S.P. No. H.010662
LA 511: Jimmie Davis Bridge Rehabilitation

March 2, 2016
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Project Team Members

LADOTD Project Manager: Paul Vaught, PE

Stantec – Design
Jacob Parker, PE
Mark Shlyakov, PE

SDR – QC/QA
Moshen Sahahwy, PE
Zhiyong Liang, PE
Presentation Outline

I. History

II. Bridge Description

III. 2013 Bridge Inspection & Findings

IV. 2014 Final Plans

V. Bid Results
**Project History**

- **1968**: Year built
- **1987**: Steel cracks found
- **1991**: M&M fracture critical report
- **1998**: M&M load rating
- **2006**: Huval inspection
- **2009**: Huval urgent and serious repairs
- **2013**: Stantec field inspection
- **2006**: Floor beams – truss spans
- **2009**: Fracture Critical Report identified
  - Tension areas - steel plate girder/stringer
  - Pin & hangers – steel plate girder/stringer
  - Vertical tension members - truss spans
- **2009**: 2009 urgent & serious repairs were completed at ~ 500k.
  - East & west approach slab replacements
  - Abutment backwall replacement
  - Contraction joint repair on truss spans
  - Cleaning & spot paint truss floor beam/stringer connections
  - Crack repairs in truss floor beams
- **2013**: Stantec field inspection, findings and partial preliminary plans
- **2014**: Stantec final plans
- **2014**: Stantec project let for construction

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Bridge Description

- 7 steel plate girder approach spans @ 70’ (Spans 1-5 & 15-16)
Bridge Description

- 7 steel plate approach girder spans @ 70’ (Spans 1-5 & 15-16)
- 6 welded plate girder/stringer spans @ 200’ (Spans 6-8 & 12-14)
Bridge Description

- 7 steel rolled beam spans @ 70’ (Spans 1-5 & 15-16)
- 6 welded plate girder/stringer spans @ 200’ (Spans 6-8 & 12-14)
- 3 truss spans @ 350’-400’-350’ (Spans 9-11)
2013 Field Inspection
Conducted on June 1st & 2nd of 2013

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Deck (Plate Girder Spans)

- Existing spalling (top of deck)
- Existing spalling (bottom of deck)
- Concrete patching

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Deck (Girder/Stringer Spans)
Deck (Truss Spans)
Paint System

Typical Truss Spans

Typical Girder/Stringer Spans

Typical Girder Spans
Joints

Finger Joint

Expansion Joint

Finger Joint (below)

Construction Joint
Fracture Critical Members

Pin and Hanger

Plate Girders

Floor Beams

Truss Hanger
Connections

Lower Laterals

![Image of lower laterals]

Splices

![Image of splices]

Floor Beams

![Image of floor beams]

Truss Gussets

![Image of truss gussets]
Steel Corrosion

Bottom Flanges

Top Flanges

Stringer Webs

Connections
Bearings

Bolt Sheared Bent 17

Bearing Corrosion Bent 2

Strained Rocker Bearing @ Pier 3
Substructure

Typical Bent

Typical Pier

Gun Blast Damage
Rehabilitation/Repair

• KEY ISSUES
  ➢ Truss span expansion bearings
  ➢ Truss span structural steel corrosion
  ➢ Concrete deck deterioration throughout
  ➢ Water intrusion at all joints
  ➢ Storm water conveyance
  ➢ Failing paint system

• FINAL PLAN SCOPE
  ➢ Truss bearing replacement
  ➢ Structural steel repair
  ➢ Pin & hanger replacement
  ➢ Joint improvement
  ➢ Clean & paint
  ➢ Drainage improvement
  ➢ Lighting improvement
Final Plans (Design Criteria)

- **DESIGN**
  - AASHTO LFD Standard Specifications (Bridge Approaches & Truss Spans)
  - AASHTO LRFD – Strength IV (Truss Spans)

- **LIVE LOAD** – HS-20

- **BARRIER** – 32”/TL-4

- **LOAD RATING**
  - AASHTO LFR Manual for Bridge Evaluation, 3rd Edition
  - Load Rating Guidance and Examples for Bolted and Riveted Gusset Plates in Truss Bridges, Publication No. FHWA-IF-09-014, February 2009

- **SOFTWARE**
  - CSI Bridge (Truss span & girder/stringer systems)
  - Gusset Plate Program by PennDOT
  - VIRTIS
Final Plans (Critical Project Constraints)

- Environmental of area beneath bridge footprint
- Environmental of paint containment
- Stability overall structure - during and after demolition
- Stability – truss during jacking and bearing replacement
- Stability – during pin and hanger replacement
- Schedule – 365-day bridge closure
Final Plans (Truss Bearing Replacement)

