

Jacobs

Challenging today.
Reinventing tomorrow.

Sherman Minton Corridor Project

Achieving 30+ years through Innovation

Sherman Minton Bridge Complex

Background

- New Albany – Louisville Bridge
- 2011-2012 Retrofit
- Corridor Project Development

Scope/Innovations

- As-Built Verification/Load Rating
- Bridge Deck Replacement
- Structural Steel Retrofits
- Substructure Repairs
- Arch Cable Replacements



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Sherman Minton Bridge Complex

- Begin Spring Street
- Downtown New Albany
- I-64 over the Ohio River
- Shawnee Golf Course
- Approximately 1 mi.
- End at Levee
- 8 IN Bridges
- 2 KY Bridges
- 1 River Bridge



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Sherman Minton Bridge Complex

- Designed by Hazlet and Erdal
- Opened in 1962
- Carries 6 lanes of traffic
- 70,000 vpd

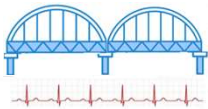


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Sherman Minton Corridor Project

- Project Goals



30 Year Service Life Extension



Reduce Impact to Community and Travelling Public



Budget, Timeline and Impacts

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Sherman Minton Bridge Rehabilitation Components

- Replacement of Bridge Decks
- Hanger Replacements
- Structural Steel Repairs
- Bridge Deck Overlays
- Traffic Lighting
- Drainage Repairs
- Bridge Painting
- Substructure Patching
- Inspection Access

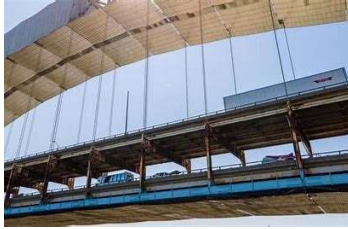


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Sherman Minton Bridge Challenges

- Maintenance of Traffic
- Procurement Schedule
- Design Schedule
 - As-Built Verification Process
 - Preliminary Load Rating
 - Structural Design & Plan Dev.

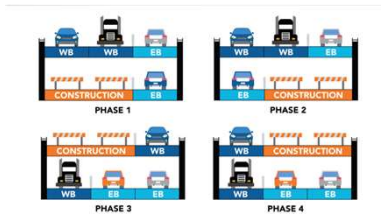


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Sherman Minton Bridge Rehabilitation Maintenance of Traffic

- Maintenance of Traffic
 - Maintain two lanes in each direction.
 - Up to 360 nightly closures
 - One, 9-day closure, per calendar year
 - Up to 3 weekend period closures per calendar year
 - One lane for a 15 consecutive day closure for As-Built Verification Inspection

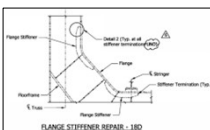


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Sherman Minton Bridge Fatigue Improvements

- Stiffener Transitions
- Feathering Existing Details



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Sherman Minton Bridge Structural Steel

- Corrosion of Structural Steel
 - Manifest at all expansion joints and exterior members
 - Suite of Standard Details Developed to address corrosion and design requirements.
 - Requirements based on Load Rating
 - Allowances available for unknown corrosion locations.

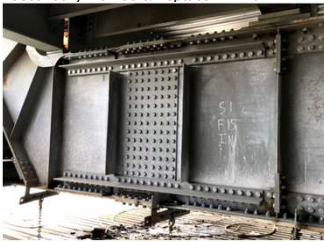


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Sherman Minton Bridge Structural Steel

- Exterior Stringers: Replaced
- Primary Members: Plating repairs
- Secondary Members: Replace in Kind



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Sherman Minton Bridge Deck Replacement

- Replaced existing 7" deck with new 8" deck, $f'_c = 4,000$ psi
- Metal SIP forms used.
- Used E5 Internal Cured Concrete
 - Nano-Silica (Liquid Fly-Ash)
 - Eliminates need for wet-cure

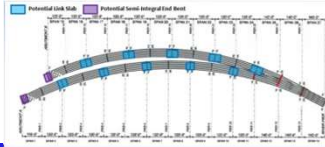
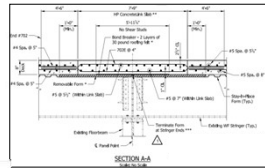


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Sherman Minton Bridge Rehabilitation Link Slabs

- Link Slabs
 - Eliminate 31 expansion joints.
 - 16 for KY Approach Structures
 - 12 for Main Spans
 - 5 for IN Approach Structures
 - Design Based on: FHWA and Purdue.
 - Concrete Similar to Deck Concrete but included fibers.



