

# Portage Bridge 2010 Structure Rehabilitation

By Kevin Robertson

**T**he Portage Bridge is a busy six-lane inter-provincial road crossing the Ottawa River, joining downtown Ottawa, ON, Canada, to Gatineau, QC, Canada. Built by the National Capital Commission (NCC) and opened in 1973, it is now a crucial passageway for many commuters between the two provinces. The bridge consists of six traffic lanes, two bicycle lanes, and a pedestrian walkway.

Genivar, a leading Canadian consulting services firm, was hired to determine the extent of the damage the bridge experienced from years of exposure to deicing salts and freezing-and-thawing cycles and design a method of repairing and restoring the structure. Minor repairs were completed in the past from below the bridge, as the bridge is too busy to shut down.

The project was released for tender in May 2010 and awarded in June 2010 to David S. Laflamme Construction, a contractor in the greater Ottawa area who has many years of experience in bridge rehabilitation.

The original specifications called for pressure grouting the small patches from below, but as the removal process began, it became evident that

the extent of the deteriorated concrete was much larger than previously anticipated. Through discussions between personnel from Genivar, David S. Laflamme Construction, and King Packaged Materials Company, it was determined that improved compatibility between the parent concrete and the repair material could be achieved if concrete was placed in the repaired areas as opposed to pressure grouting.

After examining the site conditions, logistics, and allowable time frame, it was determined that the best option for placing the replacement concrete was through the shotcrete process. All work had to be completed from below the bridge, using special platforms built between the steel girders. The platform allowed the shotcrete and chipping crews to access the damaged areas and prevented concrete debris and shotcrete rebound from entering the river flowing below. Time constraints due to eventual cold weather concerns meant that the crews had only a few months to complete the work. The shotcrete work was subcontracted to Coaster Concrete of Gatineau, QC, Canada, who employed ACI Certified Nozzlemen to complete the shotcrete work.



*Portage Bridge (Ottawa, ON, Canada, to Gatineau, QC, Canada)*

The flexibility of the shotcrete process offered a number of other advantages over traditional form-and-pump applications. Coaster Concrete crews were able to set up the shotcrete machine on either approach to the bridge, which allowed the material to be conveyed over long distances (up to 400 ft [122 m]) to the nozzleman below. The accelerated set times and rapid strength gain offered by King Packaged Materials' MS-D1 Accelerated Shotcrete allowed NCC to keep the bridge open even during the shooting process and allowed the contractors to accelerate their production schedule.

Other key properties offered by the shotcrete mixture included:

1. Air entrainment, which ensured improved salt-scaling resistance and resistance to freezing-and-thawing cycling; and
2. Silica fume, which reduced permeability values and provided further protection against future corrosion of the reinforcing steel.

The repair process started with the removal of any unsound concrete using pneumatic hammers. A minimum of 1 in. (25 mm) of space was left behind the reinforcement steel to ensure full encapsulation and provide sufficient mechanical

bond. The perimeters of all repair areas were saw cut to eliminate any feather edges.

The area to be repaired totaled approximately 9730 ft<sup>2</sup> (904 m<sup>2</sup>) and, with an average thickness of 4.75 in. (120 mm), required approximately 410 bags weighing 2200 lb (1000 kg) each of preblended shotcrete mixture. Steel reinforcing anchors were placed at 24 in. (600 mm) center-to-center each way. Any significantly deteriorated reinforcing steel was removed and replaced. A mat of 4 x 4 W2.9/2.9 (102 x 102 MW18.7/18.7) galvanized wire mesh was installed before any shotcrete was applied.

An offroad telescoping boom forklift was used to lift the bags over the hopper of the shotcrete machine and provide a continuous feed of material to the nozzleman, who had only 6 ft (1.8 m) of head room when shooting. The nozzleman designed a small movable chair that could be rolled into position, providing a distance of 3 to 5 ft (0.9 to 1.5 m) from the end of the nozzle to the concrete surface. A standard gun finish was accepted because the area under the bridge was not accessible to foot or vehicular traffic.



*Shotcrete encapsulating the reinforcing bar*



*Core testing for bond and compressive strength was taken from these locations*



*Underside of deck ready for shotcrete placement*



*Equipment setup. Bulk bags were used*

This shotcrete project is the first of its kind in the Ottawa market on a major concrete infrastructure. With the great success of shotcrete on this project, there should be many more opportunities for shotcrete to come.

## 2011 Outstanding Infrastructure Project

### *Project Name*

Portage Bridge 2010 Structure Rehabilitation

### *Project Location*

Ottawa, ON, Canada

### *Shotcrete Contractor*

Coaster Concrete

### *General Contractor*

David S. Laflamme Construction

### *Architects/Engineers*

Genivar and National Capital Commission

### *Material Supplier/Manufacturer*

King Packaged Materials Company\*

### *Project Owner*

Ministry of Transportation Ontario

\*Corporate Member of the

American Shotcrete Association



*Nozzleman in cramped quarters*



**Kevin Robertson** is a Technical Representative for King Packaged Materials Company, Boisbriand, QC, Canada. His areas of expertise include shotcrete materials, application, and equipment, focused mainly on concrete rehabilitation applications. Robertson is a member of ASA, the American Concrete Institute (ACI), and is on the Board of Directors of the Quebec Province Chapter of the International Concrete Repair Institute (ICRI).