Agenda

• What is a Bridge?
• Bridge Data Collection
• Load Rating Conditions
• Bridge Widening/Rehabilitation
• Concrete Bridge Repairs
  • Deck Expansion Joints
  • Bridge Deck
  • Superstructure
  • Substructure
• Current Project Experience
• Useful Links
• Questions & Comments
What is a Bridge?

• Definition: A structure spanning and providing passage over a river, chasm, road, or the like.

• Bridge Components
  • Superstructure
    • Beams and deck riding surface
  • Substructure
    • Pier Cap
    • Column
    • Footing
    • Piles/Drilled Shafts

Figure 2: Typical Bridge Components
Bridge Data Collection

• Obtain Latest Bridge Inspection Report
  • Go to www.bridgereports.com
  • Go to www.fdot.gov/maintenance/BridgeInfo.shtm

• Bridge Scour Reports (If over waterway)

• Existing Bridge Plans

• Pile Driving Records

• Existing Load Rating Analysis
Load Rating Conditions

• Initial Inspection of Bridge
• Post Rehabilitation of a Bridge
• Changed conditions since last load rating (i.e. additional asphalt, new bridge railing)
• Damage or deterioration affecting the structural capacity
Bridge Widening/Rehabilitation

• Is existing Load Rating accurate?
• Is Load Rating Methodology current?
  • ASD, LFD, LRFR
• Is LRFR design inventory or any FL120 Permit Rating Factors less than 1.0?
  • Calculate rating factors using LFR Methodology
• If any LRFR or LFR Inventory Load Rating Factors are less than 1.0?
  • Replacement or strengthening is required unless a Design Variation is approved
Bridge Widening/Rehabilitation

Start

Perform LRFR Load Rating (MBE, Section 6, Part A) (if necessary, use FDOT Additional Methods)

Design Inventory and FL 120 Permit Rating Factors, >=1.0?

Yes

Perform LRFR Load Rating (MBE, Section 6, Part B) (if necessary, use FDOT Additional Methods)

Inventory Rating Factor ?1.0 and Operating Rating Factor >=1.67?

Yes

Option 1
Apply for Design Variation

Option 2
Program Bridge for Strengthening (LRFR Load Rating>=1)

Option 3
Program Bridge for Replacement (LRFR Load Rating>=1)

End

No

Design Variation Approved?

Yes

Proceed with plans

No

Choose an Option
Bridge Rehabilitation

• **Deck Expansion Joints**
  
  • **Open Joints**
    
    • Butt Joints (1 in.)
    • Sliding Plate Joints (1 in. To 3 in.)
    • Finger/Tooth/Cantilever Joint (3 in.)
Bridge Rehabilitation

- **Deck Expansion Joints**
  - Closed Joints
    - Filled Butt Joints (1 in.)
    - Compression Seals (2-5/8 in.)
    - Membrane Joints (4 in.)
    - Cushion Joints (4 in.)
    - Modular Joints (4 in.)
Bridge Rehabilitation

• **Bridge Decks**
  • Concrete Deck Maintenance & Repair
    • Preventive Maintenance of Concrete Decks
      • Keep the deck clean and provide good surface drainage by keeping the drains open.
      • Monitor the condition by testing for chloride penetration, delamination and active corrosion.
      • Seal or overlay the surface to prevent and reduce salt and moisture penetration.
      • Seal cracks to prevent and reduce corrosion of the reinforcement steel.
      • Remove and replace (patch) deteriorated concrete.
• **Bridge Decks**
  
  • Concrete Deck Maintenance & Repair
    
    • **Concrete Deck Sealing** – Use a deck with a sealer to prevent chloride penetration of the deck such as silanes, siloxanes, silicone, and polymers such as epoxies and methylmethacrylates
    
    • **Concrete Deck Patching** - The need for deck patching is almost always caused by corrosion of the reinforcement.
Bridge Rehabilitation

