



Montreal Botanical Garden administration building

Montreal, QC, Canada



Project Information

Project category:
Public Buildings

Subcategories:
Products for Structural Strengthening,
Concrete Restoration Systems

Years of construction:
1932-1936

Years of MAPEI involvement:
2023-2024

MAPEI coordinators:
Hamza Ouziame and Balthazar Basabe

Project owner:
City of Montreal

Architect:
Réal Paul Architecte

Main engineer:
Yvonick Houde (HBGC Ingénieurs)

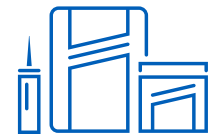
Contractor/installer:
St-Denis Thompson

Photographer:
OBLK Production



Project Overview

When the foundations of the Montreal Botanical Garden's vintage Art Deco administration building needed strengthening, engineers turned to MAPEI for its restoration know-how and its tested fiber-reinforced polymer (FRP) systems to maintain the heritage site.



Products Used

Carboplate® E 170

Epojet™ LV [NA]

Mapefer™ 1K [NA]

MapeWrap® 11

MapeWrap 12

MapeWrap 31

MapeWrap C Uni-Ax System

MapeWrap Primer 1

Planigrout® 712

Planitop® 13



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Preserving and sustaining through technology

The 185-acre (75-hectare) Montreal Botanical Garden presents a remarkably diverse array of plants to visitors in all seasons. Along with pursuing research and public-education activities, the Botanical Garden's mission statement, unchanged since 1931, is to "Conserve, develop and present to the public living plant collections."

Known internationally for the work done to conserve endangered plant species from around the world, the Botanical Garden was designated a National Historic Site of Canada in 2008 and hosts hundreds of thousands of visitors annually.

Not to take away from all the natural beauty, the Depression-era administration building that was designed by architect Lucien F. Kéroack is itself iconic. A prime example of the Art Deco style that was in vogue 90 years ago, the building serves as an invitingly grand entrance to the interior greenhouse complex, which is open year-round.

And to make sure that the administration building remains standing strong on its 27,000 square-foot (2 508-m²) footprint, the City of Montreal embarked on a major restoration project. This project focused first on strengthening the building's concrete foundation, which upon inspection was confirmed to need significant repairs.

Local engineering firm HBCG Ingénieurs was brought in to oversee the work, under main engineer Yvonick

Houde. Together with the main contractor, St-Denis Thompson, which was well acquainted with MAPEI's expertise in concrete restoration and structural strengthening, they were able to confirm that MAPEI's products and know-how met the prescribed specifications.

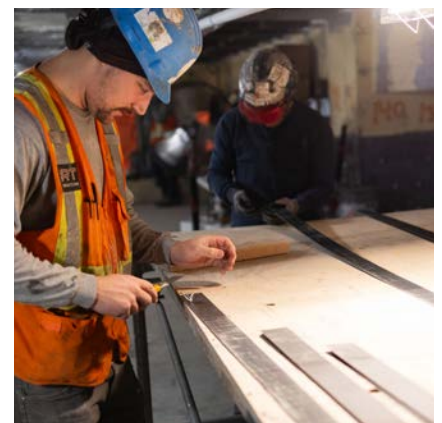
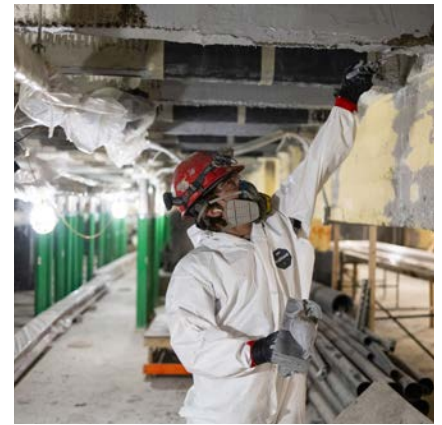
MAPEI on the job

"The aim of the intervention was mainly to reinforce the basement beams and consolidate the piles," said MAPEI engineering and architectural sales representative Hamza Ouziame. Alongside MAPEI sales representative Balthazar Basabe, he served as MAPEI coordinator for the project.

"From the outset, the MAPEI Structural Design software tool proved to be extremely helpful in selecting the right fiber-reinforced polymer [FRP] structural-strengthening systems," Ouziame explained. The proprietary software allowed the team to model the different interventions that were proposed and pinpoint the areas where each system would be needed to provide the best structural support for the overhead beams.

Consolidating the piles

The first order of business entailed reinforcing the administration building's 1,100 footings by casting new 3-1/2" [8.9 cm] wide piles 52 feet (15.8 m) straight down into the ground from the basement's concrete slab.



