Milton-Madison Bridge Slide

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OIPD Design Director, INDOT

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Project Partners

Indiana Department of Transportation

United States of America

Kentucky Transportation Cabinet

Walsh Construction

Buckland & Taylor Ltd.
a COWI company

Burgess & Niple

Baker

Wilbur Smith Associates
Markland Dam
Project Site
I-275
Cincinnati
I-65
Louisville
Study Area
One of two Ohio River bridges between Cincinnati and Louisville
I-65 Bridge - 46 miles
Markland Dam - 26 miles
I-275 Bridge - 65 miles
Project Purpose and Need

- Sufficiency Rating of 6.5 out of 100
- KYTC Structurally Deficient List

Functionally Obsolete  Structurally Deficient
Superstructure Replacement with Minimal Approaches

- Milton Approach re-construction
- STR 1 replace KY Approaches
- STR 2 Truss replacement
- STR 3 Replace IN Approach
- STR 4 Pedestrian Access to Park

No Right-of-Way required
1. Drill holes into ex. caisson
2. Grout Rebar into Caisson
3. Add Stem Reinforcement
4. 2’ thick encapsulation
5. Pier Cap Reinforcement
6. Cast new Pier cap
7. Scour Countermeasure
Final Scour Design Sketch

SECTION A1-A1

- 500 YR FLOOD EL = 474.5' (ORD)
- NORMAL POOL EL = 420' (ORD)
- EXISTING STREAMBED EL VARIES
- EXISTING TIMBER SHORING IF ENCOUNTERED TO EXPOSE CONCRETE FOR PULL DEPTH OF TOP RAP
- RAPID FILTER UP FACE OF PIER AT LEAST 2*1 (50"")
- TRAP - SPECIAL GRADATION (SEE TABLE)
- TOP OF ROCK

- ASSUMED CHANNEL BOTTOM EL = 400' (ORD)
- AMBIENT BED EL = 397'/- (ORD)
- CONTRACTION SCOUR C= 2.2
  EL = 397'/- (ORD)
- BED FORM TROUGH EL = 385'/- (ORD)

APPROXIMATE DREDGE LIMIT

A1

W=21'

W=62'

4/3W=29'

12'/-

1.5

1.5

TOP OF ROCK

GEOTEXTILE FILTER LIMIT

PLAN VIEW

INDIANA A State that Works
New Structure Typical Section

- Existing Bridge clear width is 20’
- 5’ pedestrian sidewalk
Selected Alternative

Existing Bridge

Proposed Bridge
Ferry Service during Construction

- 52 Mile Detour
- No Cost to Users

- Ferries would accommodate vehicles, up to 240 per hour
- Ferries would not be able to operate during high water, extreme fog, etc

- Special provisions for medical emergencies
Low Bid Formula and Contractual Dates

- **Formula for Effective Bid Price**
  - Lowest effective bid wins.
  - Const. Cost, Closure Days and Open to Traffic Date

- **[A + B - Adjustment]**
  - A = Construction Cost
  - B = Closure Days x $25,000/day.
  - Adjustment = $3.75 million (September 2012)
Let in September 2010
Five Contractors submitted bids

Project was awarded based on:
- Cost to construct project ($102-$127 million)
- Length of bridge closure (10-365 days)
- Date to open bridge to traffic (Sept 2012/May 2013)
Awarded Design-Build Team

Walsh Construction, Inc (CONTRACTOR)
Construction firm in La Porte, IN
www.walshgroup.com

Burgess & Niple, Inc. (DESIGNER)
Engineering firm in Columbus, OH and Indianapolis, IN
www.burgessniple.com

Buckland & Taylor (DESIGNER)
Bridge engineering firm in Seattle, WA
www.b-t.com
**Design-Build Process**

**Step 1**
- Existing bridge remains open to traffic
- Detour approach ramps are built on Vaughn Dr and KY 36
- Pier strengthening and widening begins
Design-Build Process

Step 2
- Bridge closes to traffic for 3 days
- Approach ramps are connected to existing bridge
- Existing bridge reopens to traffic
- Pier strengthening work continues
Design-Build Process

