

PRESTO *change-o*

A BUSY HIGHWAY BRIDGE GETS AN ALMOST-INSTANT OVERHAUL

BY SHARON ASCHAIK



Left, the new west abutment wall. A detail pattern was added to the concrete in addition to a pigmented concrete sealer. Above, the new westbound bridge is transported from the staging area to its final location in the early morning hours of Sunday, August 12, 2007.

Last summer, a bridge on Ottawa's Highway 417 was replaced literally overnight. The cutting-edge construction technique used saved two years' worth of lane closures.

It was like engineering on steroids: a bridge-replacement project that, through progressive thinking, many months of meticulous planning and preparation, and state-of-the-art technology, took just 15 hours to complete—and made Canadian history in the process.

It all took place on a warm summer day last August, when technology never before used on a major provincial highway in Canada was employed to swap the aging Highway 417 (Queensway) Island Park Bridge in Ottawa with a new one in record-breaking time—a process that under normal circumstances would have taken about two years to complete.

“It saved money and inconvenience to the public, and opened our eyes to new and innovative ways of doing things,” says Frank Vanderlaan, P.Eng., senior project engineer with the provincial Ministry of Transportation (MTO), who supervised the project’s design process.

Rapid replacement

The innovative approach to which Vanderlaan is referring is Rapid Replacement Technology, or RRT, a cutting-edge construction staging technique that uses powerful, highly manoeuvrable heavy-lift equipment to lift an existing bridge, move it out of the way, and replace it with a previously built new one—all within hours.

Highway 417 is Ottawa’s main east-west provincial corridor, accommodating about 150,000 drivers a day. RRT’s hyper-efficient capabilities saved the ministry an estimated \$2.4 million, and spared Ottawa-area commuters from dealing with years of prolonged delays, detours and excessive exhaust from vehicles idling in a construction zone.

Winning the contract

As six of the highway’s late-1950s-era bridges were approaching the end of their 50-year lifespans, MTO began investigating ways to rehabilitate them, starting with the Island Park Bridge.

In 2005, it issued a request for proposals (RFPs) specifying that RRT be used to complete the project during one overnight highway closure, with the intention of minimizing inconvenience to drivers, environmental impact and cost through the time-saving approach.

Used for several years in Europe and the US, RRT is new to the Canadian scene. With that in mind, McCormick Rankin Corporation (MRC), the consultant of three companies to make the RFP shortlist, hired Mammoet, a Dutch engineering company with significant experience with the high-tech technique, to provide expertise during design, work out the logistical details, and help facilitate the project.

“This was the first time we would be moving bridges with RRT, so we hired

bridge replacement design project.

As part of MRC’s proposal, Mammoet representatives explained to Vanderlaan and his colleagues how the RRT methodology worked, and supplied examples of RRT projects they had completed. Ministry staff also travelled to Philadelphia and Florida to witness first-hand other bridges being replaced using the heavy-lift technology.

In February 2007, after months of finalizing the design and completing a risk-management assessment on all the oper-

Watching the SPMT lift and carry 650-tonne bridges was a spectacular sight, reflecting the outer limits of engineering and heavy-lift technology.



The bearing plates that the girders will rest on are in place. The plates have been placed at the appropriate elevation.

Ottawa-Orléans MPP Phil McNeely, P.Eng. (left), helps officially open the new bridge along with Minister of Natural Resources Donna Cansfield, James Wildish of Dufferin Construction (second from right) and former MPP Richard Patten.

ations associated with the work, Dufferin Construction Company won the MTO contract to construct and replace the bridge, with Mammoet as their heavy-lift subcontractor.

The logistics

Mammoet as a subcontractor to advise us on what was feasible and what wasn’t, and to confirm this could be done,” says Michel Vachon, P.Eng., who leads MRC’s structures group in Ottawa and led the

Now came all the site preparation work that would make it possible to seamlessly switch the bridges overnight. The RRT process called for two new diamond-shaped decks to be built in an enclosed area adja-

cent to the eastbound and westbound sections to be replaced before being moved to their final location.