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Sherman Minton Bridge KY Approach Substructure

- Substructure Rehabilitation
 - Remove all concrete cover on pier caps.
 - Repair delamination on columns.
 - Cathodic Protection thru galvanic anodes.
 - Allowances available for unknown concrete repair not recorded.
 - Nearly 4,000 ft² patching completed



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Hanger Condition:

- Past Inspections:
 - Observed loss of galvanizing and broken wires in the hanger
 - Surface rust and swelling of cables in splash zone
 - Pack rust in the connections



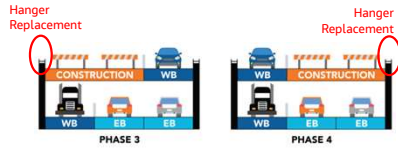
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Hanger Replacement

- Objectives:
 - Mitigate traffic closures
 - Redundant operation
 - Protected by improved collision barrier

Hanger Replacement

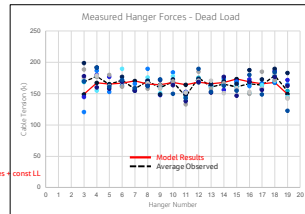
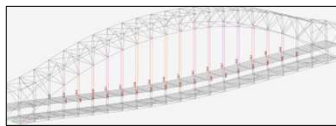


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Hanger Replacement Strategy

- Hanger Forces:
 - Modeled vs. Observed
 - Unknown Live Load Present
- Geometry Based Replacement
 - Monitor hanger lengths
 - Monitor deck displacements
 - Relative to adjacent



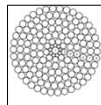
Jacking Force Table (Per Strand)*	
Dead Load =	170 Kips (85 Tons)
Live Load =	70 Kips (35 Tons) + 4 adjacent lanes + const LL
Calculated Lifting Force =	240 Kips (120 Tons)
Maximum Lifting Force =	270 Kips (135 Tons)

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Hanger Replacement - Fabrication

- Structural (Bridge) Strand (26' – 102')
 - A586 Grade 1
 - 149 wires
 - 2 9/16" dia
 - 420k breaking strength (F.S. 3.0)
- Socket Type 8/6
 - Zinc poured
 - Lower Type 6 – tapped for threaded insert



Layer	Wire Diameter	Quantity	Wire Coating	Wire Tensile Strength
1	0.1750	1	A	250,000
2	0.1750	1	A	250,000
3	0.1875	1	A	250,000
4	0.1875	1	A	250,000
5	0.1875	20	A	250,000
6	0.1875	20	A	250,000
7	0.1875	20	A	250,000
8	0.1875	20	A	250,000



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Hanger Replacement - Testing

- Hanger Testing (MO, TX)
 - Proofload: 55% breaking strength
 - Prestretched 5 min x 3 cycles
 - +/- 1/4" assembly length
 - Modulus testing
 - Breaking Test: Failure or 2x MBF
 - All 6 tests reached 2x min breaking force
 - 1 year lead time fabrication/testing



This photo is of a previous project



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Hanger Replacement - Testing

- Hanger removal to grab existing hanger
 - Holding bridge, with redundant hanger present
 - Hydraulic clamp?
 - Friction Clamp
 - Cycle Test, measure for slip



Hydraulic Clamp Option
(not used)



Friction Clamp Testing

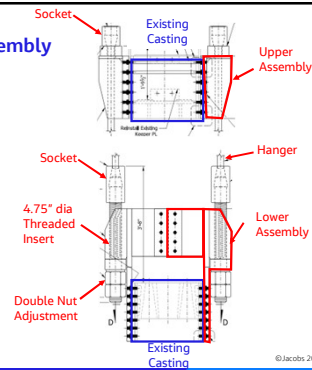
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Hanger Replacement – Hanger Assembly

- Bolted outboard of the existing casting
- Adjustment on lower assembly

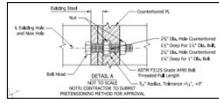


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Hanger Replacement – Attachments

- Exterior Bolted weldment
 - Cheeseplate approach
 - Replaced bolts one at a time as early works
 - Upper connection similar

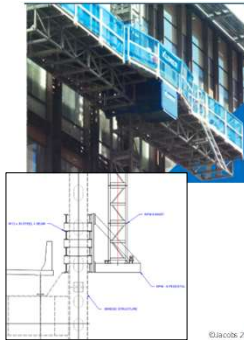
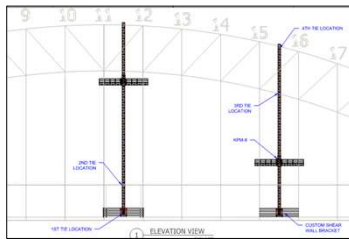


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Hanger Replacement - Installation

- Climbing Platform?

