2015 Michigan Bridge Conference
Bridge Deck Joint Replacement

Presenter
Neal S. Carboneau, P.E.

Source: Better Roads
Credits

• Federal Highway Administration, FHWA
• Michigan Department of Transportation, MDOT
• Indiana Department of Transportation, INDOT
• Indiana Local Technical Assistance Program, LTAP, at Purdue University
• Joint Transportation Research Program, JTRP, at Purdue University
• Maine Department of Transportation
• National Center for Pavement Preservation
• Michigan State University

• Dow Corning
• D.S. Brown
• RJ Watson
• SSI
• Watson Bowman Acme

Source: JTRP
Goal of the Presentation

The understanding that joint repairs and replacement are complex topics with many variables.

– Give you the ability to find what you need
– Perspective on problematic areas
– Basic understanding of the processes
  • Help you decide if you want to add joint repair to your regular maintenance activities
  • Or contract out wider scale maintenance and repair activities
Bridge Deck Joint Replacement

- Definitions
- The Importance of Joint Maintenance
- Integrating Joint Maintenance in Bridge Management Plans
- Initial Considerations
- Using Your Own Forces
- Challenges
- Other Considerations
- Recommendations

Source: JTRP
Definitions

- XJS System – Expansion Joint Sealing System
  - Polymer nosing material
  - Backer rod
  - Silicone joint sealant
- BS Joints – Type B Compression Seal

BS Source: Watson
Bowman Acme

XJS Source: Watson
Bowman Acme
Definitions

- SS Joints – Strip Seal – “Gland”
- Modular Joints
- Finger Joints
Definitions

• Hot Poured Sealants

Source: FHWA

Source: Better Roads

Source: Michigan DOT
Definitions
Hot Poured Sealants – Michigan DOT

SPECIAL PROVISION FOR RESEALING BRIDGE CONSTRUCTION JOINTS WITH LOW-MODULUS HOT-POURED RUBBER
(Capital Scheduled Maintenance) 12CT602(A035) C&T:APPR:JAB:KPK:11-08-11

This work consists of removing existing joint sealants, cleaning the joint, and sealing the joint with a low-modulus hot-poured joint sealant.

Definitions

Low Modulus Silicone Sealants – Michigan DOT

SPECIAL PROVISION FOR RESEALING BRIDGE END JOINTS WITH LOW-MODULUS SILICONE
12DS602(I145) APPR:ARB:CER:12-02-14

Materials. Provide solid, round, closed-cell, cross-linked polyethylene foam back rod meeting the requirements of ASTM D 5249, for Type 1. Select the silicone sealant from the pre-approved manufacturers in Table 1 or an Engineer approved equal:

Table 1: Silicone Sealant Manufacturers

<table>
<thead>
<tr>
<th>Manufacturer</th>
<th>Product</th>
<th>Telephone</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dow Corning</td>
<td>888 Silicone Joint Sealant</td>
<td>(989) 496-7875</td>
</tr>
<tr>
<td>D.S. Brown</td>
<td>DBS 800 Silicone</td>
<td>(419) 257-3561</td>
</tr>
<tr>
<td>Sika Corporation</td>
<td>Sikasil-728 NS</td>
<td>(800) 933-7452</td>
</tr>
</tbody>
</table>
The Importance of Joint Maintenance

Strip seals are very sensitive to debris.

Source: JTRP
The Importance of Joint Maintenance

Neglected and un-repaired joints provide easy access to water and road salts.

Source: JTRP
The Importance of Joint Maintenance

Damage from the road salts

Source: JTRP
Integrating Joint Maintenance in Bridge Management Plans

Restricting the intrusion and impacts of road salts are major goals of bridge management plans

– Washing decks, drains, beams and beam seats
– Sealing cracks and decks
– Spot painting
– Cleaning and maintaining the integrity of the joint seals

Source: JTRP
Integrating Joint Maintenance in Bridge Management Plans

• Recent LTAP and JTRP research on
  – Soy based sealers
  – Internal curing
  – High performance concrete mixtures

• Provide promising strategies to
  – Reduce the impacts of road salts
  – Increase structure longevity
  – Reduce the long term cost of the structures

Source: JTRP
Initial Considerations

• Make field visits to determine specific joint conditions, types and dimensions.
• Review as built records for supplier and model information.
• Obtain joint expansion and contraction values.

