2005 Outstanding Repair and Rehabilitation Project:

Pointe de la Prairie Lighthouse

by Patrick Giroux and Simon Reny

The Pointe de la Prairie Lighthouse is located on the north shore of the Île-aux-Coudres Island across from Baie-St.-Paul in the St. Lawrence River. Since its construction in 1972, the lighthouse has been exposed to extremely severe environmental conditions. Exposure to salt water, continuous freezing-and-thawing cycles, and impact from ice flows, have contributed over the years to severe deterioration of the concrete that makes up the base of the lighthouse. A 1/4 in. (6 mm) thick steel plate surrounding the concrete base was designed to provide added protection against impact from ice flows. In several areas, these plates were completely destroyed. The extent of the concrete deterioration behind these plates was so severe that in some areas it reached nearly 3 ft (915 mm) in depth.

Pointe de la Prairie Lighthouse before reconstruction

Nozzelmen shooting the base of the lighthouse

In the summer of 2004, Public Works and Government Services Canada elected to tender a project to conduct a much needed, major rehabilitation of the lighthouse. The consulting engineers at BPR Inc. recognized the need to come up with a system that would meet the challenges associated with the difficult access while providing protection against the severe environmental conditions.

Working with engineers from King Packaged Materials Company, BPR Inc. specified a dry-mix shotcrete mixture containing silica fume, steel fibers, a granite-based coarse aggregate, air-entraining admixture, and a set accelerator. The air-entraining admixture was specified to provide improved durability, the steel fiber and granite stone were incorporated to provide resistance to impact and abrasion from ice, and the set accelerator and the silica fume were specified to reduce the risk of wash-out created by the rapidly moving tides and waves. The new structural design of the base of the lighthouse did not include the use of steel plate to guard against impact and abrasion damage. It was agreed that this protection would be offered by the impact and abrasion-resistance properties of the shotcrete.

In July of 2004, Public Works and Government Services Canada awarded the contract to complete the rehabilitation of the lighthouse to Yves Germaine Construction of Québec City, QC, Canada, and the shotcrete portion of the contract was sub-contracted to Cimota Inc., also of Quebec City. Cimota elected to have the preblended shotcrete mixture supplied in 2200 lb (1000 kg) reusable bulk bags and worked with personnel from Yves Germain Construction to schedule the shipment of the material to the work site by barge. As in all dry-mix shotcrete applications, potable water was added at the nozzle. Cimota Inc. elected to use a hydromix nozzle to predampen the dried shotcrete material.

Before beginning the shotcrete portion of the project, test panels were shot and mechanically

finished to provide a representative sample of the finished product. The panels were left on site for 24 hours, after which time cores were taken to evaluate the compressive strength and quality of the shotcrete placement.

The concrete base of the lighthouse was divided into 14 triangular sections, each separated by a vertical construction joint. Each section was shot from the bottom of the section (at the base of the lighthouse) to the top to maximize the amount of material that could be applied before the action of the rising tides threatened to wash out the applied shotcrete. As the tide retreated, cleaning and preparation work was completed on the next section and the next shooting session began.

To ensure the project would be finished in time to meet the fall 2004 deadline, Cimota Inc. elected to use two Aliva AL 246 shotcrete machines, supplied by King Packaged Materials' Minequip division. Cimota Inc. also used two ACI certified nozzelmen. This challenging shotcrete rehabilitation project was successfully completed on time despite the difficult weather conditions that constantly

Shotcrete was supplied in 1000 kg (2200 lb) reusable, bulk tote bags

Pointe de la Prairie Lighthouse

Outstanding Shotcrete Project Award Winner

Test panels were shot to evaluate the competence of the nozzlemen and to confirm hardened properties of the mixture

Completed shotcrete application at low tide

disrupted shooting schedules. The skill of the Cimota Inc. certified nozzelmen and the quality of the specially designed King shotcrete mixture were evident by the overall quality of the completed project. After 2 years, the performance of the shotcrete has met all expectations and Public Works and Government Services Canada has expressed complete satisfaction with the performance of the product and the installation.

Outstanding Repair & Rehabilitation Project

Project Name
Rehabilitation of the Pointe de la Prairie Lighthouse

Project Location
L'Ile-aux-Coudres, QC, Canada

Shotcrete Contractor
Cimota Inc.

General Contractor
Yves Germain Construction

Project Owner
Canadian Coast Guard

Architect/Engineer
BPR Inc.

Material Supplier
King Packaged Materials Company

Patrick Giroux *is the General Manager for Cimota Inc., a Quebec-based contractor specializing in shotcrete and concrete repair. He is a graduate civil engineer from Sherbrooke University, Sherbrooke, QC, Canada. He received his master's degree in civil engineering with an emphasis on cement and concrete technology and shotcrete repairs at Laval University, Québec City, QC, Canada.*

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