Sliding Into History

Milton – Madison Bridge Project
Milton, KY – Madison, IN

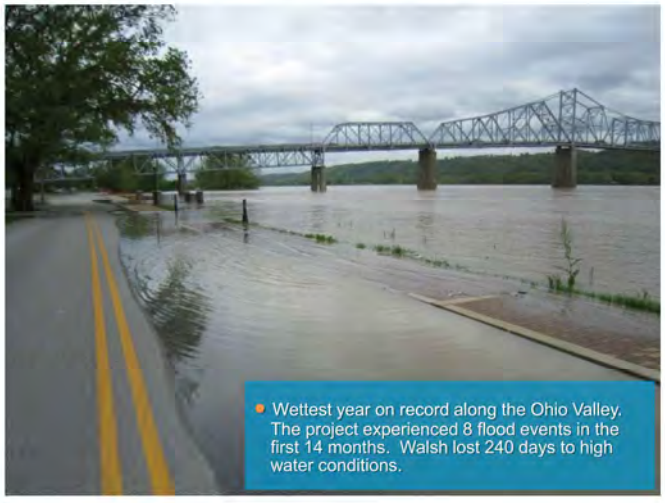
- The existing Milton-Madison Bridge was constructed in 1928-29. This photo was taken on September 3, 2010.

Project Scope

Replacement of 80-Year Old Truss

2011 – A Record Year

No way to start a project



- Wettest year on record along the Ohio Valley. The project experienced 8 flood events in the first 14 months. Walsh lost 240 days to high water conditions.

2011 – The Worst Day

Causeway

River Access from the Indiana shore

Kentucky Laydown Yard

Trestle & Work Platform

Access from the Kentucky Shore

- Work platform designed for a 275 ton crane with a max pick of 100 tons

Cofferdams

- Top of cofferdam = 435'. Ordinary high water or flood day = 432.2'.

Cofferdams – Pouring the Seal

- A 6' concrete seal was poured in each river cofferdam

Caisson Coring

- 2", 3", & 4" holes were cored into the caisson to depths ranging from 10' to 70'

Caisson Reinforcing

- #10, #11, & #14 epoxy coated reinforcing bars were grouted in place

Pull-out Testing

- The contract required a pull-out test on the caisson reinforcing to prove the bond strength of the grout.

Pier 5 Shear Connectors

- #7 epoxy coated resteel shear connectors anchored 12" deep and placed on 2' c – c. Over 7000 were installed in the three river piers

Pier Stem Reinforcing Steel

- Design included bundled #11 & #14 vertical rebar

Pier 3 Stem Strengthening Forms

- 20' sections were formed with EFCO plate girder forms.

Pier 3 Stem Strengthening Pour

- A typical pier stem "jacket" pour. Mass concrete thermal control measures were used for pours 4' thick or greater.

Pier 3 Stem Strengthening Jacket

- Complete pier strengthening jacket. Concrete varied in thickness from 2' to 6'.

Pier 4 Stem Ready to Pour….

- An all too common occurence.

Indiana Temporary Ramp

- A cross sectional view of how the ramp was constructed. Just add asphalt & barrier rail.

Indiana Temporary Ramp

- 24" and 28" pipe piles were driven to bearing to support the temporary ramps.

Indiana Temporary Ramp

- Indiana temp ramp nearly ready for asphalt

Kentucky Temporary Ramp

- Temporary earth fill was used to construct a portion of the Kentucky temp ramp.

Removing the Old Approach

- Removing an Indiana approach span in order to connect the temporary ramp.

"Dropping" an Indiana Span

- This span had to removed quickly in order to connect the Indiana temporary ramp to the existing truss.

Connecting the IN Temp Ramp

- Once the approach span was dropped, the crew installed cap and stringer beams, timber mats, concrete barrier, and laid the asphalt…in just three days.

Connecting the KY Temp Ramp

- The same sequence of construction was used to connect the KY tem p ramp.

Indiana Temp Ramp Open

- The temp ramps were rated for 15 tons and were designed to carrier vehicles up to 30' in length.

Indiana Temporary Ramp

- Designed to carry traffic for just a few months, with minimal maintenance, the ramp was in operation for 13 months.

New Truss Barge Grillage

- Surveying instruments were used to precisely position the barge grillage used for preassembling spans 2 & 3.