• **Bridge Decks**
  • Concrete Deck Maintenance & Repair
    • Crack Sealing
      • Determine the type of crack and its cause before attempting to seal the cracks, since this may affect the type of repair.
    • Small Cracks - Liquid Sealers - Small cracks can be filled by some of the liquid sealers on the market to waterproof decks.
    • Dormant Cracks - Pressure Injection - A crack sealing material (such as epoxy or polyurethane) can be pressure injected into larger dormant cracks.
    • Working Cracks - Joint Sealer - Seal with a flexible crack sealer.
  • Overlays - Overlays may be applied as preventative maintenance or as part of deck repairs.
  • Concrete Deck Replacement
Bridge Rehabilitation

**Superstructure**

- Concrete Beam & Girder Crack Repair
  - Epoxy Injection
  - Penetrant Sealer
  - Drypacking
  - Shear Crack Stitching
- Concrete Beam & Girder Spall Repair
  - **Beam End** - This procedure may be used to repair deteriorated ends of concrete beams.
  - **Pneumatic Drypack Application** - This proprietary method can be used to repair or restore a concrete section which has deteriorated or been damaged by impact.
• **Superstructure**

  • Concrete Beam & Girder Tendon Splicing - This proprietary method can be used to splice broken prestressing strands which have deteriorated or been damaged by impact. The method works well on AASHTO-type girders, but can also be used on piling.

![Concrete Beam & Girder Tendon Splicing Diagram]
Bridge Rehabilitation

• **Substructure**
  • Preventive Maintenance
    • Caps, Piles, Cleaning, and Impact Damage
  • **Concrete Pile Repair** - Deteriorated concrete in a concrete pile should be removed to sound concrete. The reinforcing steel should then be cleaned of all rust and scale, and the concrete replaced.
  • **Concrete Cap Repair** - Problems often found in concrete bridge seats include the deterioration of concrete and the corrosion of reinforcing bars caused by moisture and contaminants falling through leaking deck joints.
• Wingwall Repair
Current Project Experience

• Bridge Inspection/Assessment Report/Repair Plans
  • Bridge No. 125724, City of Cape Coral, FL
Current Project Experience

- Bridge Inspection/Aessment Report/Repair Plans
  - Bridge No. 125724, City of Cape Coral, FL
Current Project Experience

- Bridge Inspection/Assessment Report
- Bridge No. 125724, City of Cape Coral, FL
Current Project Experience

- Fort Island Trail Multi-Use Path Feasibility Study, Citrus County, FL
  - Pedestrian Bridge Evaluation for Existing and New Bridges for a Multi-Use Path (MUP) Facility.

Bridge No. 024015
(CR-44 over Salt River)
Current Project Experience

• PS 122 Collection System & Bulkhead Wall Improvements, Pinellas County, FL
  • Structural Design/Details for Cantilever Steel Sheet Pile Retaining Wall.
Current Project Experience

- PS 122 Collection System & Bulkhead Wall Improvements, Pinellas County, FL
Current Project Experience

• PS 122 Collection System & Bulkhead Wall Improvements, Pinellas County, FL

<table>
<thead>
<tr>
<th>STEEL SHEET PILE WALL, CANTILEVER DATA TABLE</th>
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<tr>
<td>CONSTRUCTION INFORMATION</td>
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* Minimum section modulus is based on hot-rolled sections. For cold-rolled sections, increase minimum section modulus by 20%.

** Minimum of design ground surface or design scour depth.

NOTES:
1. Wall deflections will cause distress of adjacent pavement during construction. The contractor shall maintain pavement conditions beside the sheet pile walls during construction. The cost of maintaining adjacent pavement shall be included in the cost of the steel sheet pile wall.
2. The design parameters indicated in this table were used in the sheet pile wall analysis. If the contractor plans operations which exceed the design parameters shown above, the contractor’s specialty engineer shall redesign the wall to resist construction loads at a maximum deflection of 1.5 inches.
3. Environmental classification is moderately aggressive.
4. Concrete for cast-in-place retaining wall cap shall be Class IV (f’c = 5,000 psi) with silica fume, metakaolin or ultrapure fly ash.
5. Coat exposed surface of steel sheet piles to 5 feet below the front of wall soil elevation (**) with coal tar-epoxy in accordance with Specification Section 300.

