



North Channel Bridge Replacement Three Nations Crossing

Category G - Project Management



Table of Contents

Forms.....	i
Notice of Intention to Enter	i
Entry Consent Form.....	ii
Letter of Acknowledgment – Catherine Karakatsanis.....	iii
Owners Letter – Glenn Hewus	iv
Executive Summary	v
Project Description	1
Background.....	2
Project Summary	3
Technical Complexity.....	4
Meeting the Client’s Needs	5
Environmental Benefits.....	6
Innovations.....	7
Social and/or Economic Benefits.....	8
Additional Photos	9



Executive Summary

Morrison Hershfield Limited (MHL) was retained by the Federal Bridge Corporation Limited (FBCL) to provide consulting engineering services for the construction phase of the North Channel Bridge Replacement – Three Nations Crossing. The replacement bridge and supporting infrastructure replaces the existing high level bridge that was put in service in 1962 and had reached the end of its serviceable design life. The Three Nations Crossing is an International border crossing between Canada, United States of America and the Akwesasne Mohawk Community on Cornwall Island.

This project faced many political and technical constraints that needed to be addressed throughout the construction schedule. The initial contract involved the construction of three in-water piers within the fast flowing waters of the St. Lawrence River North Channel. Highly technical marine equipment was needed and anchored to the piers of the existing high level bridge for stability. Steel caisson liners were drilled 6 metres into the bedrock below the river bed and construction of the piers was staged to the pier cap level utilizing barges to deliver reinforcing steel and concrete to the pier locations

The second contract consisted of the construction of the North Channel Bridge superstructure, approach detours and roadways, and a bridge crossing of the Cornwall canal. The superstructure consists of twin steel box girders with a concrete deck. The steel was placed from the north abutment using a high complexity innovated launching procedures that rolled the girders across the channel into position. A series of eleven launches were required over three month period. Upon completion of the girder placement the girders were jacked to remove the launching rollers and place the bearings.

Following the completion of the critical element of the girder placement the deck was formed and poured in a series of four major pours of over 300 m3 of concrete each pour. The concrete deck was then waterproofed and paved.

Prior to opening the new bridge to traffic the project team was required relocate the bridge tolling and Canadian Border Services Agencies (CBSA) to newly constructed facilities adjacent to the new bridge crossing.

During the construction phase of this unique project MHL collaborated and work closely with FBCL, the City of Cornwall, CBSA and the Mohawk Council of Akwesasne (MCA) to deliver this new infrastructure that will serve International travelers and the residents of the City of Cornwall and Akwesasne for years to come.

Project Description

MHL is very pleased to submit this submission entry in response to the Canadian Consulting Engineer Magazine's 2014 Awards. Our submission has been prepared in compliance with the requirements set forth under Category G – Project Management.

Our submission contains reference material to substantiate MH's role in providing project management services to the Federal Bridge Corporation Limited (FBCL) for the North Channel Bridge Replacement – Three Nations Crossing, specifically responding to the complexity of the project, meeting the client's objectives, environmental benefits, innovation and social and economic benefits.

MHL assumed the lead consultant role to manage the project through the construction and commissioning phases with responsibility for project management, contract administration, quality assurance, stakeholder consultation and overall scheduling and budget controls to the FBCL for the North Channel Bridge Replacement – Three Nations Crossing from 2011 to 2013. At a high level, our role included contract administration services, quality assurance, inspection and verification, stakeholder communications, overall project scheduling, and budget control of construction activities.

We provided thorough reviews of the contractor's detailed Operation Plan that included the Safety Plan, Environmental Protection Plan, Emergency Response Plan and Traffic Control Plan, for compliance to the Construction Contract Documents.

We ensured that the Contractor conformed to the Traffic Control Plan, including liaison with the CBSA, MCA and the City of Cornwall. We facilitated all meetings with the contractor and with government agencies such as Fisheries and Oceans Canada and Transport Canada and advised the Contractor of nonconformance issues and ensure corrective measures are put in place.