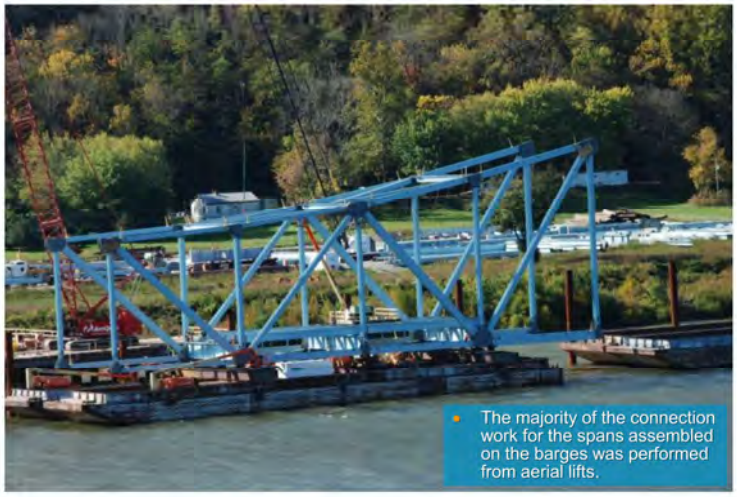
Truss Span 2 Pre-assembly

- The pre-assembly of Span 2 begins.

Truss Span 2 Pre-assembly

- Delivering the truss members to the assembly crane.

Half of Span 2 Truss



- The majority of the connection work for the spans assembled on the barges was performed from aerial lifts.

Span 2 - Preassembly

- Span 2 nearing preassembly.

Span 2 Preassembled

- Span 2 Preassembled.
- Center Section of span 3 being preassembled

Barge Impact Frame as Template

- Pile alignment given special attention

Piling for Temp Piers

- 36"Ø 1" thick walled pipe piles driven to bedrock using a D100-13 diesel hammer with a minimum capacity of 2900 kips

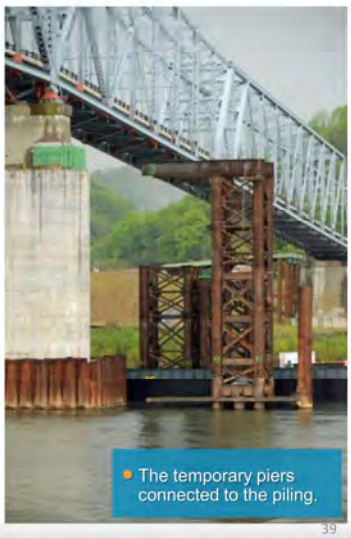
Truss Temp Support Piers

- The temporary pier sections were preassembled and hauled in sections to each pier.

Temporary Pier Positioning

- Installed square and center to the pier

Temporary Pier Construction



- The temporary piers connected to the piling.

Tine Girder Pedestal

- Sliding girder pedestal reinforcing avg = 24,000 lbs

Tine Girder Pedestal

- The pedestal's unique shape made for some interesting formwork.

Tine Girder Pedestal

- Shear connector inserts and scored lines helped ultimately tie the pedestal to the pier cap.

Temporary Jacking Towers

- The jacking tower atop the temporary pier.

Temporary Jacking Towers

- The jacking tower sat piers 3 & 4.

Temporary Jacking Towers

- Installing the jacking platform leg.

Position Tine Girders

- Tine girder assembly staged and ready for positioning.

Positioning the Tine Girders

- Connecting the tine girder assembly to the pedestal and temporary pier.

Tine Girders

- Tine girders ready to receive the sliding girder

Jacking Platform

- The preassembled jacking platform flown into position.

