

Common Bridge Maintenance Issues

Pete White, P.E.
Greenfield District Bridge Asset Engineer, INDOT

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INDOT Bridge Asset Engineers

- LaPorte (Northwest) - Steve Benczik, P.E.
(Outgoing) – Mark Pittman, P.E. (Incoming)
- Crawfordsville (West Central) – Mick Brinkerhoff, P.E.
- Seymour (Southeast) – Greg Carleton, P.E.
- Vincennes (Southwest) – David Christmas, P.E.
- Fort Wayne (Northeast) – Keith Lytton, P.E.
- Greenfield (East Central) – Pete White, P.E.



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 Systems

- Common causes for failure
 - Drain system support failure



Bridge Deck Drain Systems

- Common causes for 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



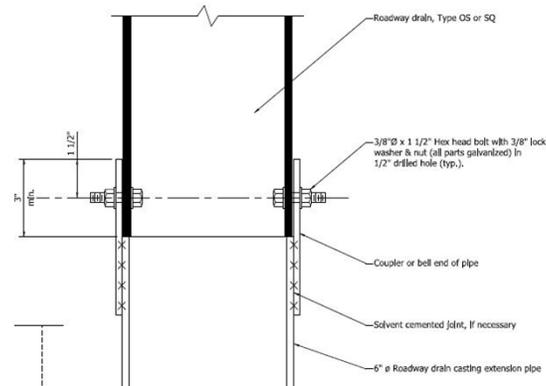
Bridge Deck Drain Systems

- **Suggestions for mitigation**
 - **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



Bridge Deck Drain Systems

- Suggestions for mitigation
 - 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?



Bridge Deck Drain Systems

- Suggestions for mitigation
 - Locate drain clean outs for ease of access



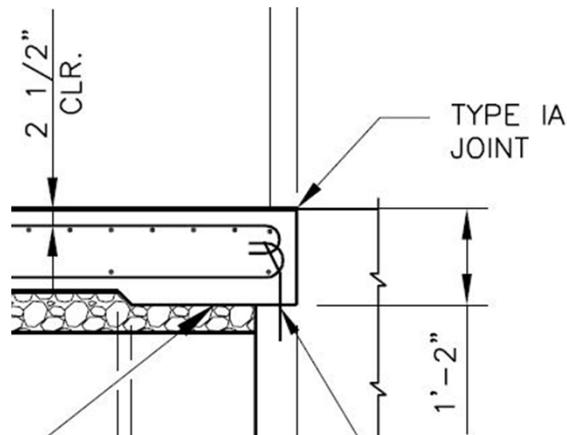
Approach Slab Cracking

- Cracking adjacent to Type IA joint



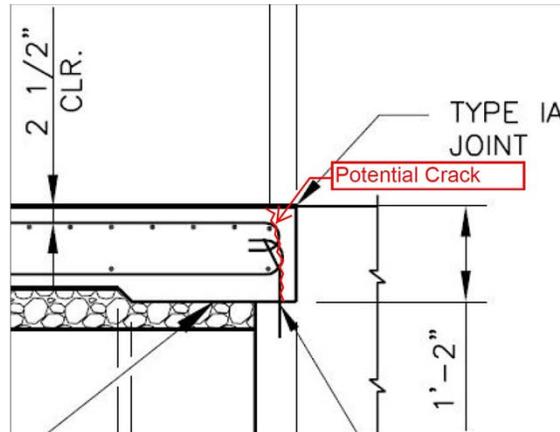
Approach Slab Cracking

- Cracking adjacent to Type IA joint
 - Old details



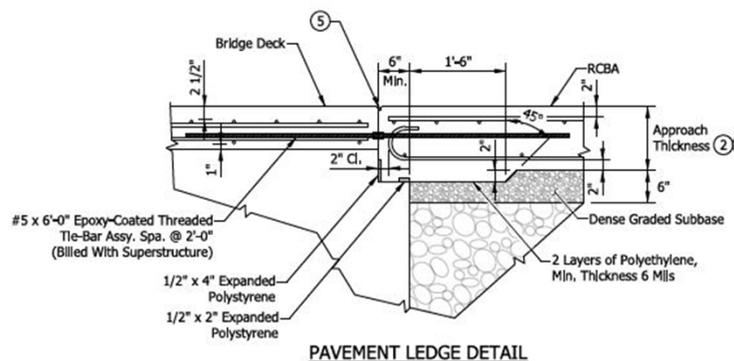
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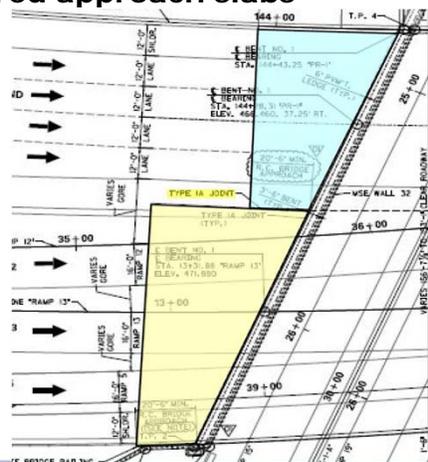
Approach Slab Cracking

