$ " Clearance



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Deck Patching

- Inspect Edge of Patch



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Deck Patching

- Sandblast Reinforcement and Concrete
- Clean Patch with Compressed Air



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Deck Patching

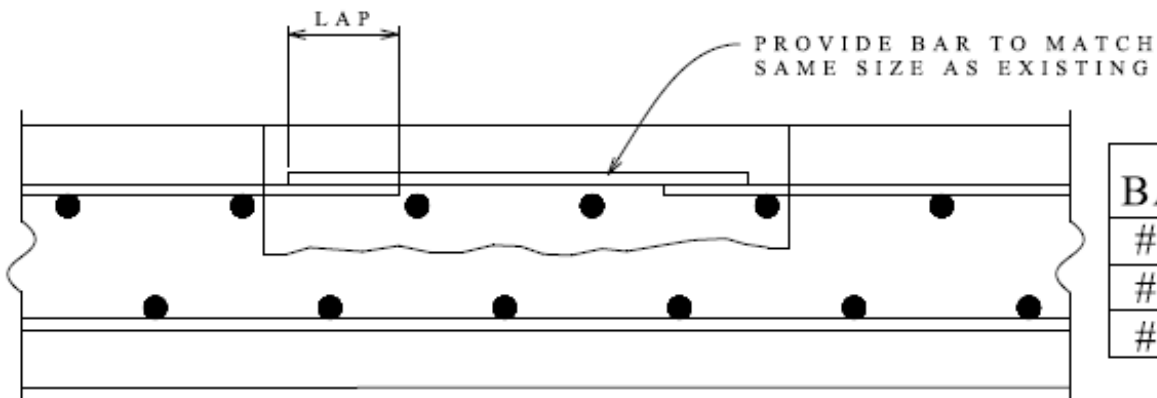
- Replace Deteriorated Reinforcement



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Deck Patching

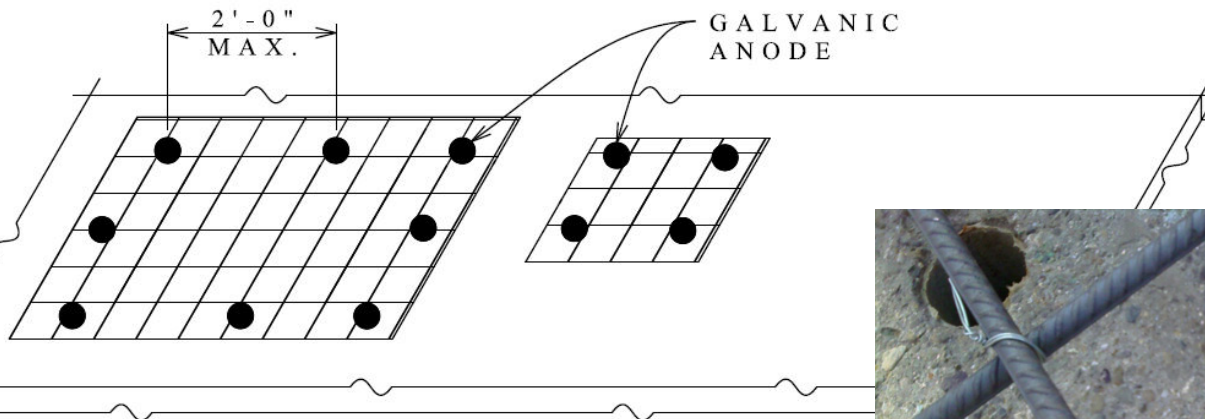
- Drill and Epoxy
- Splice
- Lap



BAR	LAP
#4	20"
#5	26"
#6	31"

