



2017 Canadian Consulting Engineering Awards

Sir Ambrose Shea Lift Bridge Replacement

PLACENTIA, NEWFOUNDLAND AND LABRADOR, CANADA



Entering Organization

Category

PARSONS

Transportation

Project Outline

Sir Ambrose Shea Lift Bridge Replacement

PROJECT OUTLINE

75-WORD SUMMARY

The Newfoundland and Labrador Department of Transportation and Works retained Parsons to replace the 50-year-old movable bridge connecting two adjacent communities in the town of Placentia that reached the end of its useful life. The complexity arose from the requirements to design an aesthetically pleasing structure celebrating the community's local heritage and yet provide a safe, reliable access to a safe harbor for fishermen and boaters and a robust structure in a relatively harsh environment.

PROJECT HIGHLIGHTS

QUESTION 1 – INNOVATION

The project's objective was to create a bridge that satisfied the functional requirements of the existing bridge including accommodating both vehicular and boat traffic, and minimizing navigation restrictions, which can negatively affect local commercial fishing activities. A three-span structure, the replacement bridge has a centre movable span (vertical lift span) flanked by two simple fixed girder spans. Towers consist of a 3-D truss shape representative of sails. Each tower component is connected by a 3-D exoskeleton truss which shelters the lift span machinery.

It was designed and constructed with a high degree of technical excellence and was successful in reaching its functional requirements while incorporating these key innovative design features:

- **Durability:** Because of the very harsh environmental conditions, special care was taken to select robust members, details, and systems that would also enhance the structure. Details included: sealed tubular structural sections; enclosures for mechanical machinery and components; positioning of mechanical and electrical components in machine rooms 25m above the water level, minimizing salt spray exposure and salty ocean water; the use of galvanized rebar within the concrete elements; and elimination of expansion joints at the approach spans' abutments. Furthermore, all structural steel components were metalized and received a two-coat paint system for extended corrosion protection in comparison with similar structures.
- **Reliability:** A vital connection between two communities, the lift bridge permits an important passage for commercial fishing vessels. As such, the reliability of the bridge's operations was a high priority. Simple and conventional mechanical and electrical operating systems bring the highest degree of reliability while minimizing maintenance and form the basis of the bridge design. Standby generators ensure continued, reliable service in case of power outages. Control system technology utilizing a Programmable Logic Controller for system control and monitoring included the capability for remote monitoring and diagnostics. This proved useful during bridge commissioning given its remote location.

- **Architecture:** The new bridge provided an opportunity for improvement to the existing crossing's architecture that complemented surrounding features and architecture. As a very visible and intrusive object in the community centre, the new bridge design promoted forms and features that enhanced the crossing, while providing practical, functional, and durable structural elements with conventional operating characteristics. Design addressed aesthetics both globally and in detail. It integrated the mechanical, electrical and HVAC systems into the structure with minimal impact from a visual perspective while minimizing maintenance requirements and improving overall system efficiency.

QUESTION 2 - COMPLEXITY

Complexity arose from requirements to design an aesthetically pleasing structure celebrating the community's local heritage and yet provide a safe, reliable and robust structure in a harsh environment. Key challenges included:

- **Harsh Environmental Conditions:** High winds, changing tides of up to three times daily and fast current of up to 8 knots is the site's norm. Although this was accounted for in the design to ensure that the structure is stable during all stages of construction, it added construction complexity and limited crane operations.
- **Foundations:** Because of silty sand, poorly graded sand and no bedrock, pier foundation design relied on friction piles or shallow foundations where limited bearing capacity was located. Parsons managed to design two foundation options allowing contractors flexibility to bid on an option based on their experience level, available equipment and cost.
- **Steel Design:** Design of the tower's tubular connections is absent in traditional literature or codes, and required extensive finite element models to confirm connection capacities. Numerous loading conditions were considered for a movable bridge in both the open and closed position complicating the design.
- **Construction:** Transportation, erection and long-term durability were vital design considerations. Tower members were designed of sealed and welded tubular pipe members. Connection design allowed the Contractor to fabricate towers into manageable segments for transportation and handling without requiring field welding. Lift span design had optional splices, allowing the Contractor to assemble the 100-ton lift span on a barge from shore and lift it into position using jacks.

QUESTION 3 - SOCIAL AND/OR ECONOMIC BENEFITS

The new bridge is making a significant contribution to the economic and social quality of life by providing a reliable link between the amalgamated communities of Placentia, Jerseyside, Dunville, and Freshwater in comparison with the original bridge which often experienced shutdowns resulting in lengthy detours through gravel roads affecting both commercial vehicles, school buses and the day-to-day life of local residents.

The bridge is raised for commercial fishing boats approximately 2400 times annually allowing them to enter and leave the Placentia Gut year-round.

"I am pleased to be in Placentia today to officially open the new lift bridge, which is a key investment in the economy of this region and is essential to this historic community. This bridge physically connects neighbours and families, provides access to a safe harbour for fishermen and boaters and supports tourism in the region. This is an important day for residents and businesses in Placentia."

