

# Sherman Minton Corridor Project

Achieving 30+ years through Innovation

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## 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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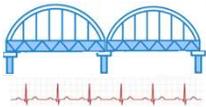
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### Sherman Minton Corridor Project

- 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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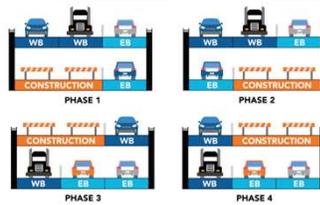
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### Sherman Minton Bridge Rehabilitation Maintenance of Traffic

- 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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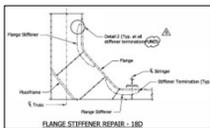
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### Sherman Minton Bridge Fatigue Improvements

- 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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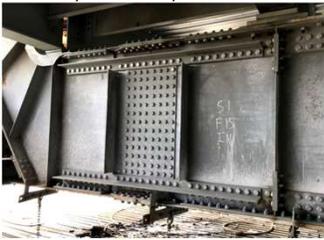
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### Sherman Minton Bridge Structural Steel

- 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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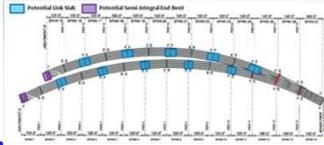
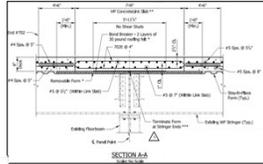
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### Sherman Minton Bridge Rehabilitation Link Slabs

- 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 ft<sup>2</sup> 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

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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)*
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	0.0750	8	Al	250,000
2	0.1176	15	A	250,000
3	0.1500	15	A	250,000
4	0.1875	15	A	250,000
5	0.2250	20	A	250,000
6	0.2625	20	A	250,000
7	0.3000	20	A	250,000
8	0.3375	20	C	420,000

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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

This photo is of a previous project

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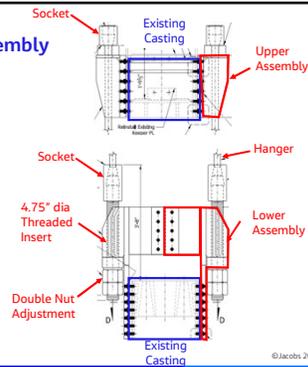
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### Hanger Replacement – Hanger Assembly

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



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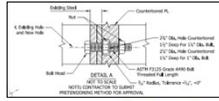
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**Hanger Replacement – Attachments**

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



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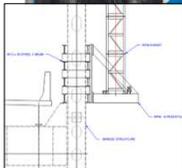
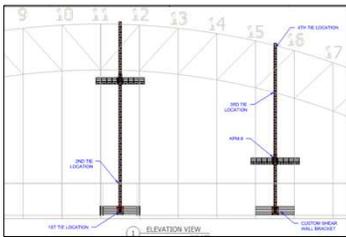
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**Hanger Replacement - Installation**

- Climbing Platform?



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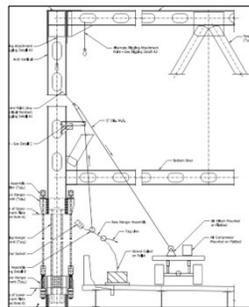
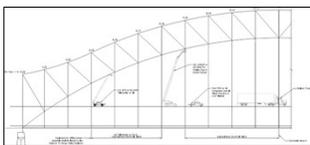
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**Hanger Replacement - Installation**

- 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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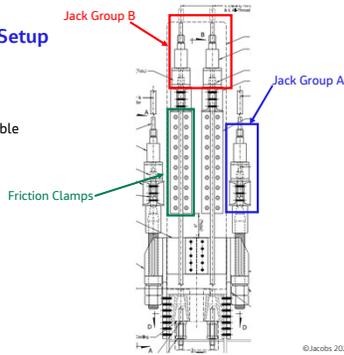
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### Hanger Replacement – Jacking Setup

- 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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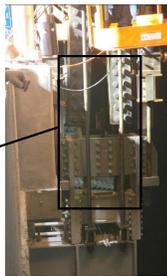
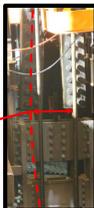
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### Hanger Replacement - Construction

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



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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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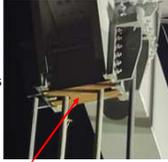
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### Hanger Replacement – Monitoring and Geometry Control

- Monitoring
  - Initial/Final hanger lengths
    - Laser measurement
  - Max 1/4" 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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# QUESTIONS?



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