

2025 Outstanding Rehabilitation & Repair Project

From Legacy to Longevity

THE ABITIBI CANYON DAM REHABILITATION PROJECT

By Eve-Lyne Sylvestre, André Corbin, and François Gagnon

PROJECT BACKGROUND

The rehabilitation of the Abitibi Canyon Dam marks a defining moment in the renewal of Canada's hydroelectric infrastructure. Constructed between 1930 and 1936, the 150 ft (46 m) high structure continues to deliver 349 MW of clean energy to Ontario, standing not only as one of the province's tallest dams but also as a lasting testament to early 20th-century engineering excellence. Located within the traditional territories of the Cree and Anishinaabe communities, the project carries profound cultural significance, underscoring the shared responsibility of ensuring sustainable development for future generations.

The dam owner's decision to rehabilitate the downstream west gravity bulkhead face was far more than a standard maintenance initiative; it also extended the service life of the dam's downstream concrete walls. These structures exhibited progressive surface scaling, spalling, cracking, staining, and delamination (Fig. 1). The repair surface presented a complex challenge due to restricted access and varying angles. The rehabilitation was performed using dry-mix shotcrete over the summer of 2025.

WHY DRY-MIX SHOTCRETE?

Conventional concrete repair methods would have required extensive formwork (significantly raising cost) and logistical complexity, stretching the schedule. In addition, the remote location in northeastern Ontario placed the nearest

concrete plant over 93 mi (150 km) away. To overcome these constraints, the project team from Peter Kiewit Sons ULC proposed an innovative alternative: Dry-mix shotcrete. This strategic shift enhanced feasibility, eliminated the need for mobilizing a batch plant for a relatively small volume of concrete, accelerated project delivery, and reduced costs, all while ensuring completion before winter. The dry-mix shotcrete approach also delivered unmatched flexibility, allowing 'stop and go' operations without material loss or cold joint issues — an invaluable advantage in a remote, weather dependent environment. Moreover, it was ideally suited to the site's access constraints, space limitations, and varying surface angles.

SCOPE OF WORK AND COLLABORATION

The rehabilitated portion of the downstream west gravity bulkhead face measured approximately 82 ft (25 m) high and 165 ft (50 m) wide. The area included slopes of 9:12 and 6:12, a vertical face, and an overhead section with a cantilever (not shown in the layout) that required thick multilayer placement (Fig. 2). The surface preparation commenced with removal of all damaged concrete, followed by erection of a scaffold system adaptable to changing surface angles (Fig. 3). FlexoDrain systems were installed on the surface prior to shotcrete placement to manage water infiltration under the future surface. Over 8000 dowels were drilled and fixed with epoxy resin, and wire mesh was affixed to lie 4 in. (100 mm) beneath the target finished surface (Fig. 4). After these steps, quality trials were executed to qualify the shotcrete mixture, shotcreters, equipment, and validate the finished surface with the client (Fig. 5).

At the heart of the project was exemplary collaboration among all parties. Kiewit led project coordination and alignment across disciplines from site preparation through completion. SWATcrete directed the technical execution, introduced customized equipment to boost productivity, and engaged trusted partners to optimize the three key factors affecting shotcrete quality: Shotcreters, concrete materials, and equipment. SWATcrete engaged L. Fournier & Fils Inc. to supply a robust dry concrete mixture in 4850 lb (2200 kg) bulk bags, MAH Béton Projeté to deliver skilled labor for precision placement, and EVO Matériaux to provide quality control, technical support, and consistency across every project phase.

Project specifications were drafted by Atkinsréalis in accordance with ACI 506.2 and CSA A23.1 24. The mixture



Fig. 1: Downstream face of the dam prior to rehabilitation, showing the scale of deterioration and the challenge of preserving one of Ontario's tallest hydroelectric landmarks