CONCRETE CAP DETAIL

NOTES:
1. Provide 3/4” chamfer on all exposed concrete edges.
Current Project Experience

- **Post Inspection Hurricane Irma/Repair Plans**
  - Bridge No. (s) 940029 & 940030, St. Lucie County, FL

  **Bridge No. 940029**
  (Old Dixie Highway over Taylor Creek)

  **Bridge No. 940030**
  (McCarty Road over 10-Mile Creek)
Current Project Experience

- Post Inspection Hurricane Irma/Repair Plans

**Backfill Void under Approach Slab Procedure**

1. Place stay-in-place formwork on front side of abutment piles.
2. Place sand-cement riprap and rubble riprap on front side of formwork as depicted above.
3. Place formwork as needed to contain flowable fill along the northern edge of the approach slab adjacent to void.
4. Core 6" holes through approach slab.
5. Backfill under approach slab by pumping excavatable flowable fill through the cores through approach slab.
6. Fill core holes in approach slab with non-shrink grout in accordance with Specification Section 934.
7. Patch cores through asphalt overlay with Miscellaneous Asphalt.
Current Project Experience

• Post Inspection Hurricane Irma/Repair Plans

Expansion Joint Repair Detail

Type 1 Joint Seal Repair
(Replace Existing Joint Seal)

Type 1 Repair Notes:
1. Patch all minor spalls, greater than $\frac{1}{2}$" in depth and intersect the Poured Joint Material, in the existing headers, existing bridge deck, or existing approach slab adjacent to the joint with Type F Epoxy. Grind a $\frac{3}{4}$" x $\frac{3}{4}$" bevel unless a $\frac{1}{4}$" radius exists.
Current Project Experience

- Post Inspection Hurricane Irma/Repair Plans

**Type 2 Expansion Joint Header Repair**

(Construct new header and replace existing joint seal)

* The width of the polymer nosing is a minimum of 3 1/2” unless otherwise noted in the plans. If the spall width is greater than 3 1/2” fill in the spall with the polymer nosing material. Clean the concrete spall surface per Manufacturer’s recommendations.

** The depth of the polymer nosing is a minimum of 1 1/2” or the depth of the spall. If the spall depth is greater than 1 1/2” fill in the spall with polymer nosing material.
Current Project Experience

• **Post Inspection Hurricane Irma/Repair Plans**

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Type (3) Expansion Joint Header Repair
(Construct new header on asphalt overlay bridges and replace existing joint seal)

* The width of the polymer nosing is a minimum of 6" unless otherwise required by the Manufacturer's recommendations.
** The thickness of the polymer nosing is the thickness of the asphalt overlay. Adjust the width of the polymer nosing in accordance with the Manufacturer's recommendations for the asphalt thickness.
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Current Project Experience

• Post Inspection Hurricane Irma/Repair Plans

**Concrete Spall Repair Detail**

**TYPE 5 - SPALL REPAIR**

- Round corners to 3/8", Typ.
- 1" Deep Sawcut limits, Typ.
- Maximum 1" deep sawcut along perimeter of area to be restored, Typ.
- Match repair mortar surface to existing concrete surface
- Aggregate-fractured surface (1/2"

**SECTION B-B**

**TYPE 5 SPALL REPAIR NOTES**

1. Repair concrete spall areas in accordance with "Technical Special Provision (TSP) - T401", on next sheet.

2. Exercise special care when removing unsound concrete to not damage existing reinforcing steel or other embedded anchorages or break the bond between the steel and sound concrete to remain.

3. Type 5 Spall Repairs shall be paid for under pay item 401-70-2.

4. Any existing reinforcing steel damaged by the Contractor’s actions in the process of removing unsound concrete or cleaning reinforcing steel shall be repaired to the satisfaction of the Engineer at the Contractor’s expense.

