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BUILDING BRIDGES



The Sir Ambrose Shea lift bridge replacement is one of dozens of bridge projects on “The Rock”

By Heather Hudson

To everything there is a season, including bridges. Many of the province of Newfoundland and Labrador's 1,134 bridge and culvert structures are at the end of their service life, having aged upwards of 50 years in some cases.

As a result, Newfoundland is in the midst of an infrastructure makeover.

The province's 2013 budget allotted \$866 million on infrastructure projects, including more than \$32 million on bridge repair, rehabilitation and replacements.

“Not unlike the rest of the country, we face the challenge of aging infrastructure,” said Department of Transportation and Works Minister Nick McGrath. “Through investments such as these, we will ensure that the bridge infrastructure is maintained at an acceptable standard in terms of safety and comfort for the people who use them.”

In the past four years, the province has awarded contracts valued at \$107 million for bridge replacement and rehabilitation projects.

Eighteen bridge repair and replacement projects are being tendered in 2013-14, but none are more extensive than the \$40.6-million contract to replace the Sir Ambrose Shea lift bridge in Placentia, N.F. The project also received \$8 million in federal funding.

The project combines the expertise and labour of designers and pile drivers from across the country.

Designed by engineering, planning, management and technology firm Delcan, the construction was awarded to H.J. O'Connell Construction Ltd., which is completing the project jointly with Vancouver Pile Driving Ltd.

Work began in May 2013 and is expected to be complete in the spring of 2016.

“I grew up in this area and they don't call it the Rock for nothing. However, on this site, the Department of Transportation and Works drilled down 70 metres and the soil got looser with depth, so driving the piles upwards of 20 to 30 metres worked.”

– Clancy Lannon, Project Manager, Vancouver Pile Ltd.





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PHOTO BY PHOTOS.COM



COURTESY OF CANADIAN CONSULTING ENGINEER

Artist's rendition of the new lift bridge in Placentia, N.F.

A bridge well travelled

The Sir Ambrose Shea lift bridge is the only one of its kind in Newfoundland and Labrador. A well-travelled thoroughfare, it connects the amalgamated town of Placentia, which is comprised of the communities of Placentia, Jerseyside, Freshwater and Dunville. The bridge is raised for vessels approximately 2,500 times a year, mostly to allow commercial fishing vessels to enter the sheltered harbour and dock.

It was built in 1961 to replace a ferry service and had an anticipated 45-year life span. According to Delcan senior structural engineer Jack Ajrab, who worked on the design of the new bridge, the original three-span has held up well, but 50 years of harsh conditions have taken a toll.

“It reached the point where maintaining it would cost as much as replacing it. In the 1950s and '60s, bridges were

designed for a lifespan of 50 years. Today, we design for 75 or 100 years, so we're looking at more durability.”

When designing the replacement, Delcan considered the basic functionality of the bridge. The three-span, steel girder bridge featured two towers, each with a visible machine room that housed all mechanical and electrical equipment at full height. Four counterweights in each of the towers were activated using mechanical components to lift the bridge when the counter weights went down. The basic mechanics and overall look of the new bridge will remain the same.

“The new bridge is functionally similar to the original, in that the centre span lifts vertically. However, the new bridge shape with the four-tower design terminating with tubular member resembles the masts of the fishing boats, which will blend into the local fishing community,” said Ajrab.

The superstructure's tubular design is also expected to be easier to maintain, more durable and, with a good coating, will be impervious to rust for many years.

Construction

Once the design was finalized, crews from a joint venture between H.J. O'Connell Ltd. and Vancouver Pile Driving Ltd. went to work mobilizing the site and demolishing existing boat buildings and houses. Two temporary trestles – one north, one south – were erected to access the centre piers and allow workers to maneuver a 150-ton crane to do the piling, concrete work and install the structural steel.

The piling component is a huge part of the job and, with semidiurnal tides (two highs and two lows at the same height every day) to work around, it's not without its challenges.

“The tide goes out at a rate of up to eight knots, stays slack for about 30 minutes and then comes back at eight knots,” explained Clancy Lannon, project manager for Vancouver Pile Ltd.

“We do certain things on the slack tide, like placing riprap when the tide stops going out and before it comes in. And we stage work, such as sheet pile installation around the tides. When the tide is going out, you work in that direction and vice versa. It’s very challenging, but that’s how marine construction is.”

A bigger – and less anticipated – issue has been high winds. The construction is crane-dependent for virtually everything done on the site.

“We have to boom down if winds are above 70 kph, which has happened quite a few times,” said Lannon. “In fact, this has been one of the worst winters for wind in memory.”

The abutments and piers are founded on pipe piles driven to a depth of about 30 metres. Lannon explains the process:

“Steel sheet pile cofferdams are installed at each location. Pipe piles are driven inside the cofferdam to the design depth. We then place concrete under water using the tremie method. The thickness of the tremied concrete seal varies from 3.9 metres on the South Pier to 6.9 metres on the North Pier. Then the cofferdams are dewatered, pilings are cut off and filled with concrete, the footing is poured and the bridge shafts installed, at which point it’s ready for structural steel.”

In the tender, Delcan offered two design choices when it came to driving piles: a shallow foundation system with massive concrete footing on the ocean floor, which would include excavation and putting piers on competent soils, or driving piles to reach the competent layer and getting supported there.



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PROJECT SPOTLIGHT



COURTESY OF H.J. O'CONNELL-VANCOUVER PILE DRIVING JOINT VENTURE

December 4, 2013 – Splicing 12.75-inch pipe piles on the welding bed

Lannon says there was no question that the latter option would be more practical and economically feasible despite the soil that featured less than ideal piling conditions.

“I grew up in this area and they don’t call it the Rock for nothing. However, on this site, the Department of Transportation and Works drilled down 70 metres and the soil got looser with depth, so driving the piles upwards of 20 to 30 metres worked. Pile driving analysis is done on selected piles to make sure they have the capacity to support the design loads.”

Another Delcan design choice concerned the structure: a conventional steel girder design or concrete precast boxes beside girders. Lannon says that one came down to a commercial decision: the steel girder design was considerably cheaper to build.

On task

With a crew of about 15 working on the piling, as of February 2014 the south abutment cofferdam and piles were in place and the south pier and abutment was expected to be complete before spring. The north side construction is under way.

Once the civil work is complete in the spring, the structural steel will be put into place and the mechanical and electrical portions of the bridge will begin. A concrete control house will also be erected for bridge operators to use in daily operations.

“The landscape will look much like it is right now. There will be some scour protection in place around the abutments and the north side will have a steel sheet pile sea wall replacing the wooden crib wall, but otherwise there won’t be much difference. However, I think the new bridge will be more aesthetically pleasing.”

Lannon says the new bridge will be complete in 2015 and the old bridge tear down will be finished in 2016.

With multiple other bridge projects happening across the province, one thing is for sure: getting around is going to be a lot smoother in the years ahead. ☺

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