Deck Patching

- Place Anodes





Deck Patching

- Wet Existing Concrete Surface to Saturated Surface Dry
- Place Concrete

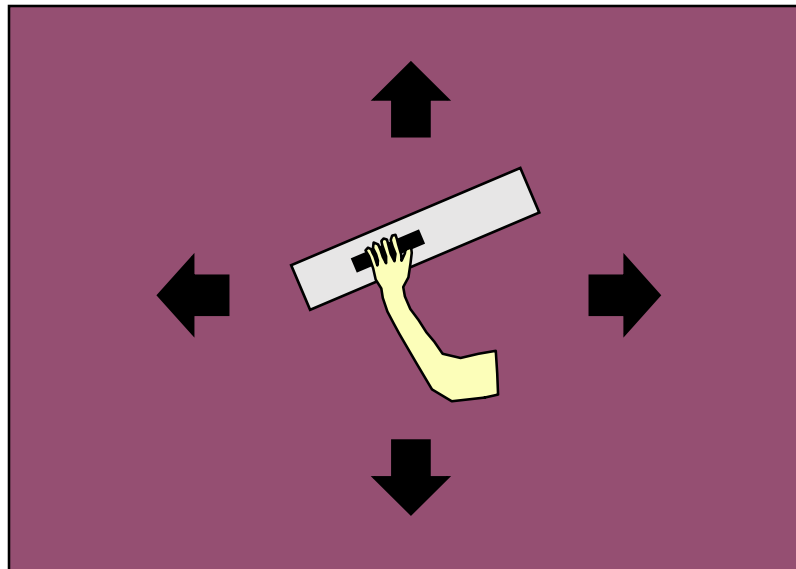


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Deck Patching

- Finish Concrete

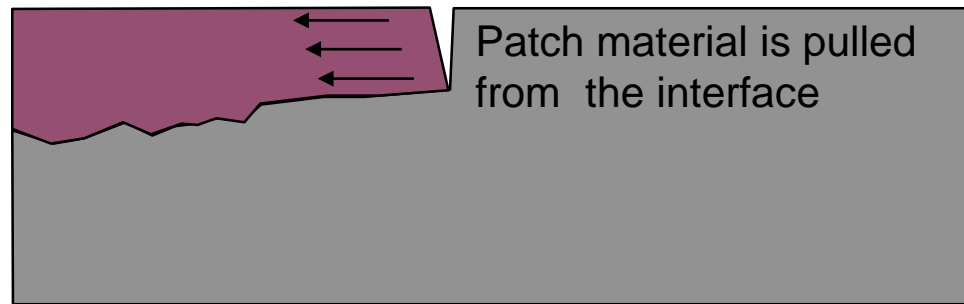


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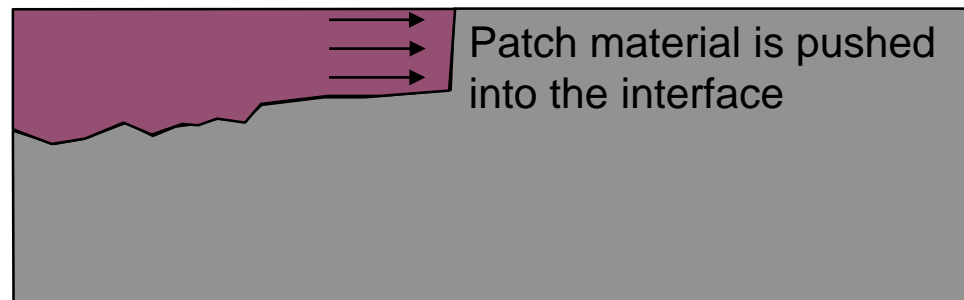


Deck Patching

- Finish Concrete



Finishing Direction →





Deck Patching

- Cure Concrete
- Grade D – Wet Cure 7 Days - \$120/CYD
- Grade C-L – Wet Cure 48 Hours plus Dry Cure 48 hours- \$500/CYD



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Deck Patching

- Cure Concrete – Faster Options
- BASF 10-60 Rapid Mortar
- 15 Minute Working Time
- Open to Traffic – 2 Hours
- \$975 /CYD



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Deck Patching

- Shallow / Cold Weather Patch Options
- Transpo – Castek T-17
- MMA Polymer Concrete System
- As Thin as ½"
- As Cold as 14F



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Deck Patching –T-17

- Open to Traffic – 30 Minutes
- \$2600 / CYD

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Deck Patching –T-17

- Prime Surface



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Deck Patching –T-17

- Measure and Mix T-17 Powder with T-17 Liquid and Powder according to TDS



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Deck Patching –T-17

- Pour and Finish



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Crack Sealing

- Whenever you go out to a bridge, plan on crack sealing.



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Stretch Video

Torqu

Jas
(517



Substructure Repair

Structure ID:		Date:	
Lead Worker Name:			

Substructure Repair

☐ Abutment Repair

Abutment Location: _____

SFT Patch QTY: _____

~~Qty~~ Anodes QTY: _____

☐ Product Trial

Concrete Mixture

☐ MDOT -7 Sack Latex Patching Concrete C-L

☐ MDOT - Concrete Grade D

☐ Other

Equipment:

--

Material:

Cost:

--	--

Personnel:

Hours:

--	--

Comment:

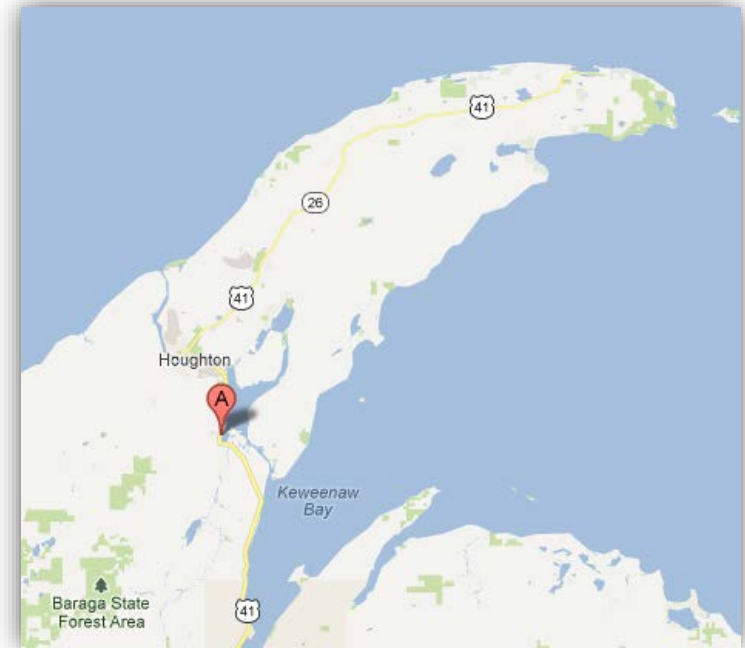
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Substructure Repair

- BO4-31051: US-41 over Sturgeon River
- 1.8 Miles SE of Chassel



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Substructure Repair

- North Abutment
- Spalls to Steel
 - Beams 7W and 8W



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Substructure Repair

- Temporary Supports



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Substructure Repair

- Saw cut perimeter approx. 1½" deep
- Removed all delam. concrete and chip at least ¾" behind reinforcement



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Substructure Repair

- Blast clean concrete, bottom of masonry plate, and existing reinforcement



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Substructure Repair

- Drilling holes for adhesive anchored reinforcement



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Substructure Repair

- Apply cold galvanizing to masonry plate
- Install anodes



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Substructure Repair

- Form



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Substructure Repair

- Mix Concrete Grade C-L On Site



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Substructure Repair

- Pour and Consolidate



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Substructure Repair

- Cure and Remove Forms



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Substructure Repair

- Is fixing the Abutment Enough?
 - Not if caused by pavement growth.



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Substructure Repair

- Is fixing the Abutment Enough?
 - Not if caused by pavement growth.



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Substructure Repair

- Is fixing the Abutment Enough?
 - Not if caused by frozen or improperly designed bearings.



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Substructure Repair

- How do we fix?
 - For Pavement Growth – Install PRJ
 - 12SP-602G-01 – Pressure Relief Joint
 - For Bad Designs – Region Support is writing a bridge movement white paper.

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Bad Joint Details



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Bad Joint Details

- 4" Expansion Joint
 - Off Bridge and On Sleeper Slab
 - Deck Slides over Back Wall
 - 1/2" Gap Between Deck Fascia and Return Wall



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Bad Joint Details

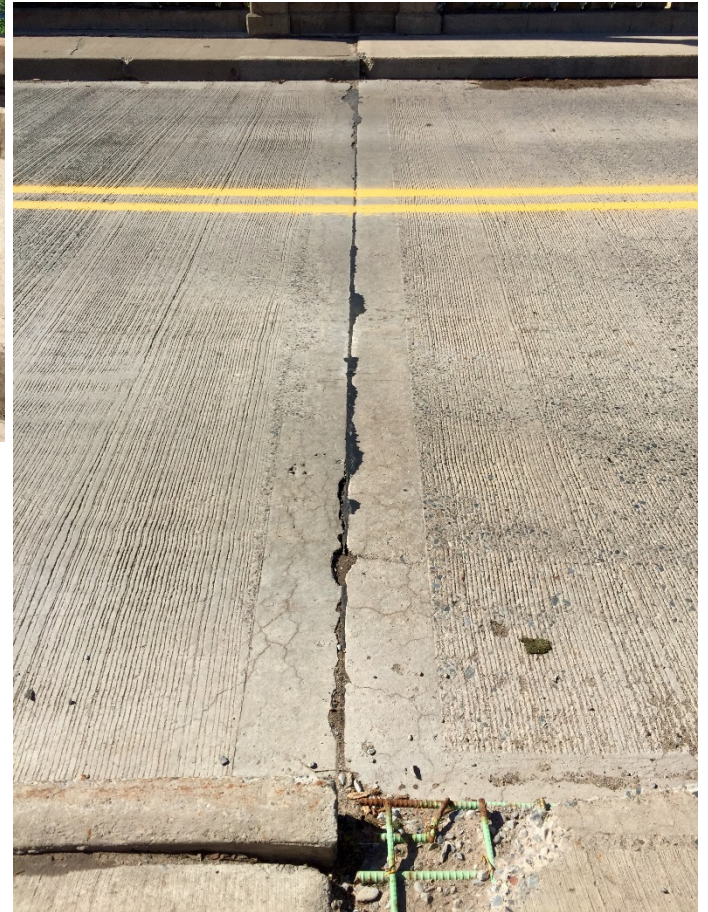
- 2" Expansion Joint
 - Off Bridge and On Sleeper Slab
 - Deck Slides over Back Wall
 - 0" Gap Between Deck Fascia and Return Wall