- Bearing replacement at Piers 1, 3 & 4 (6 locations)
- Existing nested bearings replaced with new disc bearings
- Dimension “A” provided for installation
  - Temperature sensitive
  - Incorporates truss movement after slab placement
Final Plans (Truss Bearing Replacement)

- Truss Jacking is a Contractor-Designed System
- Suggested design shown (For Information Only)

Jacking Requirements:
- Min. 300T, single action
- Jacking (service reaction) – 260k
- Wind (service reaction)
  - 45k Vertical; 14k - Lateral
- Support truss weight w/o deck
- Raise truss at 1/16” intervals
- Transfer load from jack to tower at each interval
- Maximum lift of 5”
- Differential displacement of trusses < 1/10”
- Check for any distress in end floor beam throughout jacking
Final Plans (Truss Spans)

Stringer/floor beam connection – stringer repair
• 164 locations identified
• ‘Blast & Paint’ or
• Repair Type ‘A’

Elimination of deck joints
• Repair Type ‘B’

Floor beam - stiffener repair
• Repair Type ‘C’

Floor beam - bottom flange repair
• Repair Type ‘D’

Floor beam - web repair
• Repair Type ‘E’
Final Plans (Truss Spans) ‘Blast & Paint’

- Field verification required
Final Plans (Truss Spans)  
Type ‘A’ (Stringer Repair)

- Dimension ‘G’ (4” to 9” max)
- Field verification required
Final Plans (Truss Spans) Type ‘B’ (Elimination of deck joints)

- No field verification required
Final Plans (Truss Spans) Type ‘C’ (Floor beam – stiffener repair)

- Field verification required
Final Plans (Girder/Stringer Spans) (New Diaphragms – Spans 6-8 & 12-14)

- No field verification required
Final Plans (Girder/Stringer Spans) (Pin and Hanger)

- Existing condition
Final Plans (Girder/Stringer Spans) (New Pin & Hangers)

- 12 Pin & Hanger Replacements
Final Plans (Girder/Stringer Spans) (Support System - Pin & Hanger Replacement)

11. **SYSTEM SHOWN IS A SCHEMATIC FOR A SUGGESTED TEMPORARY PIN-HANGER SUPPORT STRUCTURE.** THE CONTRACTOR SHALL SUBMIT DRAWINGS AND CALCULATIONS TO THE BRIDGE DESIGN ENGINEER FOR REVIEW AND APPROVAL PRIOR TO ERECTING TEMPORARY SUPPORT STRUCTURE.

1. **PIN-HANGER SUPPORT SYSTEM IS DESIGNED TO SUPPORT THE WEIGHT OF TRUSS WITHOUT CONCRETE DECK AND WITHOUT BARRIERS. CONTRACTOR SHALL NOT STORE ANY STOCK PILE OF MATERIAL, EQUIPMENT, MACHINERY OR PAINTING SCAFFOLDING ON THE SPANS SUPPORTED BY PIN-HANGER SUPPORT SYSTEM.**

2. **FOR EACH PIN-HANGER LOCATION THE JACKING OPERATION SHALL BE DONE SIMULTANEOUSLY ON BOTH NORTH AND SOUTH MAIN GIRDERS IN A SYNCHRONIZED MANNER WITH EQUAL JACK FORCE.**

**GENERAL NOTES:**
1. PIN-HANGER SUPPORT SYSTEM IS DESIGNED TO SUPPORT THE WEIGHT OF TRUSS WITHOUT CONCRETE DECK AND WITHOUT BARRIERS. CONTRACTOR SHALL NOT STORE ANY STOCK PILE OF MATERIAL, EQUIPMENT, MACHINERY OR PAINTING SCAFFOLDING ON THE SPANS SUPPORTED BY PIN-HANGER SUPPORT SYSTEM.

2. FOR EACH PIN-HANGER LOCATION THE JACKING OPERATION SHALL BE DONE SIMULTANEOUSLY ON BOTH NORTH AND SOUTH MAIN GIRDERS IN A SYNCHRONIZED MANNER WITH EQUAL JACK FORCE.