Step 3
- Downstream bridge piers are constructed
**Step 4**

- Existing bridge remains open to traffic
- New truss superstructure is erected on downstream piers
- Permanent approaches are built
Design-Build Process

Step 5

- Downstream bridge is connected to US 421
- Traffic is rerouted onto downstream bridge
Maintenance of Traffic
Design-Build Process

Step 6
- Existing bridge is demolished
Superstructure Demolition
Demolition Problems
Demolition Problems
Blast Repair
Design-Build Process

Step 7

- Traffic remains on downstream bridge
- Detour approach ramps are removed
- Pier strengthening and widening is completed
<table>
<thead>
<tr>
<th>Description</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wt. for Slide</td>
<td>15,260 tons</td>
</tr>
<tr>
<td>Slide Distance</td>
<td>55 feet</td>
</tr>
<tr>
<td>Length of Truss</td>
<td>2427 feet</td>
</tr>
<tr>
<td>Height of Truss</td>
<td>180 feet above water</td>
</tr>
<tr>
<td>Wt. of Truss Members</td>
<td>8000 tons</td>
</tr>
<tr>
<td>Truss Members</td>
<td>2200 pieces</td>
</tr>
<tr>
<td>Bolts</td>
<td>145,000 pieces</td>
</tr>
<tr>
<td>Length of Concrete Beam</td>
<td>3462 feet</td>
</tr>
<tr>
<td>Wt. of Asphalt</td>
<td>4000 tons</td>
</tr>
<tr>
<td>Wt. of Stone</td>
<td>46,000 tons</td>
</tr>
<tr>
<td>Concrete Poured</td>
<td>12,730 cu yds</td>
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<tr>
<td>Wt. of Rebar</td>
<td>1,907,000 lbs</td>
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<tr>
<td>Workers (Peak)</td>
<td>135</td>
</tr>
<tr>
<td>Workers (Average)</td>
<td>50</td>
</tr>
<tr>
<td>Equipment</td>
<td>300 pieces</td>
</tr>
<tr>
<td>Explosives</td>
<td>124 charges</td>
</tr>
<tr>
<td>ADT</td>
<td>11,000</td>
</tr>
<tr>
<td>Project Cost</td>
<td>$ 104 Million</td>
</tr>
</tbody>
</table>
Sliding Girders
Sliding Girder Pedestal
Sliding Girder and Pedestal
Pier Cap between Girder Forks
Temp Pier & Sliding Girder
Span D Sliding Girder

SECTION "B-B"
(EXTerior STiffener)
SCALE: 1" = 1'-0"

SECTION "C-C"
(INterior STiffener)
(SEE SECTION "B-B" FOR DETAILS NOT SHOWN)
SCALE: 1" = 1'-0"
Pier 2 Sliding Plates for Both Slides
Sliding Girder Support
Bearings for Span D
Lateral Restraint for Slide

**Slide 46**

- **Section A-A**: Scale: 3/4" = 1'-0"
  - L 6x4, Cont., Typ
  - Round Coupler to Watch Threads Bar, Set # from T/O Concrete

- **Section B-B**: Scale: 3/4" = 1'-0"
  - 3/8" Dia. P100 Grade 105
  - All Thread Bar @ 12" C/C
  - CW 2-1/2" Hex Nuts to Match Threads, Typ

- **Section C-C**: Scale: 3/4" = 1'-0"
  - 8" 2#4, Cont.
  - CW 2#4, Oversize Holes

*NOTE:* Check Pier Cap Reinforcement for Adequate Clearance (if others)

*WRAP BOLT IN WASHING TARN OR SIMILAR TO FACILITATE REMOVAL*
Embedments in Pier Cap

Anchor Bolt Patterns are symmetrical about line "A-B" and 2 bearings.