We reviewed the Contractor's Quality Control Records and obtain certificates from the Contractor for onsite work and offsite fabricated materials as required and obtain Certificates of Conformance from the contractor. Prepare and issue Certificate of Substantial Performance and Certificate of Contract Completion following inspection of the Work Conduct warranty inspection and direct the Contractor as required to correct deficient work and ensuring work is corrected.

Our firm's capabilities, experience and expertise validates our approach to deliver professional project management services on the North Channel Bridge Replacement – Three Nations Crossing on-time and on-budget and to highlight this submission for award by the Canadian Consulting Engineer Magazine's for 2014.

Background

The North Channel Bridge Replacement is a significant Federal project that has had several decades of planning and engineering to arrive at today's solution. The existing high-level bridge is a significant landmark within Cornwall, visible in most areas of the City. Built in the early 1960's many marvel at its structure and stature however due to age and deterioration and significant costs to maintain many now view it as an eyesore that has served it's time .

A Harmonized Environmental Study recommended the high level bridge be removed and replaced with including new low level the replacement low level North Channel crossing. The construction of the low level structure posed new challenges to the project that did not exist with the high level structure as the infrastructure now needed to integrate with the Cornwall waterfront, adjacent neighbourhoods and existing roadways, recreational paths and pedestrians.

At 1,625 metres long and about 50 metres high, the North Channel Bridge is a monumental structure. As it turns out, it is also far bigger than it needed to be. The North Channel Bridge was never expanded as originally intended, and Seaway traffic, which the bridge was designed to accommodate, utilizes the channel to the south. When the FBCL decided to replace the aging structure, the bridge owner chose a much more modest crossing: a low-level bridge, just seven metres above the water. And, since the bridge is lower, it is also shorter, at just 355 metres long.

For this complex and challenging project, the MHL's Construction Management team was led by Senior Project Manager Stan McGillis, P.Eng., and Senior Construction Manager Robert Goulet, C.E.T., rcsi. The construction contracts were carried out by lead general contractors American Bridge Company for the in-water piers and Aecon Construction Materials Limited for the Structures and Approach Detours.

Project Summary

Federal Bridge Corporation Limited (FBCL) required the existing North Channel Bridge to be replaced due to excessive maintenance costs and age. Morrison Hershfield (MHL) was retained to provide Contract Management services. New type of concrete was used during construction and a very precise “launch” technique was used for installing the girders. Significant consultation was on-going with stakeholders and aboriginal groups. The new bridge helped eliminate the aging structure creating opportunities for neighbourhood renewal and redevelopment.