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Bad Joint Details



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Bad Joint Details



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Substructure Repair

- PRJ Products
 - EMSEAL – BEJS (Pre Compressed)
 - Watson Bowman – Wabo H-Seal (Pre Compressed)
 - Lymtal – Iso-Flex – Silfast XL



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Substructure Repair

- PRJ Products
 - US Composites 2LB Density #245FA – Rigid Pour Foam System



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Substructure Repair



Jason DeR
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Culverts

- Injecting Culverts
 - Leaking Water – Azo-Grout 424
 - Leaking Backfill – Azo-Grout 443
 - [Azo-Grout 424 \(Video\)](#)

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Culverts

- Step 1 – Drill Ports at a 45 degree angle to intersect crack
- Step 2 – Seal crack with hydraulic cement



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Culverts



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Culverts

- Step 3 – Inject Grout to Refusal



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Culvert Repair

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Culverts

Wattles Rd Culverts at the Rough River

- Twin Multi-Plate Pipe Arch
- Originally Constructed in 1967 and extended in 1983
- Severe Corrosion at Invert and Haunch
- 170 Linear Feet of CMP
- 12 ft 10 inches Wide
- 8 ft 4 inches Tall
- 2.5 Inch Thick Geospray Mortar
- 3 Weeks

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Culverts



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Culverts



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Culverts



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Culverts



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Culverts

- Finished - \$1320 / Lineal Foot



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Culverts

Project Details

- Corroded Twin Structural Plate Culverts under 13 Mile Road in Farmington Hills, MI
- Culverts originally constructed in 1987
- 78" Diameter
- 200 linear Ft each
- 1.5 Inch Thick Geospray Mortar
- 2 Weeks

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Culverts



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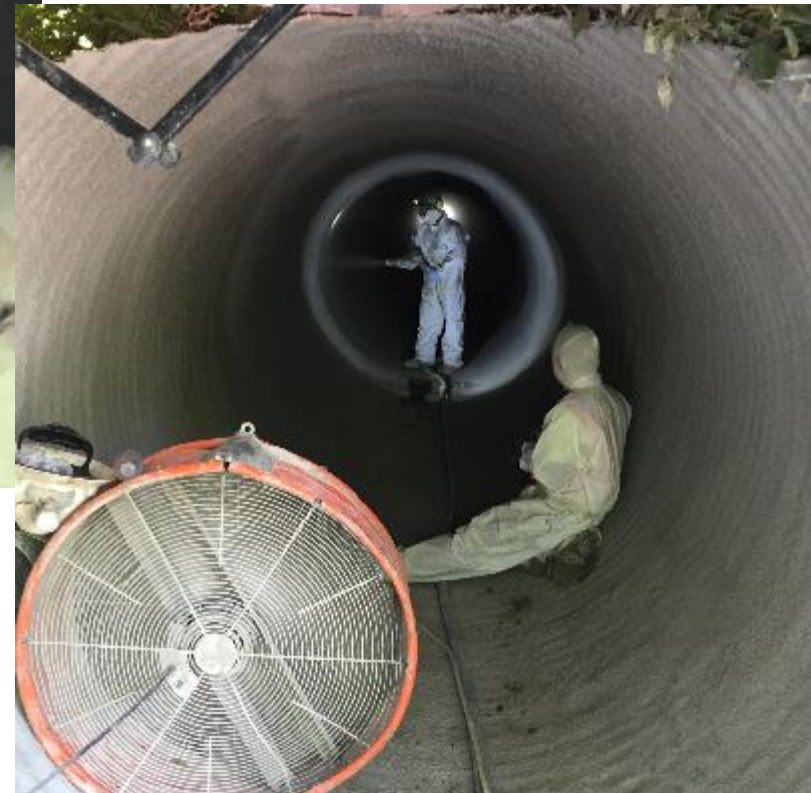
Culverts