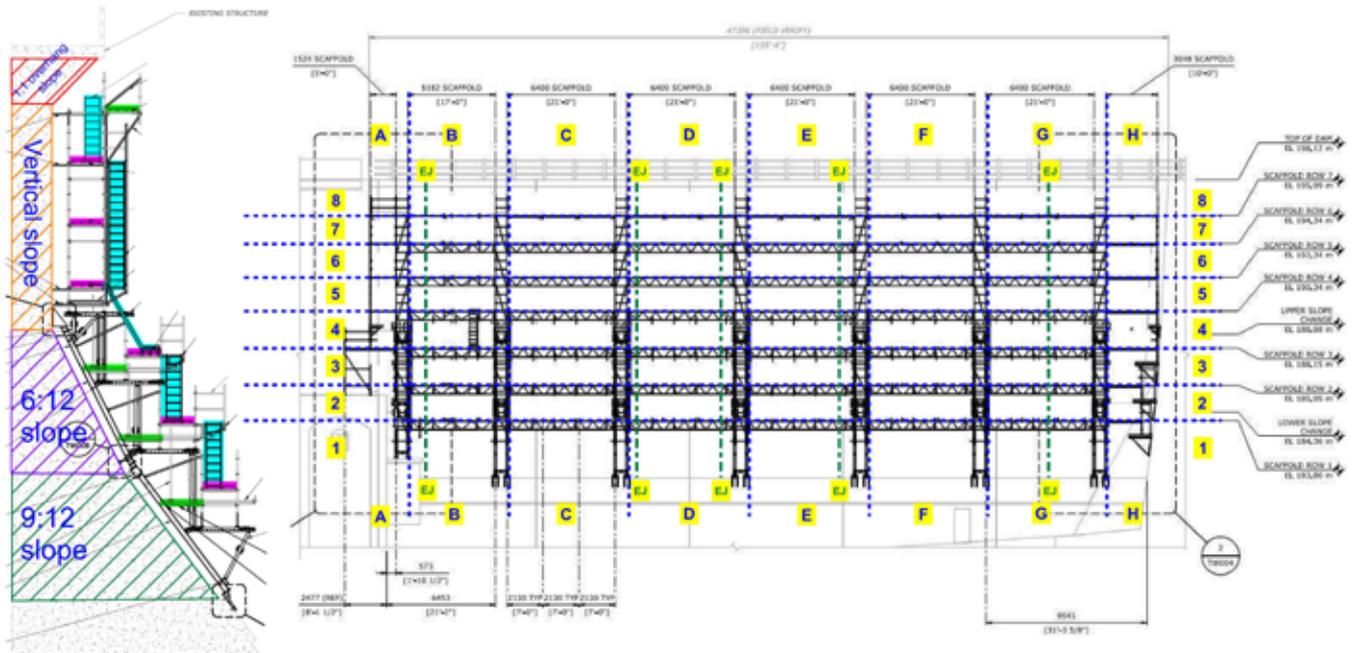


Fig. 2: Dam Grid Division — An elevation view of a scaffold system covering multiple dam slopes, emphasizing scope and complexity of access planning



Fig. 3: Full scaffold system in place, adaptable to the surface varying angles, designed to provide safe access and precise working platforms for shotcrete placement



Fig. 4: Dowels and wire mesh installation in preparation for shotcrete placement

was required to achieve a minimum 28-day compressive strength of 4400 psi (30 MPa), an air void system of $\leq 300 \mu\text{m}$ (ASTM C457), and a minimum air content of 3% to ensure freeze-thaw resistance. Synthetic microfibers were also added to minimize plastic shrinkage cracking.

Approximately 312 bulk bags were used for the project. In total, 315 yd³ (240 m³) of concrete were shotcreted and finished, excluding rebound, finishing cuts, and daily test panels. Thicknesses ranged from 8 to 20 in. (200 to 500 mm) in multilayer application across a surface area exceeding 10,000 ft² (930 m²). The surface was finished with wood trowels to preserve the air void system and maintain freeze-thaw durability. A chemical cure was subsequently applied to the finished surface.



Fig. 5: Trial setup with varied shooting angles to optimize technique and validate dry-mix adaptability before full application



Fig. 6: Loading the customized Aliva 252 dry-mix gun with bulk bags at dam crest, enabling efficient placement and high productivity in a complex environment



Fig. 7: Right section fully shot, leveled, and finished; left section awaiting final layer — showcases controlled, step-by-step methodology

TECHNICAL CHALLENGES AND EXECUTION STRATEGIES

To maximize production rate, an Aliva 252 dry-mix gun — with customized addons by SWATcrete — was deployed. The gun featured a hopper tailored to receive the dry concrete material from the bulk bags without chutes. There was also an internal knife system that opened the bulk bags automatically with only a telehandler required. The installation was protected from rain and wind by a structure erected over the dry-mix gun (Fig. 6).