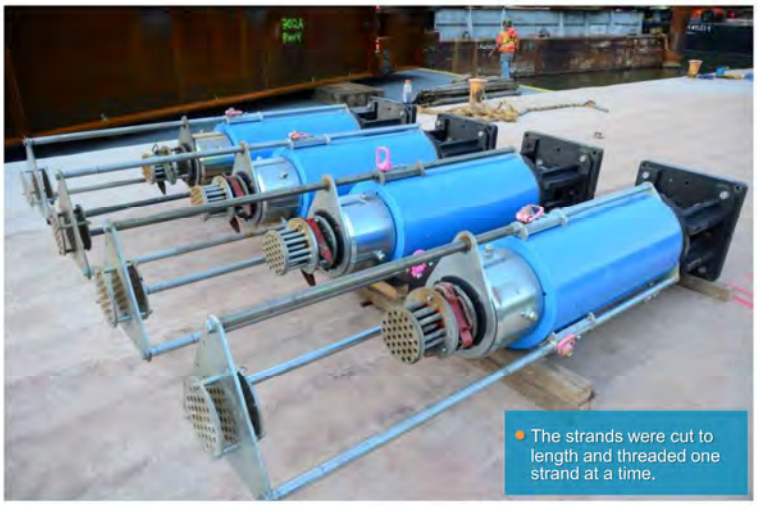
Jacking Platform

- The jacking platform bolted to the jacking tower and jacking leg.

Install Barge Impact Frames

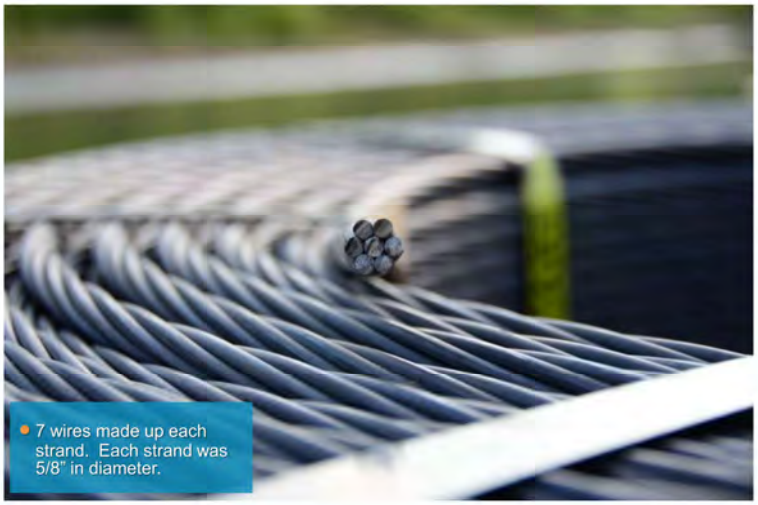
- Frame attached to the mounting brackets

Jacks Ready for Strands



- The strands were cut to length and threaded one strand at a time.

Strand

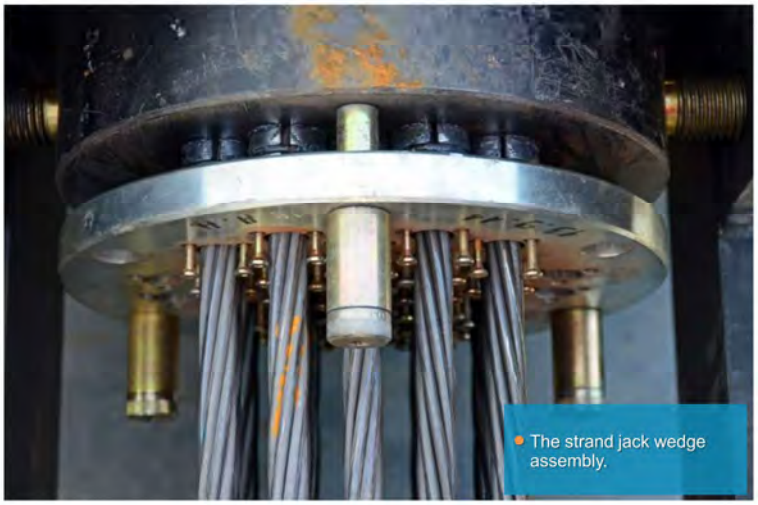


- 7 wires made up each strand. Each strand was 5/8" in diameter.

Locking the Strands

- VSL technicians locking the strands in position.

Strand Jack Wedge Assembly



- The strand jack wedge assembly.

Lifting a Jack onto the platform

- Each jack was flown into position “fully loaded”.

Strand Jacks Ready to Lift

- Four jacks were used at each platform.

Installing the Lifting Yoke System

Floating in Span 2

- The float-in began at daybreak.

Floating in Span 2

Floating in Span 2

Floating in Span 2

Floating in Span 2

Span 2 Ready to Lift

Strand Jacking Span 2

- Span 2 weighed just under 1700 tons when lifted.