Detail 1"
Scale: \( \frac{3}{4}'' = 1' - 0'' \)

Anchor Bolt Detail for Sliding Plates
Scale: \( \frac{1}{2}'' = 1' - 0'' \)

Anchor Bolt Detail for Permanent Restraints
Scale: \( \frac{1}{2}'' = 1' - 0'' \)

\( \frac{1}{2}'' \) Dia F1554 Threadbar Grade 105 Stud to Match

Restraint Base @ \( \frac{1}{2}'' \)

Heavy Hex Nut (2H) to Match C/W Hardened Washer

Coupler to Match \( \frac{1}{2}'' \) Dia F1554 Threadbar Flush with Top of Concrete

\( \frac{1}{2}'' \) Dia F1554 Threadbar Grade 105

2' Grout

Heavy Hex (2H) Nut to Match C/W Hardened Washer

Williams 150 ksf All-Thread Bar Stud to Match

R73 Hex Nut to Match C/W Hardened Washer, Typ

2 3/8 x 5 x 9 Field Drill Hole

Wrap Bolt in Masking Tape or Similar to Facilitate Removal

Round Coupler to Match All-Thread Bar, Set Coupler 4" from T/O Concrete

4 Spaces @ 12" = 4' - 0''
Pier 2 with Restraint Bolts in Place
Preparing Pier Caps
NOTE: CHECK PIER CAP REINFORCEMENT FOR ADEQUATE CLEARANCE (BY OTHERS)

SECTION "A-A"

Scale: \( \frac{3}{8}" = 1'-0"\)

(P2 SHOWN; P3 SIMILAR; P5 AND P6 SIMILAR OPP
HAND, P4 SEE DWG MS-EQ-37)
NO WELD AT THIS JOINT. SLIDING SURFACE TO BE SMOOTH

BEFORE SLIDING

GAP TO BE FILLED WITH WELD MATERIAL (~1/4"), GRIND SMOOTH

BEFORE WEST BEARING PASSES OVER BRIDGE P

DETAIL "5"

Scale: 3" = 1'-0"
Polishing Sliding Girders
Polishing Sliding Girders
Preparing for Slide
Sliding Preparations
Disc Bearing

TRUSS CHORD & GUSSETS

CONNECTION BOLTS–TOP (SUPPLIED BY OTHERS)
HARDENED WASHER (SUPPLIED BY OTHERS)
SOLE PLATE (SUPPLIED BY OTHERS) △
SLIDE PLATE (PE5)

CONNECTION BOLTS–BOTTOM (MJ5)
HARDENED WASHER (MK5)
BASE PLATE (PC5)
BEVELED ERECTION SLIDE PLATE (PM5) △
EMBEDDED MASONRY PLATE (SUPPLIED BY OTHERS)

BOTTOM PTFE FOR ERECTION SLIDING (ML5)

ELEV

DB1550M INSTALLED
OTHERS SIMILAR

SCALE: NONE

RECE
APR 2
BUCKLAND & I

INDIANA DEPARTMENT OF TRANSPORTATION
A State that Works
Product Details

Product Name:
Dow Corning 4 Electrical Insulating Compound White 3.6 kg Pail

Part#:
4 CMPD 3.6KG

Description:
Dow Corning 4 Electrical Insulating Compound is practically nonvolatile, odorless, moisture resistant, electrically insulating, excellent rubber lubrication, excellent release and sealing properties, resistant to oxidation, essentially nontoxic and non-melting and shows little tendency to dry out in service. 3.6 kg Pail.

Product Information

Typical Use: Used for making a moisture-proof seal for aircraft, automotive and marine ignition systems and spark plug connections, electrical assemblies and terminals, assembly lubricant for various metal-on-plastic and metal-on-rubber combinations.
### Key Data for VSL Lifting Units