5. Detail Applies to both horizontal and vertical restorations.

6. For locations of deficiencies, see bridge “Plan with Work Identification” sheet.
Current Project Experience

- Post Inspection Hurricane Irma/Repair Plans

**TYPE 6 PILE SPALL REPAIR NOTES**

1. **Surface Preparation**
   Remove deteriorated concrete to sound material by scarification or by chipping with light duty pneumatic or electric concrete chippers (30 lbs or less in general, 15 lbs or less adjacent to prestressing strands, reinforcing steel, and structural limits of construction). Provide an aggregate-fractured surface with a minimum surface profile amplitude of 1/4 inch by use of a scabbler or other appropriate means. Blast clean all reinforcing bars exposed after concrete removal in accordance with SSPC SP-10 “Near-White Blast Cleaning.” Blast clean existing concrete surfaces that will be in contact with freshly placed repair material and clean to remove loose material and dust immediately before application of repair material.

2. **Repair material shall be Latex Modified Mortar—Styrene-Butadiene in accordance with Section T401-2 of "Technical Special Provision (TSP) T401" on next sheet.**

3. **Type 6 Pile Spall Repairs shall be paid for under pay item 401-70-2.**

4. **Exercise special care when removing unsound concrete to not damage existing reinforcing steel or other embedded anchorages or break the bond between the steel and sound concrete to remain.**

5. **Any existing reinforcing steel damaged by the Contractor’s actions in the process of removing unsound concrete or cleaning reinforcing steel shall be repaired to the satisfaction of the Engineer at the Contractor’s expense.**

6. **Detail applies to both horizontal and vertical restorations.**

7. **For locations of deficiencies, see bridge "Plan with Work Identification" sheet.**
Current Project Experience

- Post Inspection Hurricane Irma/Repair Plans

**Cracks between \( \frac{1}{8} \)" and \( \frac{1}{4} \)"

shall be "Veed" out to a depth of at least \( \frac{1}{4} \)" prior to drilling. Voids greater than \( \frac{1}{4} \)" wide by \( \frac{1}{4} \)" deep shall be patched with epoxy paste.

**Step A** - Clean out crack with hand tools, high pressure air blast and/or vacuum clean surfaces.

**Step B** - Drill holes for ports to a width and depth sufficient to assure a snug fit of the port. Clean out debris with high pressure air blasting. Insert ports and seal surface of crack with epoxy repair paste. Seal shall extend above concrete surface a min. of \( \frac{1}{16} \)" and extend a min. of 1" to either side of crack. Allow a min. of 6 hours curing before initiating injection process.

**Bottom of Concrete Deck**

Provide temporary formwork, if needed, to seal the bottom of the through deck cracks.

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**TYPE 7 CRACK REPAIR DETAIL**

**CRACK REPAIR NOTES:**

1. Seal cracks by epoxy injection.
2. Repair details are for illustrative purposes.
3. See FDOT Standard Specifications Section 411.
Current Project Experience

• **Post Inspection Hurricane Irma/Repair Plans**

![Diagram showing crack repair details.](image)

**Step C** - Inject epoxy Type E, from FDOT's APL as detailed in Specification Section 411. Allow min. of 6 hours curing time. Remove ports and grind surface smooth to remove excessive amount of epoxy paste and sealer to satisfaction of the Engineer.

**Bottom of Concrete Deck**
Provide temporary formwork, if needed, to seal the bottom of the through deck cracks.

**Space ports as detailed in the Specifications Section 411. Epoxy Injection starts at lower end of vertical crack and proceeds upward to the end of crack, or until thickness of crack decreases to less than 1/32”.

**Typical Crack**

**TYPE 7 CRACK REPAIR DETAIL**

**CRACK REPAIR NOTES:**

1. Seal cracks by epoxy injection.
2. Repair details are for illustrative purposes.
3. See FDOT Standard Specifications Section 411.
Bridge Rehabilitation

• **Useful Links**
  - Go to [Maintenance and Repair Handbook](#) for practical methods for the maintenance and repair of various bridge elements in a range of conditions.
  - Go to [Approved Products List (APL)](#) for approved products by the Florida Department of Transportation and Other Links.
Questions & Comments?