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Culverts



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Culverts

- Finished - \$427 / Lineal Foot



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Culverts - Scour



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Culverts - Scour



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Culverts - Scour



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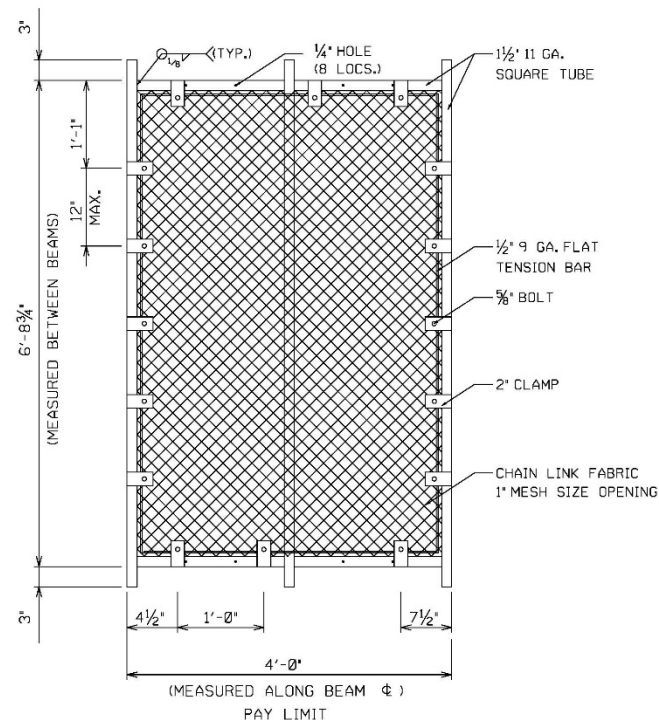
Culverts - Scour

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Metal Mesh Panels

- Protect Public from Falling Concrete
 - Includes Vehicles & Boating Public



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Metal Mesh Panels



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Metal Mesh Panels

- Do they Work?



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US-2 Roadside Park in Naubimway

B05 of 49022

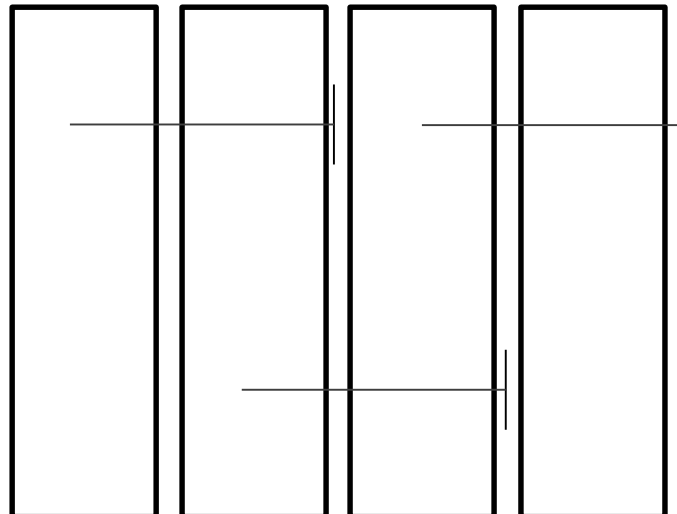
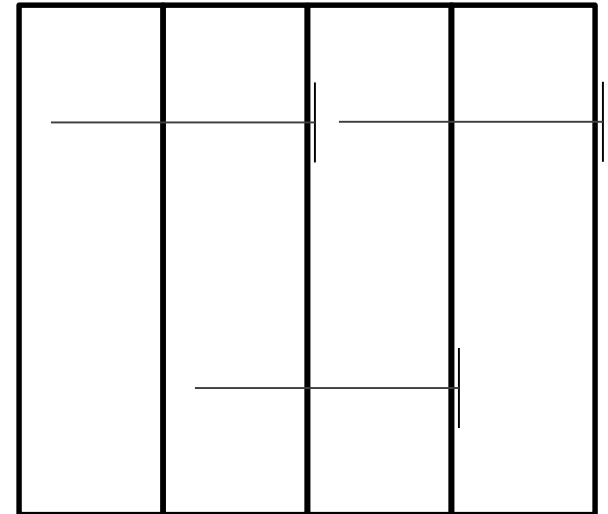
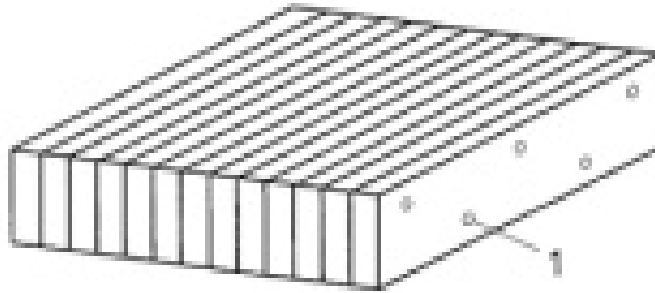
- Constructed in 1990
- Timber Superstructure comprised of 2 x 12 timbers spanning 24 feet nailed together.