<table>
<thead>
<tr>
<th>Type</th>
<th>Capacity</th>
<th>Max. numbers of strands</th>
<th>Cable diameter</th>
<th>Overall dimensions</th>
<th>Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>SLU-10</td>
<td>104 kN</td>
<td>1</td>
<td>16 D (mm)</td>
<td>970 x 200 mm</td>
<td>60 kg</td>
</tr>
<tr>
<td>SLU-30</td>
<td>312 kN</td>
<td>3</td>
<td>54 D (mm)</td>
<td>1130 x 250 mm</td>
<td>120 kg</td>
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<tr>
<td>SLU-40</td>
<td>416 kN</td>
<td>4</td>
<td>67 D (mm)</td>
<td>1275 x 250 mm</td>
<td>200 kg</td>
</tr>
<tr>
<td>SLU-70</td>
<td>728 kN</td>
<td>7</td>
<td>82 D (mm)</td>
<td>1122 x 400 mm</td>
<td>230 kg</td>
</tr>
<tr>
<td>SLU-120</td>
<td>1248 kN</td>
<td>12</td>
<td>116 D (mm)</td>
<td>1400 x 400 mm</td>
<td>430 kg</td>
</tr>
<tr>
<td>SLU-220</td>
<td>2288 kN</td>
<td>22</td>
<td>167 D (mm)</td>
<td>2100 x 520 mm</td>
<td>1520 kg</td>
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<tr>
<td>SLU-330</td>
<td>3224 kN</td>
<td>31</td>
<td>190 D (mm)</td>
<td>2140 x 600 mm</td>
<td>1820 kg</td>
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<tr>
<td>SLU-440</td>
<td>4368 kN</td>
<td>42</td>
<td>228 D (mm)</td>
<td>2050 x 610 mm</td>
<td>2220 kg</td>
</tr>
<tr>
<td>SLU-580</td>
<td>5720 kN</td>
<td>55</td>
<td>254 D (mm)</td>
<td>1780 x 790 mm</td>
<td>3250 kg</td>
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</tbody>
</table>

Piston strokes vary between 160 mm and 550 mm, depending on the type of unit.

1. The figures given in the table are also valid for Strand Moving Units of type SMU.
2. Capacity is based on grade 270 strands, according to ASTM A 416-90/A and a safety factor of $s = 2.5$ with respect to the minimum breaking load of the strands.
3. Weights quoted are for the basic version of the lifting units.
VSL Strand Jack Setup
VSL Strand Setup

[Images of bridge construction and equipment setup]
### Strand Jacking

<table>
<thead>
<tr>
<th>PIER</th>
<th>LOAD PER JACK AT 10% FRICTION (NOMINAL DESIGN LOAD)</th>
<th>JACK LOAD NOT TO EXCEED</th>
<th>No. OF STRANDS PER JACK</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>281 KIPS (141 TONS)</td>
<td>400 KIPS (200 TONS)</td>
<td>22</td>
</tr>
<tr>
<td>3</td>
<td>431 KIPS (216 TONS)</td>
<td>700 KIPS (350 TONS)</td>
<td>31</td>
</tr>
<tr>
<td>4</td>
<td>405 KIPS (203 TONS)</td>
<td>700 KIPS (350 TONS)</td>
<td>31</td>
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<td>5</td>
<td>462 KIPS (231 TONS)</td>
<td>700 KIPS (350 TONS)</td>
<td>31</td>
</tr>
<tr>
<td>6</td>
<td>174 KIPS (87 TONS)</td>
<td>400 KIPS (200 TONS)</td>
<td>22</td>
</tr>
</tbody>
</table>
Bearing Pulling Harness
Bearing Pulling Harness
Strands through Upstream Bearing
Strand Anchor and Rod between Bearings
Rods at Downstream Bearing
Step 8

- Downstream bridge closed for 7 days
- Using steel rails and plates, new truss superstructure is moved from downstream piers to its permanent place
- New Milton-Madison Bridge opens to traffic
- Downstream piers are removed
Expansion Joint
Link Slab

**Diagram Description:**

- **Span 'C':**
  - 3'-0"
  - 5 x 7'-6"
  - 4 bars @ 1'-0" full length

- **Link Slab Width:** 11'-0"
  - 6" lap
  - 2"-7" lap
  - 2 - 5 bars x 8'-6" @ 4" spacing between each #4 bar

- **Span 'D':**
  - 3'-0"
  - 4 bars @ 1'-0" full length

**Note:**

- Provide thread spacers on the ends of the top long reinf. & alt. at bot. long. reinf.
- Chamfer debond slab from top of beams & diaphragm.
- Elastomeric bearing pad.
- Construction joint.
QUESTIONS?