Source: Neal Carboneau
Initial Considerations

• Consult with engineers and product manufacturers for optimal solutions
• Consider
  – Time till next major rehab
  – Necessary life
  – Cost of repairs
  – Duration of repair activities
  – Cure times
• Expense of other activities can impact the cost of the operation
  – Detours
  – Overnight lane closures

Source: SSI

SS replacement with XJS
Initial Considerations

• Consider alternatives for
  – Contracting
  – Self Performance

• Will the work be part of regular maintenance operations

• Can a contract be created with enough work and time per location to make it economically feasible

Source: DS Brown
Initial Considerations

Can the work be combined with other maintenance or repair activities

- Improve value and efficiency of contracting or self performed operations
- Reduce the number and duration of lane interruptions

Source: FHWA
Using Your Own Forces
Start by reviewing the resources and talking with the experts
FHWA, MDOT, INDOT ...
Standards, Specifications and Guidelines

– Installation Information
– Quality Control Information
– Potential Problem Areas
712
Bridge Rehabilitation - Concrete

2012 STANDARD SPECIFICATIONS FOR CONSTRUCTION - SECTION 712

CERTIFIED TECHNICIAN PROGRAM
TRAINING MANUAL

Bridge Construction
and
Deck Repair

Revised 2014
Using Your Own Forces
Start by reviewing the resources and talking with the experts

- Product Manufacturers
  - Dow Corning
  - D.S. Brown
  - RJ Watson
  - SSI
  - Watson Bowman Acme

- Material procurement information
- Tool and equipment suggestions
- Typical workforce needs
- Training, certification and installation videos
- Safety considerations
Using Your Own Forces

Have the workforce properly trained for each activity

– Estimating, Budgeting, Procurement
– Construction Processes and Material Installation
– Targeted Safety Training
– Workzone Safety and Traffic Control Training

Source: Neal Carboneau
Using Your Own Forces

Calculating quantities and costs

Use caution with XJS System Quantities
• Depths, Nosing Quantities
• Consider irregularities
• Impacts of deterioration
• Partial mixtures and waste

Source: SSI
Using Your Own Forces
Calculating quantities and costs

Use caution with XJS System Quantities

A 2” x 4” Nosing x 30’ long
On 2 sides of the joint at
2 ends of the bridge has a
Volume of 6.7 cft.

Source: Watson Bowman Acme

If the joint is chipped out an average of 2.5” x 4.5”, the volume
would be 9.4 cft. If you add 0.5 cft for waste and 0.5 cft loss
in the drum and mixing, you might need 10.4 cft.
Using Your Own Forces

Calculating quantities and costs

If you figured 6.7 cft and ordered 2 units with a volume of 5 cft, you could be short by 1 cft.

The job would be stopped and you would have wished you ordered more. It would have been a small price to pay for a more material in case of an overrun compared to not being able to complete the joint while you were there.

Source: SSI
Using Your Own Forces

Calculating quantities and costs

You can miss the silicone by even more $$ with slight variations in the width and depth of the backer rod

Source: SSI
Using Your Own Forces
Planning (with special considerations)

• Materials
  – Quantities, Procurement,
    Transportation, Temperatures

• Tools
  – Manufacturer Specific
  – Pry Bars, Brushes, Buckets ... 