Span 2 Ready for Sliding Girders

- Span 2 reaching the top.

Threading the Needle

- Each girder weighed 90 tons and was installed using a single crane pick.

Marrying Girder to Tines

- Once the tines were connected to the sliding girder, the assembly was rolled into its final position using Hilman rollers.

Sliding Girder & Tines Secured

- Sliding girder on designed station

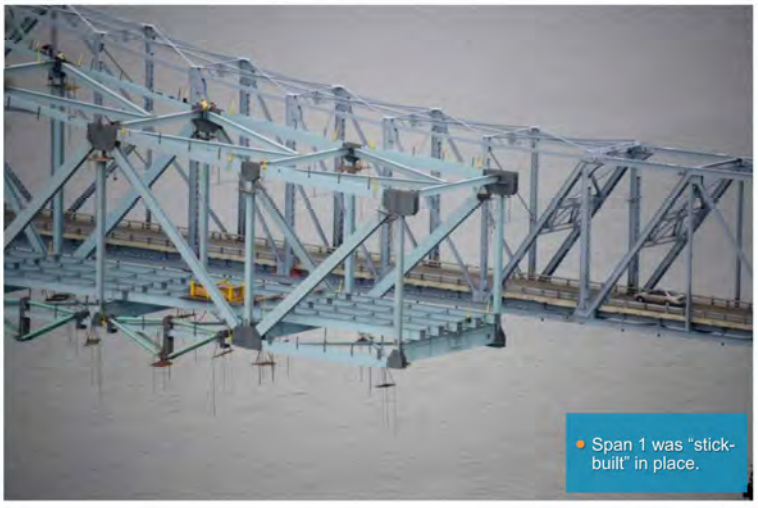
Span 3 Lift

- Span 3 weighed 1900 tons

Span 3 Lift Nearly Complete

- The navigational channel could only be closed for 24 hours. Walsh began the float in just after midnight and secured the truss at 7:30 pm.

Erecting Span 1



- Span 1 was "stick-built" in place.

Erecting Spans 1 & 4

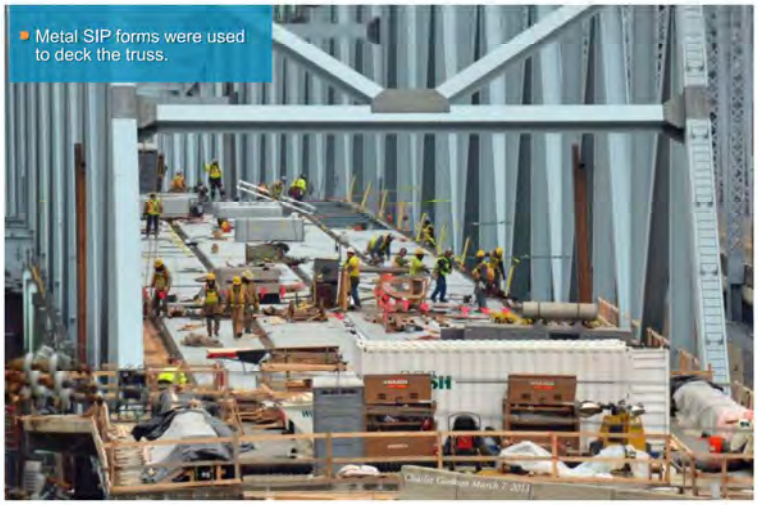
- Conventional "stick building" used to assemble Spans 1 & 4

Erecting Span 4

- "Connectors using their skills to erect span 4.

Preparing to Pour Truss Deck

- Metal SIP forms were used to deck the truss.



Preparing to Pour Truss Deck

- "Overhangs were formed and the deck reinforcing steel installed.

Preparing to Pour Truss Deck

- 800' of rigid pipe carried the concrete from the pump to the spider.

Pouring the truss deck

- A "spider" was used to distribute the concrete.