- 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**



End Bent & Approach Slab Undermining

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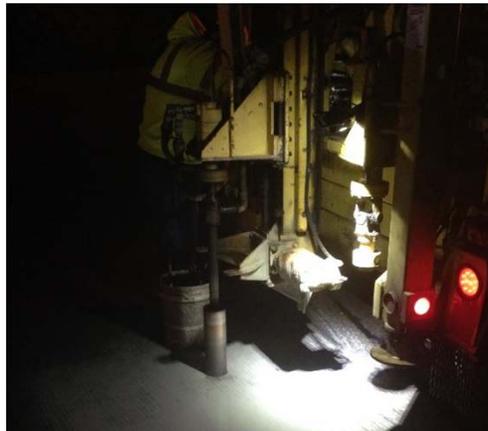
End Bent & Approach Slab Undermining

- Can be repaired by coring through approach slab and filling voids with grout



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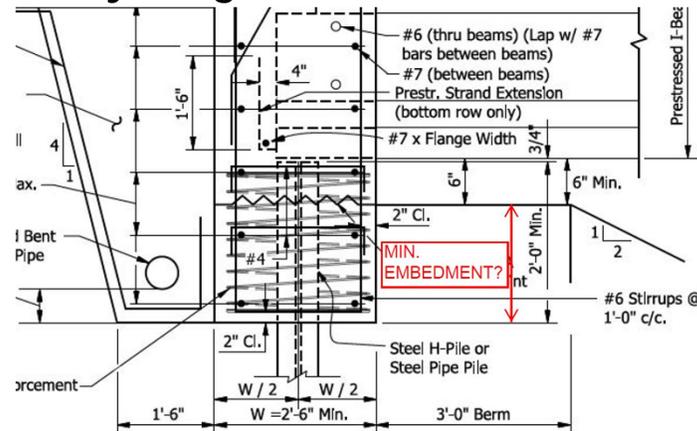
End Bent & Approach Slab Undermining

- Can be repaired by coring through approach slab and filling voids with grout



End Bent & Approach Slab Undermining

- Provide adequate end bent embedment to possibly mitigate erosion



End Bent & Approach Slab Undermining

- Consider specifying coarse aggregate material when specifying MSE walls



Slopedwalls

- **Voids underneath slopedwalls 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 slopedwall 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



Slopedwalls

- **Slopedwall failure example**



Slopedwalls

- **Slopedwall failure example**



Slopedwalls

- **Possible undermining prevention methods**

- Stop the water from getting to the slopedwall
 - 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 slopedwall ditches
 - Find the slopedwall 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**



Rocker Bearings

- **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
 - Slopewall undermining



Bridge Joints

- **Beam end corrosion example**



Bridge Joints

- **Substructure deterioration example**



Bridge Joints

- **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

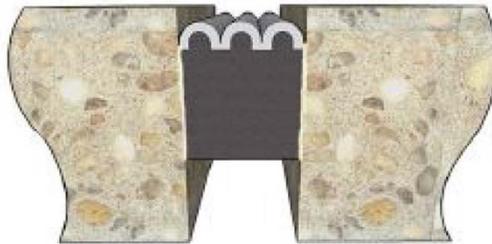


Image taken from Watson Bowman data sheets



Bridge Joints

■ Other joint types to consider

- Preformed Silicone
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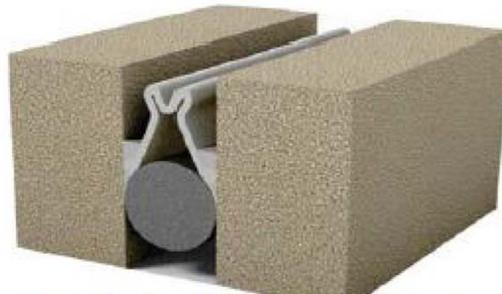


Image taken from Watson Bowman data sheet



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 retrofit (Kenny Keeper)



Bridge Maintenance Example Projects

- Bearing replacement



Bridge Maintenance Example Projects

- Bearing replacement



Bridge Maintenance Example Projects

- Beam end shoring (Corbel)



Bridge Maintenance Example Projects

- Beam end shoring (Gutter foundation)



Bridge Maintenance Example Projects

- Beam end shoring (Gutter foundation)



Bridge Maintenance Example Projects

- Beam end shoring (Gutter foundation)



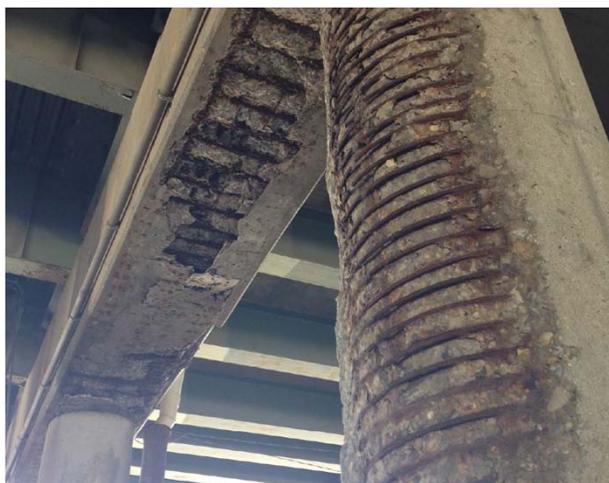
Bridge Maintenance Example Projects

- Substructure shoring



Bridge Maintenance Example Projects

- Substructure shoring



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- Substructure shoring



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- Substructure shoring



Bridge Maintenance Example Projects

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