• Equipment
  – Lifting Equipment (Pallets and Joints)
  – Oil Water Separators
  – Blasting Pots and Hoods
  – Torches, Welders
Using Your Own Forces
Planning (with special considerations)

- Cleanup and Disposal
  - Water
  - Solvents, Alcohol
- Safety Considerations
  - Fire
  - Medical Testing
  - Respirators
  - Safety Data Sheets
  - PPE
- Traffic Control

Source: Neal Carboneau
Using Your Own Forces

Operations

- Removal
- Cleaning
- Installation (Quality Control – Dimensions)
  - Temperature Sensitive (Ambient and Surface)
    - Materials (Cure)
    - Joints (Expansion and Contraction)
- Cure Time
- Restriction Removal

Source: DS Brown and SSI
Other Considerations

• Time Consuming Processes
  – Inspection
  – Determining the type of joint
    • Exact materials for matching
    • Record review
    • Samples
  – Acquisition times
  – Removals
  – Cure Times

Source: DS Brown
Other Considerations

- Small Quantity Premiums
- Traffic Control and Durations
- Splicing
  - Difficult
  - Prohibited by many DOTs
  - Phased with full length stored in initial phase

Source: JTRP
Other Considerations

- Mixing Types
  - XJS or Hot Pour in SS
- Design for Future Structures
- Design for Maintenance
- Elimination of Joints
  - Consult an Engineer

Source: SSI

(b) Integral Construction

Figure 1.1: Methods of Construction
Recommendations

• Establish a regular preventative maintenance program
• Use asset management concepts and information to plan your program
• Get training on estimating, budgeting, workforce skill sets and associated safety practices
The concepts provided here are investments to reduce long term costs, lane restrictions, and associated user costs.

Source: JTRP
Bridge Deck Joint Replacement

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• Integrating Joint Maintenance in Bridge Management Plans
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• Challenges
• Other Considerations
• Recommendations

Source: JTRP
Contact
Neal S. Carboneau, P.E.
249 Connolly Street, PO Box 2344
West Lafayette, Indiana 47996
(812) 322-4277
ncarboneau@gmail.com
www.TransportationTrainingInstitute.com

Resources
TTI Dropbox Link
To Bridge Joint Resources
http://goo.gl/T8p0KN
Resources

DS Brown
http://www.dsbrown.com/

RJ Watson, Inc.
http://www.rjwatson.com/

SSI XJS Website
http://www.ssicm.com/highway.php

Watson Bowman Acme
https://wbacorp.com/

Dow Corning® 902 RCS Joint Sealant and the X.J.S®tem - Video
http://www.youtube.com/watch?v=CONWRrULsXo

D.S. Brown New York State Delcrete Joint Work - Video
http://www.youtube.com/watch?v=ojSWLyu8_o8
Resources

NYSDOT SSI XJS Installation Information

NYSDOT SSI XJS Design Details

FHWA Bridge Preservation Guide

FHWA Bridge Management Practices

Bridge Deck Joints, John Buxton, Maine DOT

Bridge Preservation
http://tsp2bridge.pavementpreservation.org/technical/task-force-results/
Resources

- INDOT Bridge Inspection Training (Certified Technicians)
  http://www.in.gov/indot/2403.htm

- MDOT Bridge Rehab Wiki Instructions
  https://mdotwiki.state.mi.us/construction/index.php/712_-_Bridge_Rehabilitation,_Concrete

- MDOT Special Provisions
  http://mdotcf.state.mi.us/public/specprov/index.cfm?sy=439690
  - Resealing Bridge Construction Joints With Low-Modulus Hot-Poured Rubber - 12CT602(A035)
  - Resealing Bridge End Joints With Low-Modulus Silicone-12DS602(I145)

- Michigan Bridge Capital Scheduled Maintenance Manual

- Michigan Bridge Design Manual – New and Reconstruction
  https://www.google.com/?gws_rd=ssl&q=michigan+bridge+design+manual+ch+7

- Michigan Bridge Design Manual – Rehabilitation

- Oman Systems, Inc – Unit Prices
  http://www.omanco.com/index.asp
Resources

Joint Transportation Research Program, Purdue University
https://engineering.purdue.edu/JTRP

Indiana Local Technical Assistance Program
http://rebar.ecn.purdue.edu/LTAP1/Home/

Indiana using new concrete to increase bridge life span

Internal Curing Video
http://www.youtube.com/embed/-y9y7g5eqBE

Concrete Construction Soy Sealer Article
http://www.concreteconstruction.net/sustainability/green-beans.aspx

Long Term Behavior of Integral Abutment Bridges
http://docs.lib.purdue.edu/jtrp/1486/