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The team from St-Denis Thompson consolidated all the piles using the pumpable, single-component **Planigrout 712** cement-based grout, which aside from ensuring excellent compressive strength, also provides superior resistance to water penetration and freeze/thaw cycles. “*Planigrout 712* is perfect for casting such deep piles because it is very fluid,” Ouziame said.

Concrete pre-repair of the beams

Next, the contractors needed to repair concrete and prepare the substrate before adding the strengthening systems. Cracks in areas that were identified by the engineer as needing structural repair were filled with **Epojet LV** [NA] epoxy injection resin. The engineer also assessed that the original rebar of the many beams had suffered corrosion and had to be exposed in places to be treated with a corrosion inhibitor.

Where sandblasting proved insufficient, the team manually chipped the concrete down to expose the corroded rebar. Dating from the 1930s, the rebar proved to be old-fashioned in nature, meaning that it was uncharacteristically smooth and “not ribbed, like we’ve been doing the past 40 years,” Ouziame said.

On the exposed rebar, the team applied **Mapefer 1K** [NA], a corrosion-inhibiting coating for reinforcing steel. Not only did *Mapefer 1K* [NA] meet the technical spec for the job, but since 2023, it has been added to the Zero family of MAPEI products that include a total offsetting of residual CO₂ emissions during each product’s life cycle.

With the rebar’s protective coating in place, the next step was to add **Planitop 13** vertical and overhead repair mortar to make a flat, cementitious substrate for the **Carboplate E 170** and/or FRP system application. “Many of the overhead concrete-beam surfaces

requiring strengthening presented with straight, ridged profiles, undulating at a depth of about 1/2" [12 mm] and doubly wide. The FRP system application requires a flat substrate,” Ouziame said.

“In other areas, they sandblasted, applied *Mapefer 1K* where necessary and then used **MapeWrap 12** [a structural epoxy putty adhesive], impregnated with sand for extra body, to form a suitable substrate for the FRP system,” Ouziame added.

E-wing section needed extra strengthening

The administration building’s E-wing section needed the most extensive intervention. The design engineer, Ouziame and the MAPEI Technical Services team, who were all guided by the MAPEI Structural Design software, determined that *Carboplate E 170* was needed to bolster the undersides of the beams for that wing of the building. *Carboplate E 170* provided extra flexural strengthening in support of the existing rebar, with the **MapeWrap C Uni-Ax** System then applied overtop at 320 strategic locations.

“Basically, *Carboplate E 170* was used for flexural strengthening due to the loss of capacity caused by the cracks, but also the addition of weight on the slab and the removal of the steel structure which had been added for this weight. The *MapeWrap* System was used as a shear-strengthening system around repaired shear cracks,” Houde said. “The cracks in these parts, combined with the lack of reinforcement of this type of construction and the addition of weight, led to [the need for] added shear capacity.”

Carboplate E 170 is a range of pultruded carbon-fiber-reinforced polymer (CFRP) plates that are pre-impregnated in epoxy-based resin and bonded to the substrate to strengthen and stiffen structures. The *MapeWrap C Uni-Ax*



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System is a high-strength carbon fiber fabric (also impregnated with *MapeWrap* epoxy resins) that allows for an increase in the strength of structural elements without increasing the dead load supported by the structure.

“The geometry of the beams was a real challenge because they were irregular, making surface preparation particularly long. In addition, the beams were ribbed with a very thick layer of paint to remove, so they had to sandblast or bush hammer when pipes prevented sandblasting,” Houde said. “It was necessary to move a lot of electro-mechanical pipes for this work, which was a challenge because the building remained in service throughout the work.”

The three other wings needed only the *MapeWrap* FRP system, in just 50 places altogether as confirmed by the modeling done with the MAPEI Structural Design software. The software pinpointed areas where the strengthening systems could be applied most efficiently – saving time, costs and labor while ensuring the systems that were employed were appropriate for all engineering specifications that were required.

When the project was complete, the administration building’s foundation had been restored and strengthened with the benefit of quick and efficient installation techniques, together with easily applied products. MAPEI technology and expertise helped make each intervention cost- and labor-efficient, allowing the world-renowned Montreal Botanical Garden to stay in operation not only during all the repair work, but for many years to come.

MAPEI Inc.

2900 Francis-Hughes Avenue
Laval, Québec H7L 3J5
(450) 662-1212

Technical Services

1-800-361-9309 (Canada)

Customer Services

1-800-42-MAPEI (1-800-426-2734)