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US-2 Roadside Park in Naubimway



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US-2 Roadside Park in Naubimway

2011 Bridge Inspection

- During the Inspection a large truck drove over the bridge, and it deflected more than expected.
- November 8, 2011 – Superior Region conducted a load test.
- Load test used the Engadine Garage's Water Truck with 2,000 gallons of water – Deflected $\frac{3}{4}$ "

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	West Fascia	4' West	8' West	Centerline	8' East	4' East	East Fascia
Baseline	N.M.	53	52 1/4	52	51 1/4	51 1/4	N.M.
Test 1	N.M.	53	52 1/8	51 5/8	51 1/8	51	N.M.
Test 2	N.M.	52 1/4	51 3/4	51 1/2	51 1/8	51 1/4	N.M.
Test 3	N.M.	52 3/4	51 7/8	51 5/8	51 1/4	51 3/8	N.M.

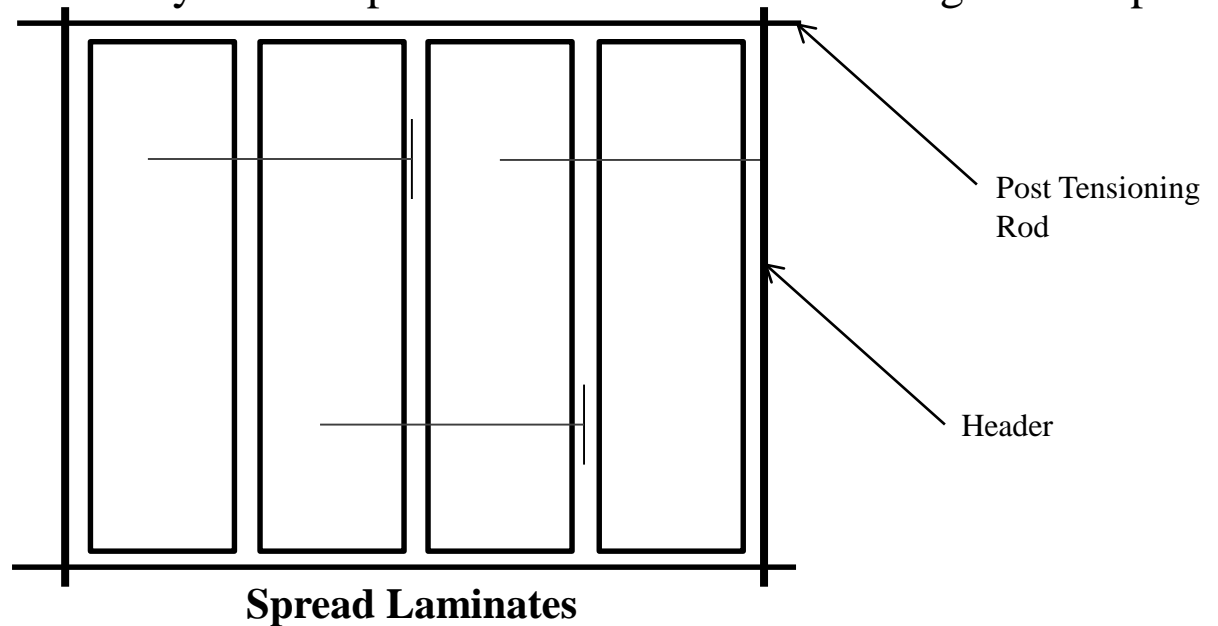


How do you fix this?