While there was enough space in nearby Hampton Park to build the new bridges, much planning was required to work out how to get the equipment and materials there and how to begin building in a space not meant for such work.

Then, of course, it had to be ensured the bridges were built to the right specifications. Adding an extra challenge was the fact the decks were built on special structures of a very specific height, so they could be easily lifted by the self-propelled modular transporters (SPMT) that would carry them to the highway. A relatively new bridge span replacement tool, an SPMT is a platform vehicle with multiple axles and wheels that transports massive objects that are too big or heavy for trucks.

“There were a lot of geometric requirements that had to be respected. It took



are visible as the westbound bridge is moved into position. elevations to ensure the correct positioning of the new bridge.

about four months to build the two replacement bridges,” Vachon says.

Media and public event

At 8 p.m. on Friday, August 10, 2007, about 100 workers were on hand to begin the rapid replacement—some part of Dufferin Construction, which had the main contract for the job, and some part of Mammoet, which supplied and operated the SPMT using a control box-mounted joystick. Also on site that night were MTO personnel, including Vanderlaan

and Vachon and his MRC colleagues, to watch their plans actualize and to troubleshoot if necessary.

Also on hand were about 1000 members of the public, their curiosity sparked by extensive media coverage, who showed up to witness the groundbreaking process unfold from nearby bleachers MTO had set up. Even into the wee hours of the night, hundreds of people stayed to watch. As well, Rogers was on hand to broadcast portions of the event live, and MTO had set up a live webcam to cover it.

“We thought it would be a great story for the public, and believed the public would embrace this as something worthwhile to witness,” Vanderlaan says. “With most construction projects, people sit in traffic being delayed. In this case, it was satisfying for everybody involved.”

Indeed, watching the SPMT lift and carry 650-tonne bridges was a spectacular sight, reflecting the outer limits of engineering and heavy-lift technology.

Even more amazing was the fact that, given the complexity of the \$8.6 million project and that it was the first time the technology had been used in Canada for this purpose, the whole thing took place with almost no glitches. Only a small problem with a hydraulic hose, and asphalt that didn't cool quickly enough due to the extreme heat that day, delayed things slightly.

Minimal disruption

But perhaps most significant is all the financial and traffic hassles this highly successful engineering endeavour saved local residents and MTO. Vachon and Vanderlaan agree that the \$2.4 million cost savings estimate would be much higher if it included the societal costs of user delays.

“When calculating the cost of people sitting in traffic being delayed for extended periods of time, it's generally accepted that those values run into mul-

triple millions of dollars. When you consider that, this was a huge money saver,” Vanderlaan says.

Way of the future

The new Island Park overpass won't need any more tinkering any time soon, as it's designed to last 75 years. But because of its tremendously successful replacement, other Highway 417 bridges will soon get the overnight RRT treatment, including at Clyde Avenue this coming August—which MRC also designed—and at Carling Avenue and Kirkwood Avenue in 2010.

The way Vachon sees it, RRT is the way of the future. There are about 2800 bridges under provincial jurisdiction in Ontario, and their average age is 37 years. MRC also expects that other Canadian governments and companies will see the value of this tool for bridge replacements and other similar projects.

“I'm sure others are looking at RRT and saying if we use this, we can save the public a lot of grief and get things done more quickly,” Vachon says. “In this day and age, especially in densely populated urban areas, this technology has real merit, so it won't be the last time it's used.”

Phil McNeely, P.Eng., MPP for Ottawa-Orléans, parliamentary assistant to the minister of public infrastructure renewal, and actively involved in provincial transportation issues, was among the observers of the bridge replacement—and quite impressed with what he saw.

“This is great technology that I'd never heard of before, and it was wonderful to watch and to realize that this was going to save several million dollars and save all that inconvenience to the public,” McNeely says. “The ministry showed some very advanced thinking in grabbing this technology, and it demonstrates the innovation that can happen in engineering.”

VISIT

www.canada.com/ottawacitizen/features/bridge/index.html

for an animation of the bridge replacement, and videos that feature Frank Vanderlaan describing the process.