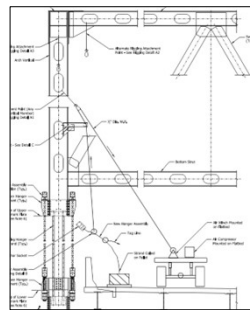
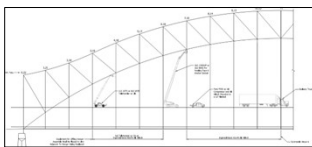


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Hanger Replacement - Installation

- Min coil 25x dia
- Flatbed mounted winch for lifting
- Marked with longitudinal stripe

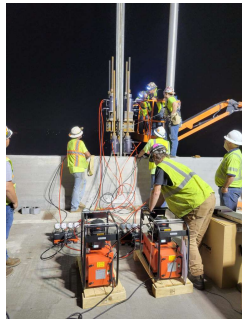


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Hanger Replacement – Jacking Equipment

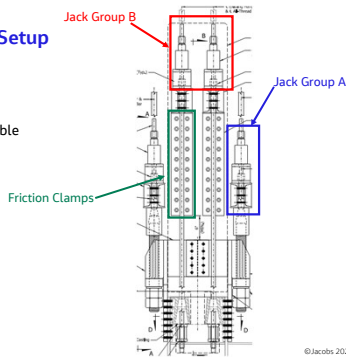
- Equipment
 - 100 ton Thru hole jacks for 1.75" thread bars
 - Group A (4) –new hanger tensioning system
 - Shared manifold
 - Group B (4) –existing hanger detensioning system
 - Shared manifold
 - Maximum stroke: 4"



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Hanger Replacement – Jacking Setup

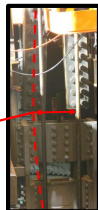
- 3 Operation Stages:
 - Detension Existing Hangers:
 - Tension Jack Group B
 - Friction clamps to 'bite' a section of cable
 - Transfer Load:
 - Detension Jack Group B
 - Tension Jack Group A
 - Iterative
 - Set Final Geometry:
 - Detension Jack Group A



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Hanger Replacement - Construction

- Jacking sequence – Detensioning Cables
 - Hanger sounding
 - First few – over jacked



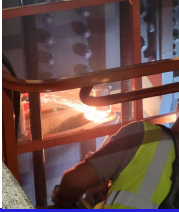
Buckled shape, hanger in compression



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Hanger Replacement - Construction

- Jacking sequence – Detensioning Cables
 - Keeper plates removed
 - Unseating?
 - Torch cut existing cable

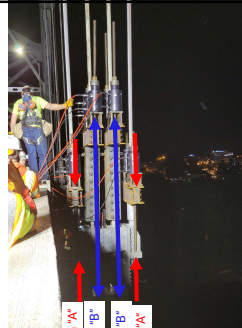


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Hanger Replacement - Construction

- Jacking sequence – Loading New Cables
 - Transfer load from Jack Group B (existing) to Jack Group A (new)
- Small increments:
 - prevent deck movement +/- 1/4"
 - Relieve B: deck sagging
 - Stress A: deck hogging



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Hanger Replacement - Construction

- Jacking sequence – Setting Final Elevations
 - Jack Group A
 - Adjust bearing nut
 - Lower jack to seat the nut
 - Check final elevations/measurements
 - Repeat as needed

Seat nut at final elevation

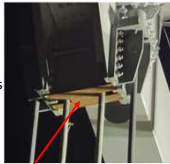


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Hanger Replacement – Monitoring and Geometry Control

- Monitoring
 - Initial/Final hanger lengths
 - Laser measurement
 - Max ¼" deck displacement
 - Piano wire between floorbeams



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Hanger Replacement – Success

- 1 cable/night start
- 2-3 cables/night
 - Setup crew, jacking crew, demo crew
- 68 hanger pairings (136 hangers)
- Went down one side, came back another



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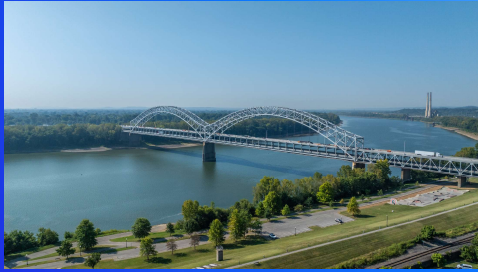
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