**SUGGESTED SEQUENCE OF PIN-HANGER TYPE 1 REPLACEMENT:**
1. REMOVE ALL LATERAL SHEAR KEYS FROM THE FLAP PLATES OF BOTH NORTH AND SOUTH MAIN GIRDERS.
2. INSTALL NEW PIN AND OUTSIDE LATERAL SHEAR KEYS.
3. REPEAT STEPS 1 AND 2 FOR INSIDE LATERAL SHEAR KEYS.
4. REMOVE THE SUPPORT SYSTEM ON BOTH NORTH AND SOUTH MAIN GIRDERS.
5. INSTALL AND TIGHTEN ALL BOLTS AT THE MIDDLE SUPPORT.
6. INSTALL REAR SUPPORT, HAND TREASURE ONE NET AT EACH END OF THE BOLTS.
7. INSTALL DECK PLATES AND PIN HANGERS TO THE GIRDER SUPPORT STRUCTURE AT THE FRONT AND REAR SUPPORT.
8. HAND TIGHTEN NUTS "A" AND "B" TO MATCH EACH OF THE NUTS WITH A WRENCH.
9. REMOVE NUTS "C" AND "D" TO MATCH EACH OF THE NUTS WITH A WRENCH.
10. APPLY JACK FORCE, DO NOT EXCEED 30 KPS PER JACK.
11. ENSURE NUTS "C" AND "D" ARE TIGHT TO THE GIRDER SUPPORT STRUCTURE.
12. INSTALL ALL BOLTS WITH LONG HANDIES.
13. INSTALL THE SUPPORT SYSTEM ON BOTH NORTH AND SOUTH MAIN GIRDERS.
14. ENSURE NUTS "C" AND "D" ARE TIGHT TO THE GIRDER SUPPORT STRUCTURE.
15. INSTALL PIN HANGERS IN THE APPROPRIATE LOCATION.
16. ENSURE ALL NUTS ARE TIGHT TO THE GIRDER SUPPORT STRUCTURE.
17. INSTALL DECK PLATES AND PIN HANGERS TO THE GIRDER SUPPORT STRUCTURE AT THE FRONT AND REAR SUPPORT.
18. HAND TIGHTEN NUTS "A" AND "B" TO MATCH EACH OF THE NUTS WITH A WRENCH.
19. REMOVE NUTS "C" AND "D" TO MATCH EACH OF THE NUTS WITH A WRENCH.
20. APPLY JACK FORCE, DO NOT EXCEED 30 KPS PER JACK.
21. ENSURE NUTS "C" AND "D" ARE TIGHT TO THE GIRDER SUPPORT STRUCTURE.
22. INSTALL ALL BOLTS WITH LONG HANDIES.
23. INSTALL THE SUPPORT SYSTEM ON BOTH NORTH AND SOUTH MAIN GIRDERS.
24. ENSURE NUTS "C" AND "D" ARE TIGHT TO THE GIRDER SUPPORT STRUCTURE.
25. INSTALL PIN HANGERS IN THE APPROPRIATE LOCATION.
26. ENSURE ALL NUTS ARE TIGHT TO THE GIRDER SUPPORT STRUCTURE.
27. INSTALL DECK PLATES AND PIN HANGERS TO THE GIRDER SUPPORT STRUCTURE AT THE FRONT AND REAR SUPPORT.
28. HAND TIGHTEN NUTS "A" AND "B" TO MATCH EACH OF THE NUTS WITH A WRENCH.
29. REMOVE NUTS "C" AND "D" TO MATCH EACH OF THE NUTS WITH A WRENCH.
30. APPLY JACK FORCE, DO NOT EXCEED 30 KPS PER JACK.
31. ENSURE NUTS "C" AND "D" ARE TIGHT TO THE GIRDER SUPPORT STRUCTURE.
32. INSTALL ALL BOLTS WITH LONG HANDIES.
33. INSTALL THE SUPPORT SYSTEM ON BOTH NORTH AND SOUTH MAIN GIRDERS.
34. ENSURE NUTS "C" AND "D" ARE TIGHT TO THE GIRDER SUPPORT STRUCTURE.
35. INSTALL PIN HANGERS IN THE APPROPRIATE LOCATION.
36. ENSURE ALL NUTS ARE TIGHT TO THE GIRDER SUPPORT STRUCTURE.
37. INSTALL DECK PLATES AND PIN HANGERS TO THE GIRDER SUPPORT STRUCTURE AT THE FRONT AND REAR SUPPORT.
38. HAND TIGHTEN NUTS "A" AND "B" TO MATCH EACH OF THE NUTS WITH A WRENCH.
39. REMOVE NUTS "C" AND "D" TO MATCH EACH OF THE NUTS WITH A WRENCH.
40. APPLY JACK FORCE, DO NOT EXCEED 30 KPS PER JACK.
41. ENSURE NUTS "C" AND "D" ARE TIGHT TO THE GIRDER SUPPORT STRUCTURE.
42. INSTALL ALL BOLTS WITH LONG HANDIES.
43. INSTALL THE SUPPORT SYSTEM ON BOTH NORTH AND SOUTH MAIN GIRDERS.
44. ENSURE NUTS "C" AND "D" ARE TIGHT TO THE GIRDER SUPPORT STRUCTURE.
45. INSTALL PIN HANGERS IN THE APPROPRIATE LOCATION.
46. ENSURE ALL NUTS ARE TIGHT TO THE GIRDER SUPPORT STRUCTURE.
47. INSTALL DECK PLATES AND PIN HANGERS TO THE GIRDER SUPPORT STRUCTURE AT THE FRONT AND REAR SUPPORT.
48. HAND TIGHTEN NUTS "A" AND "B" TO MATCH EACH OF THE NUTS WITH A WRENCH.
49. REMOVE NUTS "C" AND "D" TO MATCH EACH OF THE NUTS WITH A WRENCH.
50. APPLY JACK FORCE, DO NOT EXCEED 30 KPS PER JACK.
51. ENSURE NUTS "C" AND "D" ARE TIGHT TO THE GIRDER SUPPORT STRUCTURE.
52. INSTALL ALL BOLTS WITH LONG HANDIES.
Final Plans (Cleaning & Painting)