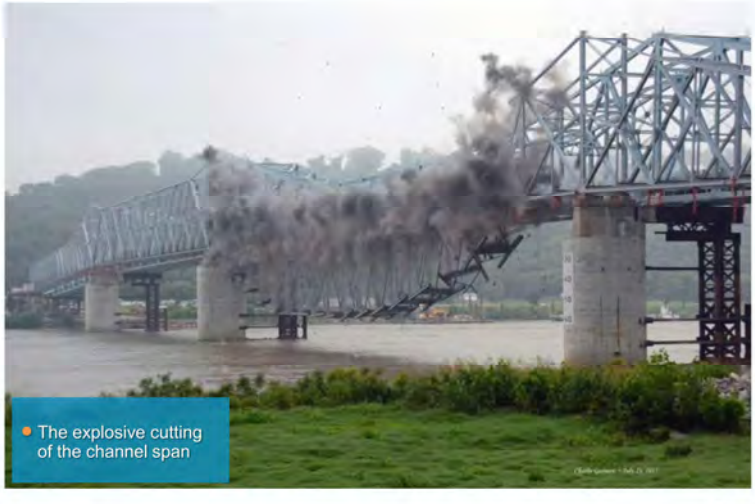
Shifting Traffic to New Truss

- The Indiana transition span.

Shifting Traffic to New Truss

- The Kentucky transition span.

Old Truss Demo



- The explosive cutting of the channel span

Old Truss Demo

- With only 15' between trusses, it was essential that the old truss followed a straight path downward.

Pier Cap Formwork

- Specially shaped EFCO forms were used to form the new pier caps.

Pier Cap Rebar

- Extra reinforcing steel was placed along the slide path.

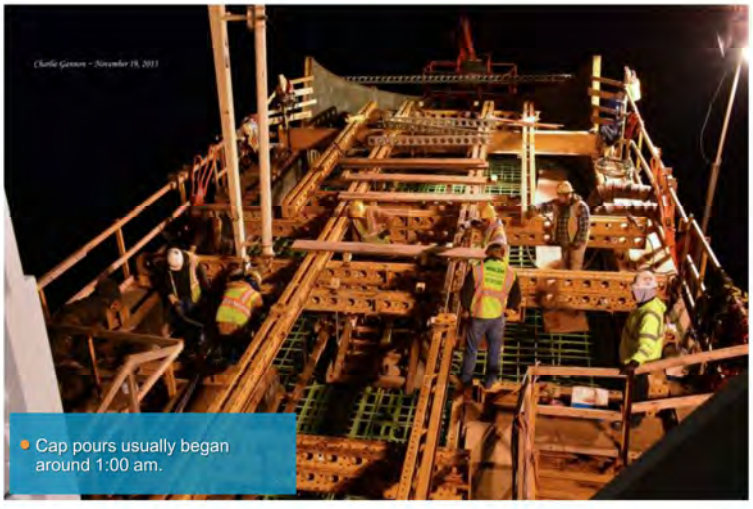
Pier Cap Insert Template

- The trusses on top of the forms were used to hold inserts needed for the slide.

Pier Cap Pour

- Taking advantage of the new truss to pour the pier caps.

Pier Cap Pour



- Cap pours usually began around 1:00 am.

Pier Cap Pour

- Pier cap ready for slide appurtenances.

Span D

Span D Slide

Span D Slide

Span D Slide

The Slide By the Numbers

- 2,427-foot-long, 4-span, continuous truss bridge
- Total weight approximately 15,260 US tons
- 55-foot lateral slide distance
- 95 feet above the Ohio River at normal pool

Truss Slide

- Dimpled PTFE on polished, greased, carbon steel
  - Permanent bearings utilized for sliding
- 1" thick slide plate, varied from 37" to 78" wide
  - Flatness of slide path critical
- Guided at only one pier (P4)
- BRAVO laser control system
- Bearing harness system
- Eight 350-ton strand jacks

Slide Jacking Platform

Truss Bearing Sliding Surface

Pier 4 Sliding Surface

- P4 slide plate complete with guide angle

Pier 5 Sliding Surface

- Pier 5 slide plate

Piers 2 & 6 Truss Bearing

- The shape of this bearing created the need for a unique “keeper”.

Piers 2 & 6 Truss Bearing

- The "Stuffer"

Piers 2 & 6 Sliding Harness

- Lead bearing harness

Piers 2 & 6 Sliding Harness

- Trailing bearing harness with "skates".

