Common Bridge Maintenance Issues

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Presentation Overview

- Bridge Deck Drain Systems
- Approach Slab Cracking
- End Bent, Approach Slab and Slopewall Undermining
- Bridge Bearings and Beam Ends
- Bridge Joints
- Job Order Contracting

Bridge Deck Drain Systems

- Common causes for failure
  - Clogged drains or pipes

![Bridge Deck Drain System Image]
Bridge Deck Drain Systems

- Common causes for failure
  - Drain system support failure

- Holes in drain systems caused by corrosion
Bridge Deck Drain Systems

Suggestions for mitigation

- Eliminate drains whenever possible
  - Only use deck drains when required by design (see IDM section 404-2.07)
  - May be beneficial to place drains up hill from bridge deck expansion joints

- Provide adequate support for drain pipes
  - Avoid using clamped connections if possible
Bridge Deck Drain Systems

Suggestions for mitigation

- Provide adequate support for drain pipes
  - Avoid using clamped connections if possible

- Consider specifying thermosetting resin pipe material

  - INDOT Standard Specifications section 715.02(n) allows for either thermosetting resin or cast iron
  - Thermosetting resin is lighter weight than cast iron, which reduces demand on supporting hardware
  - Cast iron will corrode over time
  - Longevity of thermosetting resin pipe?
Bridge Deck Drain Systems

Suggestions for mitigation

- Why not use PVC for drain systems?

- Locate drain clean outs for ease of access
Approach Slab Cracking

- Cracking adjacent to Type IA joint

Old details
Approach Slab Cracking

- Cracking adjacent to Type IA joint
  - Old details

![Diagram of Approach Slab Cracking with Type IA Joint and Potential Crack]

Approach Slab Cracking

- Cracking adjacent to Type IA joint
  - New details

![Diagram of Approach Slab Cracking with Type IA Joint and Improved Details]
Approach Slab Cracking

- Random cracking throughout slab
  - Shrinkage cracking
  - More prevalent in larger approach slabs
  - Wide roadway widths and large skew angles create very large approach slabs
    - Possibly reduce approach slab sizes by staggering sections of slab
    - Possibly mitigate shrinkage cracking by introducing longitudinal joints to create separate pours

Approach Slab Cracking

- Random cracking throughout slab
  - Staggered approach slabs
Approach Slab Miscellaneous

- Always repair terminal joints with bridge or roadway projects.
  - If they’re not in bad shape now, they will be before the next rehabilitation
- Consider using paved gutter turn-outs at the top of riprap turn-outs
  - May need to tie turn-outs to approach slab for thermal movements
- Don’t allow approach slabs to be poured with bridge decks
  - Provides a smooth transition, but has historically had cracking problems near type IA joint

End Bent & Approach Slab Undermining

- Caused by waterway scour, cracks in the approach slab, or unsealed joints
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**End Bent & Approach Slab Undermining**

- Can be repaired by coring through approach slab and filling voids with grout
End Bent & Approach Slab Undermining

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End Bent & Approach Slab Undermining

- Provide adequate end bent embedment to possibly mitigate erosion

- Consider specifying coarse aggregate material when specifying MSE walls
Common Bridge Maintenance Issues

**Slopeswalls**

- **Voids underneath slopewalls are a common issue**
  - May be evident by loss of material through cracks near the bottom of the wall, or cracked and settled sections of concrete.

  - Voids are caused by water flowing under the slopewall and carrying fill material away.
    - Possible contributing factors are failed bridge expansion joint, cracks in the approach slab, failed Type IA joint, failed drainage system.

**Slopeswalls**

- **Slopewall failure example**
Slopedwalls

- Slopewall failure example

Stop the water from getting to the slopewall
- Reroute or eliminate deck drain systems
- Repair or eliminate bridge deck expansion joints
- Repair or replace cracked approach slabs
- Repair or replace Type IA joints
- Repair cracks in slopewall ditches
- Find the slopewall drain pipe outlet and make sure it's clear and functional
Rocker Bearings

- Several common issues caused by corrosion of rocker bearings
  - Deterioration of upper or lower pintles connecting the shoe to the upper or lower plates
  - Pack rust between plates lifting the beam ends and causing elevation difference between the deck and mudwall
  - Pack rust between plates causing adjacent bearings to be loose

Rocker Bearings

- Deterioration of pintles
Rocker Bearings

- Loose bearing

Suggestions to consider during design

- Check for loose bearings during preliminary field check
- Advanced deterioration of bearings may warrant semi-integral end bent conversion
- If bearings are to be painted with deck work, create a unique special provision to specify bearing work is done prior to deck work. The removal of pack rust can lower the beam ends.
Bridge Joints

- Leaking bridge joints likely cause the most damage to our superstructures and substructures
- Problems caused by leaking joints
  - Beam end corrosion
  - Bearing corrosion
  - Substructure deterioration
  - Slope wall undermining

Bridge Joints

- Beam end corrosion example
Bridge Joints

Substructure deterioration example

What types of joints do we typically use?

- Semi-integral end bent conversion
  - Pros – Eliminates joint and associated future maintenance
  - Cons – Highest cost and most disruption to MOT

- SS and Alternate SS
  - Pros – Best service life and possible to maintain
  - Cons – Moderately expensive and installation requires demolition

- Poured Silicone
  - Pro – Inexpensive and minimal disruption to MOT
  - Cons – Short service life and sensitive to proper construction techniques
Bridge Joints

Other joint types to consider

- Precompressed Foam
  - Pros – Inexpensive and minimal disruption to MOT
  - Cons – Unproven service life in Indiana

Bridge Joints

Other joint types to consider

- Preformed Silicone
  - Pros – Inexpensive and minimal disruption to MOT
  - Cons – Unproven service life in Indiana
Bridge Joints

- **Other joint types to consider**
  - SS Joint gland replacement or modification
    - Pros – Inexpensive and moderate disruption to MOT
    - Cons – Difficult to determine feasibility

Bridge Joints

- **Joint repair - vs- Semi-integral conversion**
  - No specific rules or guidance
  - Considerations
    - Semi-integral may require additional MOT time and have other associated costs, such as temporary shoring
    - May be most economical during deck replacements when the weight of the deck doesn't need to be jacked and supported
    - Use life cycle cost analysis to justify higher present construction costs
Job Order Contracting

- Referred to as Job Order Contracting (JOC) or Indefinite Delivery Indefinite Quantity (IDIQ)

- Pilot program in Greenfield on the March 17, 2016 letting

- Allows INDOT to perform maintenance and repair type projects without the time and expense of typical contract delivery methods

Job Order Contracting

- On-Call Contractor will be selected based on low bid price for a catalog of task items

- Projects will be identified by the INDOT District Asset Engineer

- Project scope documents will be prepared
  - Drawings and details will likely be 8 ½” x 11” plan sheets stamped by a P.E. and standard drawings
  - Contractor will develop quantities and price proposal
Job Order Contracting

- Typical project types may include:
  - Bridge joint repairs
  - SlopeWall repairs
  - Bearing replacement
  - Beam end repairs
  - Emergency repairs

- JOC contracts will likely be coming to all INDOT Districts next year

Bridge Maintenance Example Projects

- Bridge deck patching is our most common activity
Bridge Maintenance Example Projects

- Bearing retrofit (Kenny Keeper)
Bridge Maintenance Example Projects

- Bearing replacement
Bridge Maintenance Example Projects

- Beam end shoring (Corbel)

- Beam end shoring (Gutter foundation)
Bridge Maintenance Example Projects

- Beam end shoring (Gutter foundation)
Bridge Maintenance Example Projects

- Substructure shoring

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