- Existing condition
Final Plans (Cleaning & Painting) (Paint Containment Details)

- Schematic Details Provided

Contractor Required to Design System & Submit for Review

8. SYSTEM SHOWN IS A SCHEMATIC FOR A SUGGESTED PAINT CONTAINMENT SYSTEM. THE CONTRACTOR SHALL SUBMIT DETAILS FOR THE ACTUAL SYSTEM TO BE USED. SUBMITTAL REQUIREMENTS SHALL BE IN ACCORDANCE WITH SUPPLEMENT SPECIFICATION 811 "CLEANING, PAINTING AND DISPOSAL (NEAR WHITE FINISH)."
Final Plans (Cleaning & Painting)

- DOTD involved the public
Final Plans (Shear Stud Additions)

- Plate Girders (Spans 6-8 & 12-14)
- Stringers (Spans 6-8 & 12-14)
- Floor Beams (Truss Spans 9-11)
- Stringers (Truss Spans 9-11)
Final Plans (Deck Replacement)

- Typical deck deterioration at joints
- Typical deck patching
Final Plans (Deck Replacement)

- Steel Plate Girder Approach Spans
- Steel Girder/Stringer Spans
- Truss Spans
OTHER REPAIRS & IMPROVEMENTS
Final Plans (Drainage Improvements) (Finger Joint Trough Drainage System)

- Existing system
Final Plans (Drainage Improvements)
(Finger Joint Trough Drainage System)

- 3 locations (Truss Spans)
- 6 locations (Girder/Stringer Spans)
Final Plans (Drainage Improvements) (Scupper and Downspouts)

- Hydraulic design based on maximum 2.5 ft. spread in travel lane
- 32 Scuppers (Truss Spans)
- 18 Scuppers (Girder/Stringer Spans)
- 8 Scuppers (Plate Girder Approach Spans)
Final Plans (Lighting Improvements)

- 27 Blisters, poles & light fixtures (Plate girder approach & girder/stringer spans)
- 9 Structure-mounted light fixtures (Truss spans)
Bid Results (November 12, 2014)

<table>
<thead>
<tr>
<th>Specific Items</th>
<th>Bid</th>
<th>Unit Cost</th>
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<tbody>
<tr>
<td>Deck Demolition (~92,000 sf of deck)</td>
<td>$1.17M</td>
<td>$13/sf of deck</td>
</tr>
<tr>
<td>Deck Replacement (~92,000 sf of deck)</td>
<td>$4.80M</td>
<td>$52/sf of deck($1,800/cy)</td>
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<td>Painting (~400,000 sf surface area)</td>
<td>$8.28M</td>
<td>$21/sf of steel</td>
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<tr>
<td>Deck Drainage System</td>
<td>$1.22M</td>
<td>$13/sf of deck</td>
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<tr>
<td>Repair – Type ‘A’</td>
<td>$439K</td>
<td>$7,700/ea</td>
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<tr>
<td>Repair – Type ‘B’</td>
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<td>Repair – Type ‘C’</td>
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<td>Repair – Type ‘F’ (Bolt/Rivet Replacement)</td>
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<td>Truss Jacking</td>
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<td>Truss Bearings</td>
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<tr>
<td>Pin &amp; Hangers</td>
<td>$870k</td>
<td>$72,500/ea</td>
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Engineer’s Estimate $20,228,000
Bid (PCL Civil Constructors, Inc.) $23,438,000
THANK YOU