Piers 3, 4, 5 Sliding Harness

- Lead bearing harness

Sliding Harness

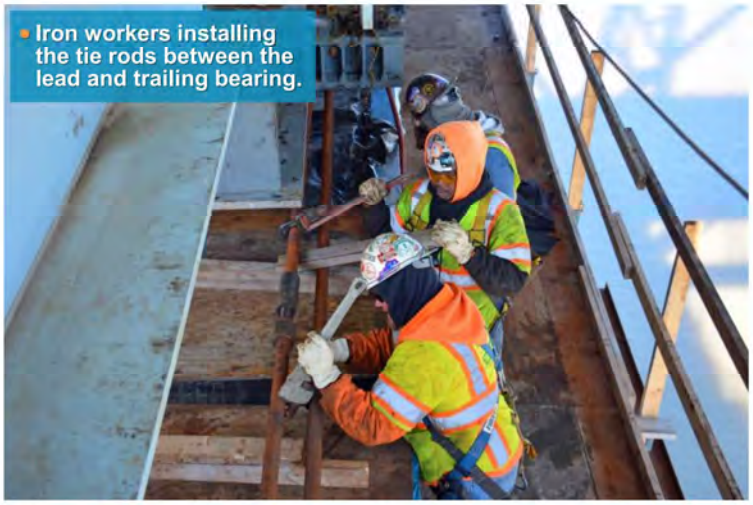
- Rear half of lead bearing harness

Sliding Harness

- Rear half of trailing bearing harness

Sliding Harness Tie Rods

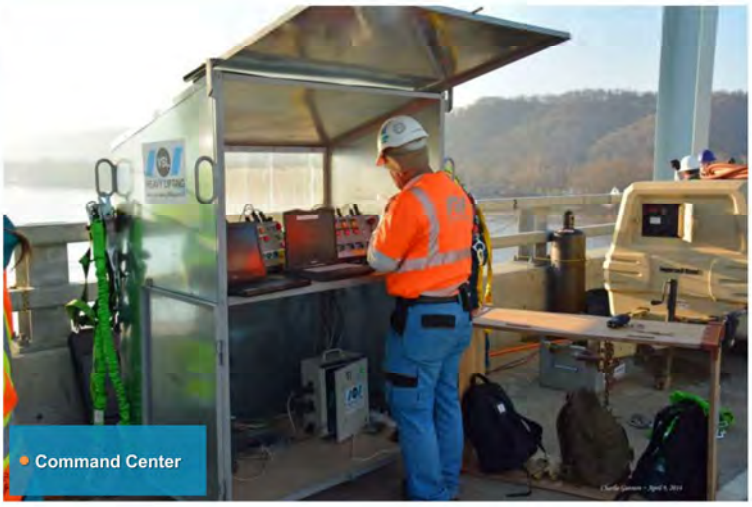
- Iron workers installing the tie rods between the lead and trailing bearing.



Strand Jacks

- BRAVO System

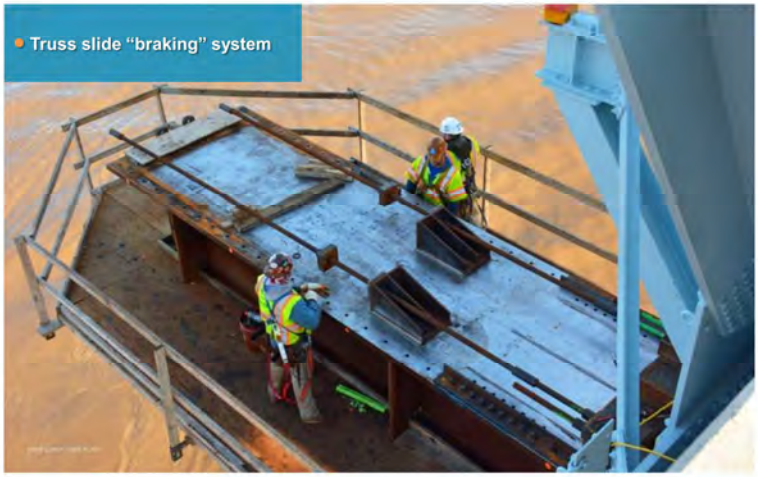
Slide Control



- Command Center

Slide Braking

- Truss slide "braking" system



Slide

- Halfway home…

Just a Few Feet to Go

Secured & Ready for Traffic

Pier Cap Closure Pour

Completed Pier Cap

New Milton-Madison Bridge