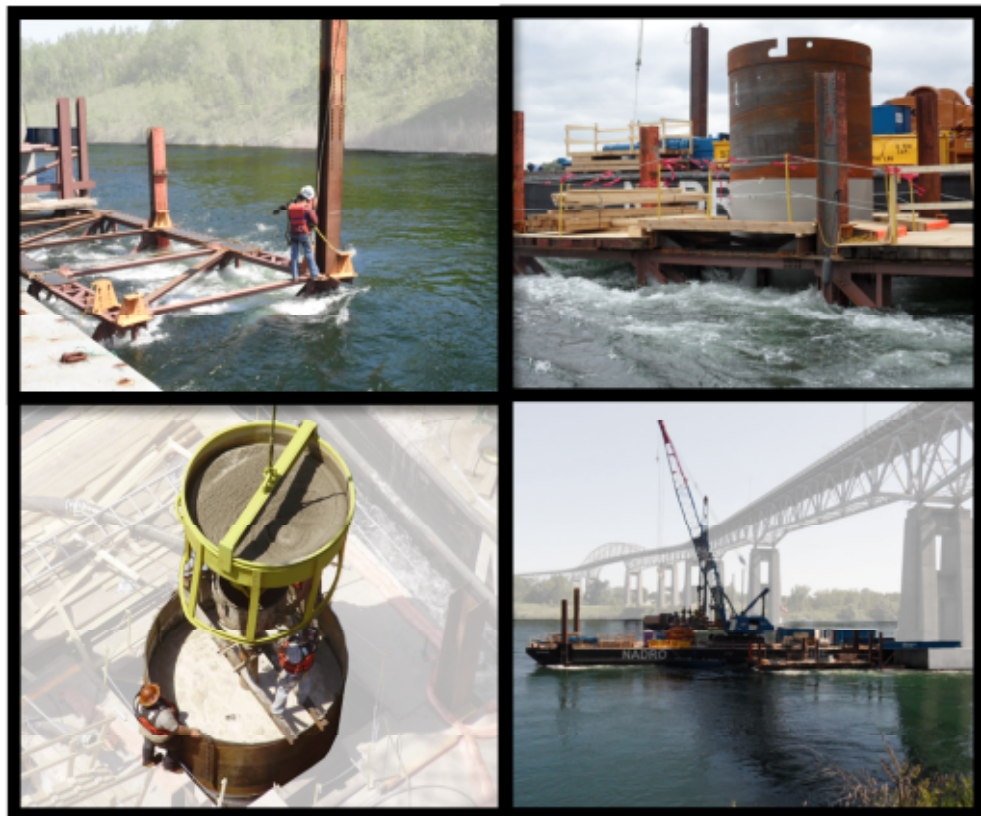
Technical Complexity

The design of the Low-Level Bridge specified two parallel rows of 11 box girders, supported at either end by a concrete abutment on the bank of the channel and the three concrete piers in the channel. The box girders, made with steel plate up to 60mil thick, measure 3.6m wide, 3.2m high and about 30m long and weigh as much as 85 tonnes. Given the size of the structural elements and limited room to manoeuvre, the girders were pushed across using what is known as a “launch” technique. This unique installation approach which required a highly precise modeling to ensure not to overstress any part of the structure during the launch sequence was closely monitored by MHL’s QA staff.

The concrete deck for the Canal Bridge was constructed using a National Research Council (NRC) experimental concrete mix design. Developed by Dr. Daniel Cusson, Senior Research Officer at NRC, this high-performance concrete is designed to minimize shrinkage while maintaining all of its structural properties and to be less prone to cracking. This new product could also potentially increase the lifespan of concrete bridges by up to 40 years. MHL staff coordinated the scheduling of NRC, Aecon and Lafarge Concrete staff to address concrete placement requirements, placement of monitoring instrumentation within the formwork. Several different trial batches were needed before NRC was comfortable enough with its performance to start pouring the concrete for this bridge.

Under a very tight schedule for opening of the new low level bridge to traffic, the FBCL commenced work on a new toll plaza immediately north of the low level bridge and a new CBSA border control facility. Phase 1 of the facilities costing over \$10M needed to be completely constructed in four months. To accelerate construction, FBCL turned to MHL to provide Contract Management services to assist with the procurement of all sub-trades and provide onsite coordination, integration and scheduling of the work. MHL’s project and Contract Management expertise ensured the work was completed and commissioned on time and budget for the opening of these facilities to the satisfaction of FBCL and CBSA.

Marine operations for the in-water pier work using pre-manufactured steel caisson liners that were drilled via marine equipment 6m into underlying bedrock was complex and challenging. With swift current water flowing through the Channel, monitoring and inspections were completed from the working platforms at each pier location to conduct QA inspections.



Meeting the Client's Needs

The FBCL was established in 1998 to oversee and be accountable for the bridges under its control and to provide strategic direction to the asset operators under its jurisdiction. Its mandate is to provide the highest level of stewardship so that its bridge structures are safe and efficient for users. In order to achieve its objectives, FBCL has been clearly focused in recent years on bridge safety and financial sustainability.

FBCL in partnership with numerous stakeholders, which included the City of Cornwall, CBSA and MCA, completed the planning and engineering for the replacement of the North Channel high level bridge. A major consideration for FBCL was to integrate this project with the City of Cornwall's existing waterfront development plan and to augment this new "Gateway" to mark the entrance to Canada through Cornwall and Akwesasne.

Through the construction phase the impacts on the communities of Cornwall and Akwesasne had to be managed while maintaining the international crossing. A strong project team was needed to provide regular communications and opportunities for all stakeholder input into this project that would address the needs of the communities.