*The Honourable Dwight Ball,
Premier of Newfoundland and Labrador*

The design and construction of the new bridge limited interruptions to fishing operations/ navigation to only a few days and mostly off-season.

QUESTION 4 - ENVIRONMENTAL BENEFITS

The bridge design incorporated reliability, long term durability and sustainability features to achieve a 100-year bridge service life while minimizing future maintenance costs and associated impacts to the environment. This was achieved by a combination of durable material selection, resilient detailing, designs aimed at simplifying maintenance tasks and thorough quality control during construction. Other sustainable design features included specifying materials with reduced corrosion potential that resisted degradation processes. Examples include the use of galvanized rebar in the deck and provision of a superior coating system that was more durable in the harsh Placentia environment. The coating system involved metalizing the steel surface and the application of two additional coats to provide extended service life.

One of the more important design features which improves durability, is the selection of closed members. The towers and machine room framing system is comprised of tubular pipe members completely sealed to the elements. Thus, reducing the area exposed to corrosion and minimizing the exposed surface that require coating and future maintenance.

The horizontal alignment of the new bridge is parallel to the existing bridge alignment, but offset by 22 m to the east. An offset roadway alignment allowed new bridge construction without disturbing vehicular traffic. The shortest detour to cross from one side to the other is about 35 minutes and requires driving on a gravel road. This offset alignment resulted in significantly minimizing the carbon footprint and greenhouse gas emissions associated with potential lengthy detours during construction.

QUESTION 5 - MEETING CLIENT'S NEEDS

To celebrate the community's local heritage, the new bridge provides an aesthetically pleasing iconic structure with architecture sympathetic to the local culture and the region's tourism potential while being durable and reliable at the same time. It exceeded the imposed design requirements and the client's expectation, and provided a sustainable design with net positive effect from the natural, social, economic and environmental perspective.

The bridge was open to traffic on September 23, 2016 in the presence of the Premier of Newfoundland and Labrador with hundreds of residents viewing the ceremony. The community welcomed the opening of the new bridge with great enthusiasm. Quotes included here from dignitaries attending the opening ceremony is a testimony to the importance of this bridge and its contribution to the economic, social and environment quality of life.

"Today is a significant day for the residents of the Town of Placentia as we welcome and officially open a new structure that will serve as an important piece of the transportation network in our community. The Sir Ambrose Shea Lift Bridge provides a vital link for our communities; it also allows access to the harbour and serves as a unique attraction for visitors. The opening of the new bridge is a great milestone and as a community we are thankful for the investment made to make this a reality."

Wayne Power, Mayor of Placentia

Images

CCE – 2017 - Captions to be added to Photos

PARSONS Photo 1: Architect's Rendering.jpg

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Architect's Rendering of the bridge in the open position

Photography courtesy of Barry Padolsky Associates Inc., Architects, Planners & Heritage Consultants, Ottawa, Ontario.

PARSONS Photo 2: Architect's Rendering.jpg

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Architect's Rendering of the bridge in the closed position

Photography courtesy of Barry Padolsky Associates Inc., Architects, Planners & Heritage Consultants, Ottawa, Ontario.

PARSONS Photo 3: Overview of the Sir Ambrose Shea Vertical Lift Bridge.jpg

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An overview of the bridge showing the innovative tower design and the transparent machine rooms.

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PARSONS Photo 4: Overview of the Sir Ambrose Shea Vertical Lift Bridge.jpg

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Bridge spanning the Placentia Gut as seen from the sea.

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PARSONS Photo 5: New and existing Sir Ambrose Shea Bridges.jpg

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Bridge on opening day – September 23, 2016 with the new iconic bridge besides the existing bridge that reached the end of its useful life.

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PARSONS Photo 6: White coated Bridge comprised of 3-D exoskeleton truss towers and machine rooms.jpg

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Beautiful white bridge blending into the natural setting with towers mimicking nautical lines.

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PARSONS Photo 7: Bridge Tower Erection.jpg

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The bridge towers were designed with bolted connections to facilitate erection in a harsh environment.

Photography courtesy of the Newfoundland and Labrador Department of Transportation and Works

PARSONS Photo 8: Lift Span Moving into Place.jpg

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Lift span moved into position from shore using a barge.

Photography courtesy of the Newfoundland and Labrador Department of Transportation and Works

PARSONS Photo 9: Pier Foundations.jpg

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Pier foundations comprised of 135 friction pipe piles.

Photography courtesy of the Newfoundland and Labrador Department of Transportation and Works

PARSONS Photo 10: Lift Span Assembly.jpg

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Assembly of Lift Span components with span in the raised position to minimize interruption to commercial fishing operations.

Photography courtesy of the Newfoundland and Labrador Department of Transportation and Works

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PARSONS Photo 11: Bridge Towers.jpg

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Bridge towers accommodating access stairs, counterweights and electrical/control wireways.

Photography courtesy of Parsons

PARSONS Photo 12: Raising Lift Span into Position.jpg

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Lift span jacked into position by the barge.

Photography courtesy of Parsons















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05/01/2014





