CANADIAN CONSULTING ENGINEERING AWARDS 2018 ST. CROIX RIVER CROSSING

CATEGORY B: TRANSPORTATION



FS COWI

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B. PROJECT OUTLINE

PROJECT SUMMARY

Five decades in the works, the newly complete St. Croix River Crossing balances environmental and stakeholder concerns while providing increased vehicular capacity of 55,000 vehicles per day between Minnesota and Wisconsin, significantly reducing delays. The largest public works bridge project in state history and longest extradosed bridge in the country, it crosses the federally-protected "Wild and Scenic" St. Croix River.

The extradosed bridge form used for the bridge is unique in optimizing environmental and visual footprints while being sustainable and constructible. When the COWI/ HDR team was selected to design the St Croix River Crossing, there were only two extradosed bridges (Golden Ears and Canada Line) constructed to date in North America – both of which are in Lower Mainland and were designed by COWI at its headquarters in North Vancouver. Expertise developed in British Columbia was instrumental to the successful completion of the St Croix River Crossing.

The structure is designed to have an "organic" feel with rounded shapes used for the deck, and carefully shaped piers with legs designed to resemble reeds. Throughout design and construction, extra care was taken to protect the natural setting, minimizing disturbances to nearby bald eagle nests, relocating mussels and endangered flowers, and preserving historic structures nearby. To minimize construction impacts to the Wisconsin Bluff, designers aligned the new bridge with an existing ravine – reducing the need to cut into the highly erodible bluff slope and creating the striking effect of the bridge emerging from the crest of the Wisconsin Bluff.



1. INNOVATION

The bridge is the largest public works bridge project in Minnesota and the longest extradosed bridge in the U.S.

- The new bridge combines segmental box girder and cable-stay bridge technology. The mile-long bridge is more than five times longer than the other extradosed bridge in the U.S.
- The profile and alignment for the approach sections and ramps was significantly optimized in order to minimize complexity and maximize constructability. The bi-furcated approach structure and shorter ramps removed the roadway widening and super elevation transitions from the river spans resulting in a uniform cross section for the extrodosed spans and an improved drainage system. The optimization process also resulted in longer river spans, a reduction in river towers, a deeper cross section, and a continuous extradosed structure from river bank to river bank with no internal expansion joints or bearings.
- Significant 3D and 4D visualizations were used throughout the design process to work with the visual quality committee and aid the design team in developing and communicating the visual quality design issues and construction methods and timelines.





2. COMPLEXITY

Since the 1930s, this project faced unparalleled challenges and complications:

- Protected under the federal Wild and Scenic Rivers Act since 1968, the St. Croix River is a treasure to both Minnesotans and Wisconsinites, and the Stillwater Lift Bridge is listed on the National Register of Historic Places. The project not only required Congressional approval, but a Presidential signature.
- A stakeholder process in the early to mid-2000s determined that only an extradosed bridge would address the stakeholder commitments. The plan called for improving three miles of roadway in each state, preserving the lift bridge by converting it to a pedestrian and bicycle crossing as part of a new trail.
- The Environmental Impact Statement limited the number of piers in the river, the height of the piers above the roadway, and mandated that the deck height be uniform across the entire structure.



3. SOCIAL AND/OR ECONOMIC BENEFITS

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. The lift bridge drained everything directly into the river, untreated. The new St. Croix Crossing's drainage system was carefully designed to meet or exceed stormwater quality requirements. With 16 ponds, the new system is capable of filtering out sand, sediment, and gravel. Best practices were provided for the contractors to implement. During construction, crews were diligent to protect water quality. The project included a water treatment plant, utilized turbidity curtains, concrete barriers, and silt fencing to contain sediment.

The two-lane lift bridge often caused traffic back-ups for more than 20 minutes for only 17,000 crossing per day. The new bridge, designed to accommodate more than 71,000 vehicles per day, improved the lives of the commuters for generations to come. On top of making commuting simpler, the new bridge removes traffic from historic downtown Stillwater. The town of nearly 20,000 often faced gridlock in the heart of downtown. Beyond traffic traveling across the new bridge, the bridge will spur development in a portion of western Wisconsin that is now more easily within reach of the Minneapolis-St. Paul area.



4. ENVIRONMENTAL AND SUSTAINABILITY

The project involved groups on both sides of the river such as the Wisconsin Garden Club, which constructed two gardens of native plants near the project. The gardens will filter water before it goes into the ground while providing food for bees and butterflies.

High-performance concrete and stainless-steel reinforcement were used in critical superstructure and substructure elements in order to provide a 100-year design life. With more money being invested in St. Croix-related environmental improvements than any other Minnesota bridge project, other projects have begun to take note. Quickly after project completion, MnDOT utilized the environmental requirements and best practices developed on the St. Croix Crossing for the Trunk Highway (TH) 53 project, which crosses several states' water supply. Potential contractors were provided a presentation of the best practices used during St. Croix Crossing construction and instructed that they should expect to be held to high standards.



5. MEETING CLIENT NEEDS

COWI together with HDR were responsible for the main river bridge and associated approach bridge design. The design team studied the visual quality and environmental commitments and desires developed through the 30-year history of this project. Through a process of optimization, a refined final bridge design was developed to balance the visual quality and environmental requirements; provide bridge characteristics that were desired, and achieve the environmental impact commitments made by MnDOT and WisDOT. The COWI/HDR team's process decreased the structural complexities of the approach structure by revising the geometry and eliminated two towers from the main bridge by increasing the span lengths. The new bridge removes traffic from the historic lift bridge, reducing the congestion in Stillwater, provides faster access to jobs in the Twin Cities and is a significant driver for economic development in western Wisconsin.

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Aesthetics were considered in the details when building the bridge. The rounded edges of the box girders and crossbeam soffits allow the pedestrian overlooks to flow seamlessly



Shapes, details, and colours chosen for the piers, deck, and stay cables compliment each other resulting in a stunning and durable bridge



Stainless steel anti-vandalism pipes & hoods for the stay cables are aesthetically pleasing as well as durable even at the roadway salt spray zone