The concrete mixture provided by L. Fournier & Fils Inc. was the 1220-5160 HQ Series. A non-accelerated formulation was deliberately chosen to allow consistent surface finishing before the initial set, which occurred approximately three hours after application (Fig. 7). To offset the absence of an accelerator and ensure strong adhesion, the shotcrete was applied in multilayer passes, particularly in overhead sections where the thickness of a layer remained between 2 and 4 in. (50 to 100 mm). Piano wires were installed to align with previously finished areas, serving as guides to accurately trim excess material prior to final surface finishing. While water curing using geotextiles would have offered optimal crack prevention, it was impractical on the vertical, inclined, and overhead surfaces with limited access; thus a spray-on curing membrane was selected as the pragmatic and efficient solution.

Protecting adjacent structures from rebound and overspray posed a major challenge. Without adequate protection, cleanup — particularly of wire mesh — would have been labor-intensive and time consuming, as residual shotcrete material could hinder proper encapsulation (Fig. 8). Protection and cleanup of each section were integrated efficiently in the daily coordination.

Precise sequencing and coordination of all teams were



Fig. 8: Image illustrates restricted scaffold access during placement, finished surface protection, and second layer application



Fig. 9: Shotcreter operating from manlift on cantilever section, supported by scaffold crews preparing, cleaning, and removing protections below — demonstrates teamwork and coordinated trades

essential to synchronize each stage (Figs. 9 & 10). This project was a demanding undertaking that required creative solutions, technical mastery, and close collaboration. Beyond individual achievements, the partnership thrived on clear communication, adaptability, and a unified commitment to excellence. Challenges were met as one team; lessons were applied in real time, and incremental innovations emerged through shared endeavour. The result was not only a technically exemplary rehabilitation but also a model of collaborative success — one that strengthened expertise, forged relationships, and established a new benchmark for complex hydroelectric infrastructure renewal (Figs. 11 & 12).



Fig. 10: Shotcreter operating from manlift on cantilever section, supported by scaffold crews preparing, cleaning, and removing protections below — demonstrates teamwork and coordinated trades (view from another angle)



Fig. 11: Newly restored downstream surface revealed during scaffold removal, highlighting uniform quality and precision in application



Fig. 12: CENTER: Dry-mix shotcrete rehabilitation; LEFT: Conventional concrete rehabilitation; RIGHT: Unrepaired section — clear visual contrast demonstrates the effectiveness of the chosen method

**2025 OUTSTANDING
REHABILITATION & REPAIR PROJECT**

Project:
Abitibi Canyon Z7 Dam Rehabilitation

Project Location:
Abitibi Canyon, ON, Canada

Shotcrete Contractor Company:
SWATcrete*

Architect Company:
Atkins Realis

Engineer Company:
Atkins Realis

Materials Supplier Company:
L. Fournier & Fils Inc*

Equipment Manufacturer Company:
SWATcrete* (Customized Aliva 252)

General Contractor:
PETER KIEWIT SONS ULC

Additional Team Members:
MAH Béton Projeté / Evo Matériaux

Owner:
Ontario Power Generation

*ASA Sustaining Corporate or Corporate Member



Eve-Lyne Sylvestre, Ph.D., is the Director of Quality, Product Innovations, and Environment at L. Fournier & Fils Inc. With 15 years of experience in the industry, she specializes in developing innovative concrete and shotcrete solutions tailored to diverse project needs. Her work focuses on combining technical performance with environmental preservation, supporting both fixed and mobile operations, particularly in northern and remote areas.



André Corbin, Eng. Civil Engineering, began his career at Kiewit working on a hydroelectric project; a field which has remained central to his expertise over 17 years of service. Now a Project Manager, André has led a wide range of infrastructure projects, including several major hydroelectric developments. Aligned with Kiewit's culture of innovation, he is committed to mobilizing top resources and exploring new approaches to deliver high-quality solutions to clients.



François Gagnon has over 35 years of experience in underground mining operations, and brings deep expertise in the application of cement-based products, including dry-mix shotcrete, as well as the logistics and operational complexities these projects involve. His career has been shaped by challenging work in northern, remote, and underground environments, where precision, adaptability, and innovation are key to success.