3 Research Reports Consulted

Report 1: Transverse Post-Tensioning of Longitudinally Laminated Timber Bridge Decks

- Ontario Ministry of Transportation Post Tensioned Bridge to 150 psi



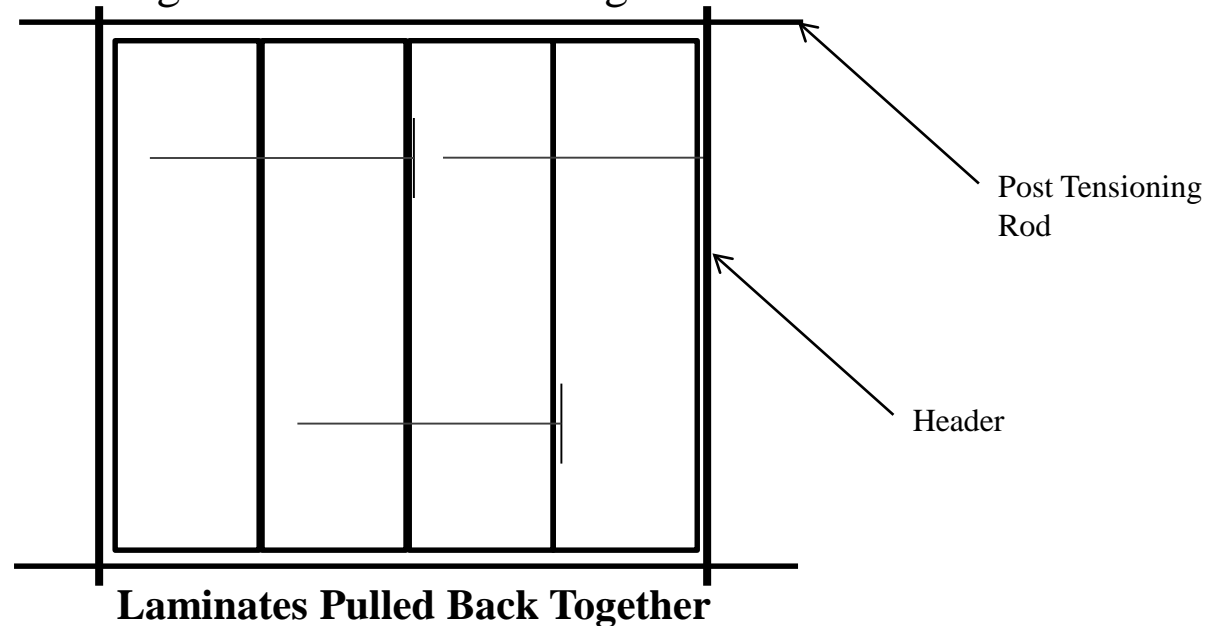


How do you fix this?

3 Research Reports Consulted

Report 1: Transverse Post-Tensioning of Longitudinally Laminated Timber Bridge Decks

- Post Tensioning Force shrunk the bridge 6 inches





How do you fix this?

3 Research Reports Consulted

Report 1: Transverse Post-Tensioning of Longitudinally Laminated Timber Bridge Decks

Results

- Deflections reduced by 50%
- Strength increased by 100%

Follow-up

- Measure post tensioning force every 3 months for first year
- Tighten as needed
- Measure post tensioning force every inspection thereafter

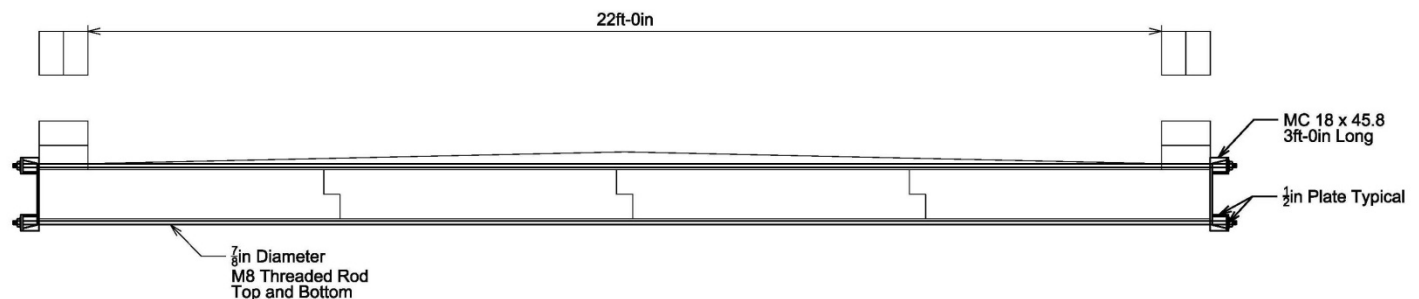
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Design

Post Tensioning

- The test bridge shrunk 6 inches when post tensioned to 150 psi
- B05 of 49022 Measured 24'-2" Wide (Only 2" wider than As-Built)
- Report 1 determined only 40 psi between timbers needed for composite action.