MHL working with FBCL's Communications provided continuous updates on the progress of the project through the website www.pontcornwallbridge.ca. MHL staff also provided updates to the City of Cornwall Engineering Department and MCA on upcoming roadway and recreational path closures and detours so that these communications could be issued to the residents. This collaborative approach was very effective in maintaining positive communications throughout the construction schedule.



Environmental Benefits

MHL provided environmental inspection services during the administration phase of this project in conjunction with monitoring carried out by the Contractor's representative in environmental and fisheries matters. We reviewed all CA compliance with environmental obligations including archaeology, heritage, in-water contamination, HADD, restoration and mitigation landscaping, etc. MHL liaised with all approving agencies to prescribe working conditions and constraints to be followed by the contractor, and ensure the contractor has all necessary permits in place for the construction to proceed.

The in-water works contract was completed in an environmentally safe manner that protected the waters of the St. Lawrence River channel. The pier construction utilized steel caisson liners embedded into the bedrock bow the river bed so that all work was contained within the steel liner. Liners were designed to be left in place so there would be no disturbance of the river bed during removal. The abutments for the Bridge were setback from the river banks to avoid disturbing the sensitive shoreline.

The new bridge was designed and constructed with no roadway run-off or deck drains out-letting into the St. Lawrence River. All roadway and bridge drainage is contained and collected into a new stormwater management pond where the water is filtered prior to be released into the river

Roadway improvements were partnered with the City of Cornwall's upgrading of their Combined Sewer Overflow. These new multi-million dollar facilities will provide the City with the latest technologies to control and regulate the discharge of untreated water into the River.



Innovations

The Canal Bridge used a high-performance, self-curing Hydrocure concrete on a standard rigid-frame bridge structure. This new experimental formulation, first ever used in Canada and developed by Dr. Daniel Cusson, Senior Research Officer at the National Research Council's Institute for Research in Construction, this high-performance concrete is designed to minimize shrinkage while maintaining all of its structural properties. It is also designed to be less prone to cracking. Since fewer cracks mean less chloride from road salt seeping into the concrete and corroding the reinforcing steel, this new product could also potentially increase the lifespan of concrete bridges by up to 20 years when compared to standard high-strength concrete formulations and by more than 40 years when compared to conventional strength concrete.

Hydrocure concrete's formulation uses a lightweight porous shale aggregate that can hold up to 20-percent of its own water weight, essentially curing the concrete from within. The product's formulation manages to minimize shrinkage which is a typical problem with standard high-strength concrete – while also reducing cracking and the subsequent damage and corrosion of the bridge's substructure at a cost roughly five percent higher than standard high strength concrete. A characteristic of this concrete is that it flows much more freely than normal concrete.

Interesting to note, the bridge is wired with temperature and strain gauges so that the National Research Council can monitor the performance.



Social and/or Economic Benefits

For over 40 years, the character of Cornwall has been defined by the North Channel Bridge and its approach spans. This structure has overshadowed the adjacent residential neighbourhood and created an edge to the heavy industrial site west of the bridge. The new bridge will impact the owners, users and communities in numerous ways. The primary benefits of the new bridge construction helped eliminate the higher than necessary structure that imposes the adjacent neighbourhood, thus created opportunities for neighbourhood renewal and redevelopment. The construction was completed without significant impact on the existing bridge and surrounding roadway traffic.

As a benefit to all stakeholders the new bridge will lower user risk due to the substantially shorter length of bridge, wider vehicle lanes and less rise in roadway elevation during crossing of the St. Lawrence North Channel.

The new bridge will impact neighbourhoods, in terms of bridge clearing operations, noise, shadows and maintenance. It has a greater direct accessibility to downtown Cornwall and central areas by international bridge traffic. There is a better, more user friendly access to Cornwall Island by all modes of transportation and for pedestrians.

With the successful completion of this bridge it will provide an important transportation link for the City of Cornwall and Akwesasne that is good for the environment and will support future growth for both communities.



Additional Photos







MORRISON HERSHFIELD