

St. Croix Bridge

Category: Long Span and Cable-Stayed Bridges

Innovation of Design and/or Construction

Chosen to minimize the environmental impact and reduce visual impairments to the native area, the extradosed bridge combines segmental box girder and cable-stay bridge designs. As the largest public works bridge project in Minnesota, the unique design was chosen to ensure pier heights remain below the river bluff line. The supporting towers rise only 67 ft above the bridge surface, so the entire bridge fits into the river valley as naturally as possible.

The mile-long bridge features five towers. It includes slender, reed-like piers, with pier blades that resemble cattails. A stringent visual quality requirement resulted in the entire bridge structure being rounded or tapered. In fact, there are only two flat surfaces on the entire bridge — the roadway surface and the bottom of the box girders.

This is the first bridge in the country to require an Act of Congress and a Presidential signature to receive an exemption from the Wild and Scenic Rivers Act. At the forefront were residents trying to ease congestion in Stillwater and encourage economic growth in western Wisconsin, pitted against environmentally concerned organizations seeking to protect the waterway and prevent urban sprawl. With the act approved — and an exhaustive list of mitigation requirements — many of the protected waterway's features were improved upon as a result of this project.

The final design for the mainline approach spans consists of four separate units: units 1 and 2, east and west. Both units 1 and 2 are composed of continuous spans of post-tensioned box girders, with the unit 1 box girders being precast concrete segments erected using balanced-cantilever method and unit 2 box girders constructed with cast-in-place concrete on falsework.

Aesthetics and/or Harmony with Environment

Constructed in 1931 and listed on the National Register of Historic Places, the Stillwater Lift Bridge had served its purpose for nearly 90 years. It long outlasted what designers thought would be its useful life and, over the years, caused congestion throughout historic Stillwater.

The use of precast and cast-in-place concrete on the approach spans and the extradosed unit on the new bridge was essential in meeting the goals of the visual quality manual prepared by MnDOT.

These include:

- The parts of the bridge look as if they were found in nature, or shaped by natural forces.
- The vertical pier forms are reed-like; the girders are rounded and tapered like bones or tree branches; and walls, barriers and railings are curved and blended into the larger forms.
- Transitions are gradual and smooth; edges are soft and curved; and colors are unified and natural expressions of their materials.

The curved “organic” nature of the girder webs are clearly exposed from both viewing directions and visually provide for consistent leading edges on both sides.



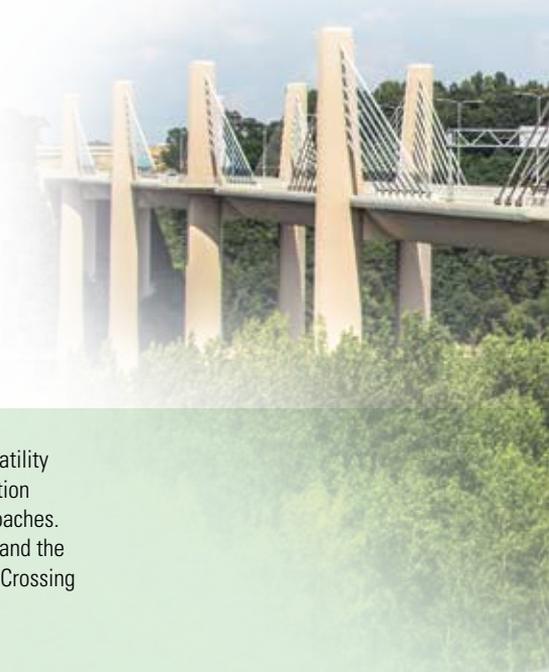
Photo Courtesy of HDR, Inc.

A rare vertical-lift highway bridge spanning the St. Croix River, the Stillwater Lift Bridge has long outlasted its useful life for vehicular crossings. With the original crossing built in 1931, talks of a new bridge began as early as 1951, when flooding forced its closure. Successive flooding and growing use of the two-lane bridge by interstate commuters to Minneapolis hastened debate over building a new and bigger bridge — which city leaders saw as their salvation.

Delayed for decades due to lack of funding, it wasn't until 1985 that a formal environmental review began, and it was another decade before a decision was made. Finally, after several lawsuits, an Act of Congress, a Presidential signature, and five years of construction, the St. Croix Crossing is complete.

Jury Comments

With its multiple 600-ft extradosed supported spans, the St. Croix Crossing is a testimony of the versatility of segmental bridges to adapt to the surrounding environments. The flexibility of segmental construction allowed the use of balanced cantilever and cast-in place framework to construct the bifurcated approaches. The aesthetics inherent to the segmental bridge come together in a perfect blend between structure and the surrounding nature. Given the unparalleled complications, challenges and requirements the St. Croix Crossing project shines. The bridge is well-conceived and is clearly a new favorite for the local population.





The St. Croix River is protected under the U.S. Wild and Scenic Rivers Act. It is surrounded by tree-lined bluffs and pristine shorelines. With 16 ponds, the new system filters out sand, sediment, gravel and nutrients, while also reducing the quantity of phosphorus entering the St. Croix River from stormwater by nearly 25%.

Due to highly erodible soils on the Wisconsin bluff, construction crews used less-invasive techniques that included constructing the drainage structure by hand, operating small machines and equipment, and using a temporary trestle system that reduced impact to the bluffs below Pier 13 and the east abutment.

To minimize work on the Wisconsin bluff line, the new bridge was aligned with an existing ravine, reducing the need to cut into the bluff and creating a smooth transition from highway to bridge.

The project took extra care to protect nature around the site and prevented disturbing an active bald eagle nest by maintaining a 300 ft perimeter — later to observe that three eaglets were hatched in the spring, instead of the normal one hatchling.