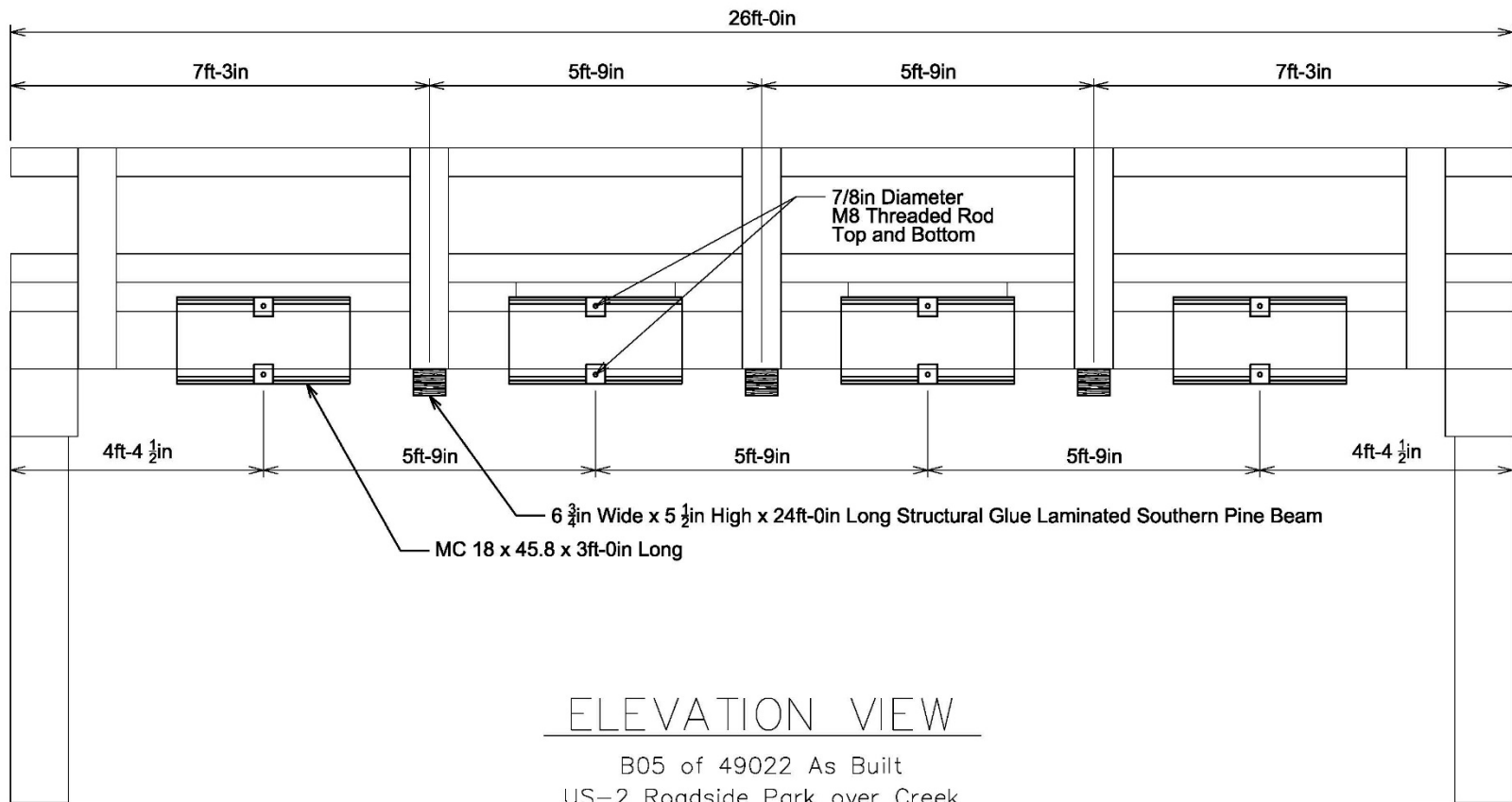
SECTION A-A

Section at
MC 18x45.8 and
M8 Threaded Rod

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Design



ELEVATION VIEW

B05 of 49022 As Built
US-2 Roadside Park over Creek
2.6 Miles East of Naubinway



Construction



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Construction



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Results

- $\frac{3}{4}$ inch deflection before
- $\frac{1}{4}$ inch deflection after



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Questions?



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