Further, the project required that Higgins eye pearly mussels that lived in the construction area be relocated. These native mussels were eventually transplanted back into the river and other tributaries. In Wisconsin, seeds of the endangered Dotted Blazing Star flowers were gathered from flowers and stored for future planting before crews relocated the flowers.

While the light brown paint matches the adjacent bluff, painters opted to roller-apply the paint over

the waterway instead of spray it on. This eliminated overspray from paint guns, which would have ended up in the water. The contractor utilized a series of checks and balances including curtains and tarps to ensure no items were dropped into the river during construction.

Cost Competitiveness

The extradosed bridge type was selected by the stakeholder group based on many decision points, cost being one of them. While other bridge types would have been more cost competitive, the extradosed bridge type provides a strikingly beautiful structure that fits into the scenic St. Croix River and will be enjoyed by the public for decades to come.

The early foundation and superstructure as-bid contracts totaled \$370 million, an average of \$645 per sq. ft.

Minimization of Construction Impacts on the Traveling Public

The St. Croix Crossing is on a new alignment, so the majority of the project did not impact the traveling public. The bridge crosses Trunk Highway (TH) 95 in Minnesota, and at least one lane in each direction was provided for the duration of the project. Traffic was staged to allow safe segment erection and other construction activities.

Temporary ramps from TH 95 to TH 36 were maintained around the on-site casting yard. The biggest impact was to the boating public, which traveled through a no wake zone that was implemented to minimize impacts to floating construction equipment.

CREDITS

Owner:

Minnesota DOT
Wisconsin DOT

Owner's Engineer:

Kevin Western, Minnesota DOT

Designer:

HDR, Inc.
COWI

Contractor:

Lunda / Ames JV (Superstructure)

Construction Engineering Services:

McNary Bergeron & Associates
Corven Engineering, Inc.

Constructability Review/

Estimating Services:

Armeni Consulting Services, LLC

Construction Engineering Inspection:

Parsons Transportation Group

Precast Producer:

Lunda / Ames JV

Formwork for Precast Segments:

Southern Forms
EFCO

Erection Equipment:

Structural Technologies VSL

Post-Tensioning Materials:

Freyssinet, Inc.

Bearings:

mageba USA LLC

Expansion Joints:

Watson Bowman Acme

Epoxy Supplier:

Sika Corporation

Prepackaged Grout:

The Euclid Chemical Company

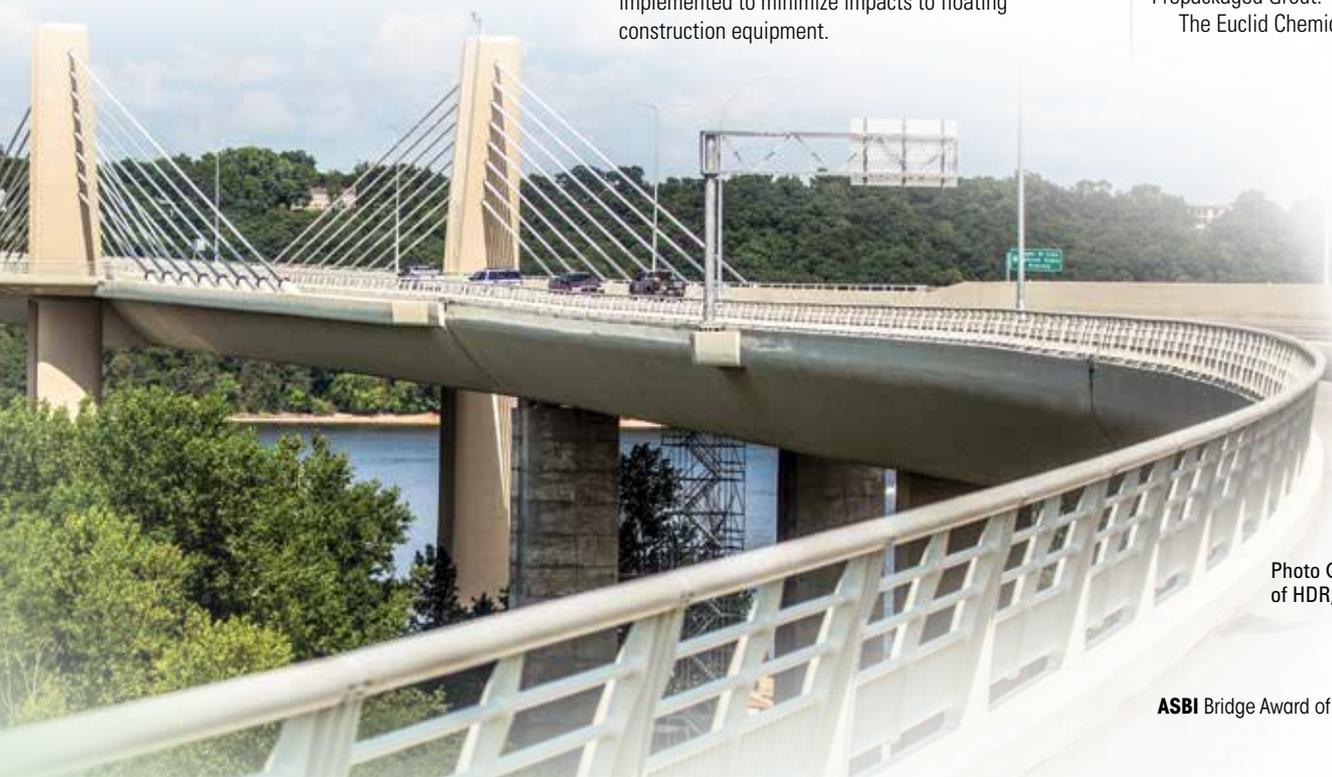


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