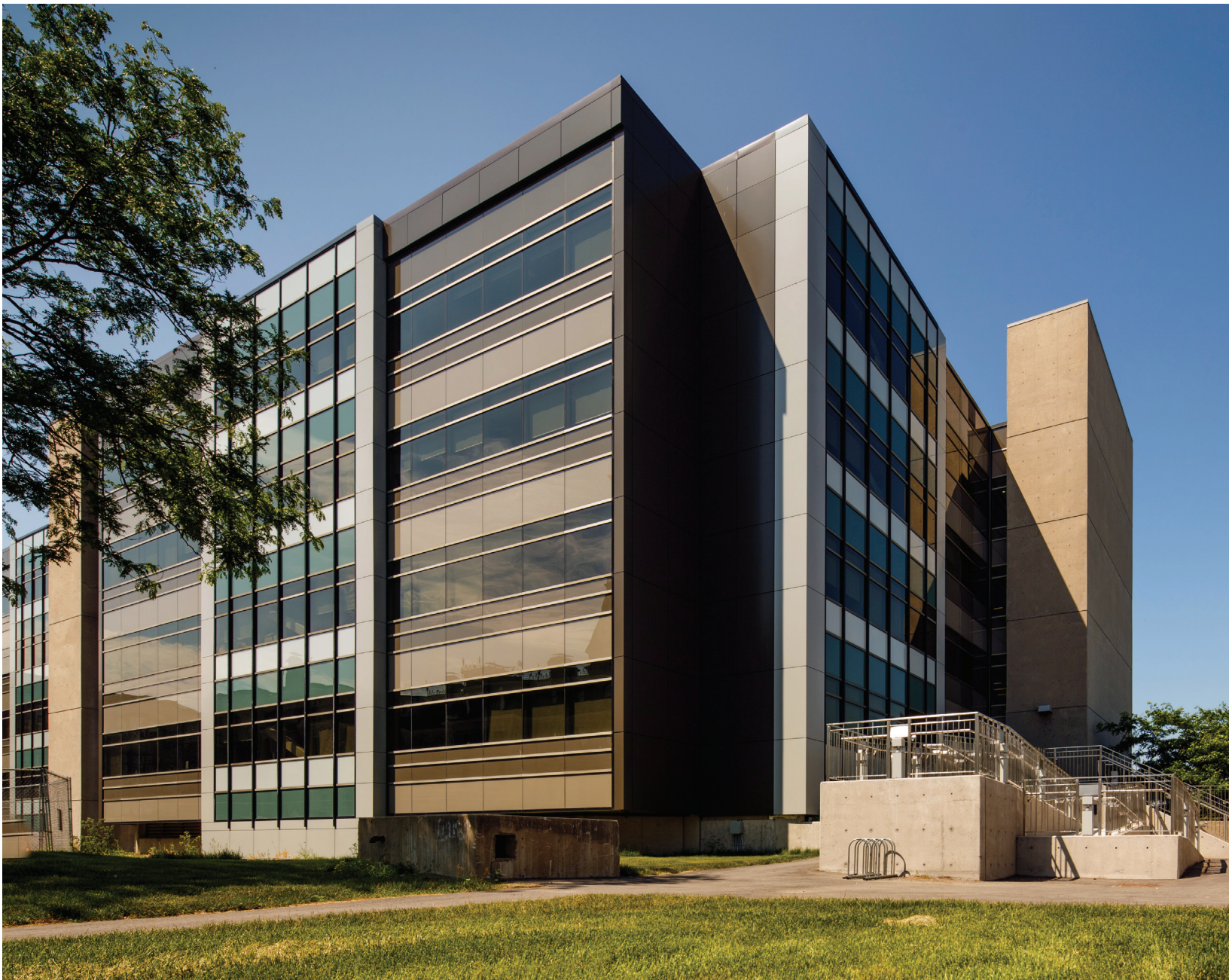
2018

50th Annual Canadian Consulting Engineering Awards

Sawyer and Girouard Buildings Retrofit
Royal Military College of Canada
Kingston, Ontario

J.L.Richards

ENGINEERS · ARCHITECTS · PLANNERS





Sawyer and Girouard Buildings Retrofit Royal Military College of Canada

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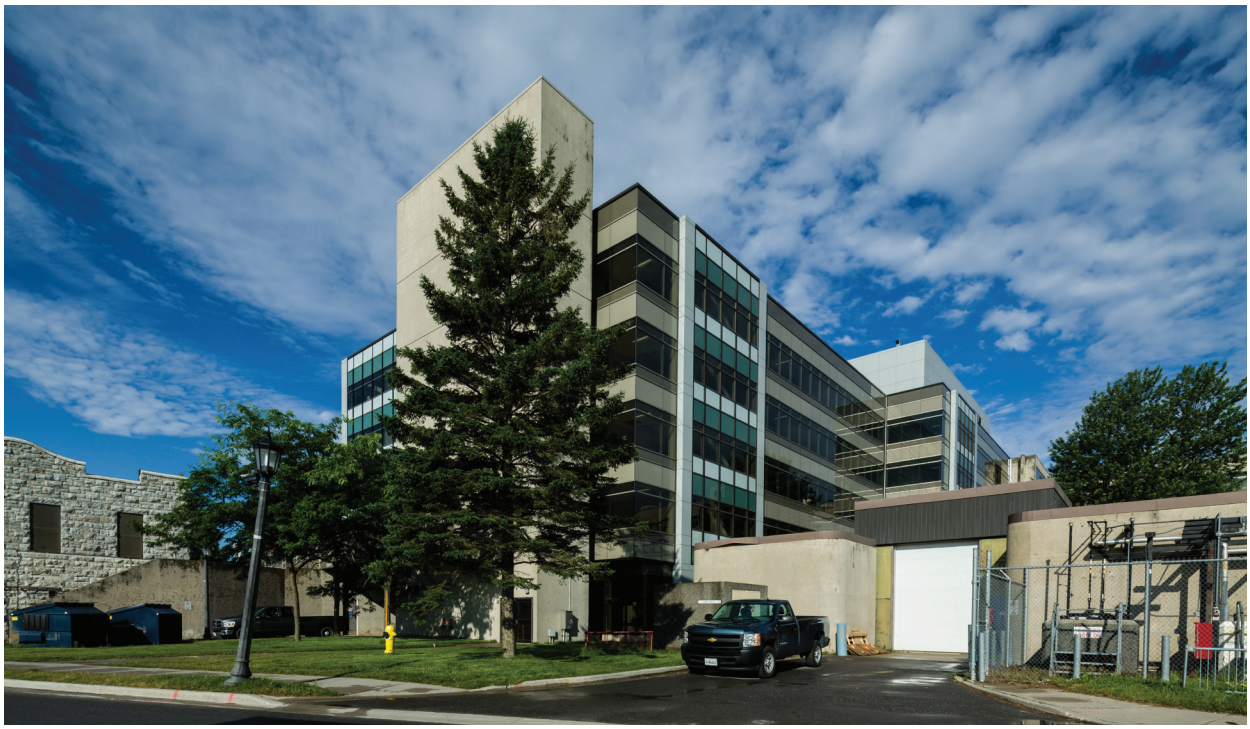
Prime Consultant: J.L. Richards & Associates Limited
Client: Defence Construction Canada
Owner: Department of National Defence
Construction Manager: EllisDon
Construction Cost: $125M
Start Date: 2010
Completion Date: 2017



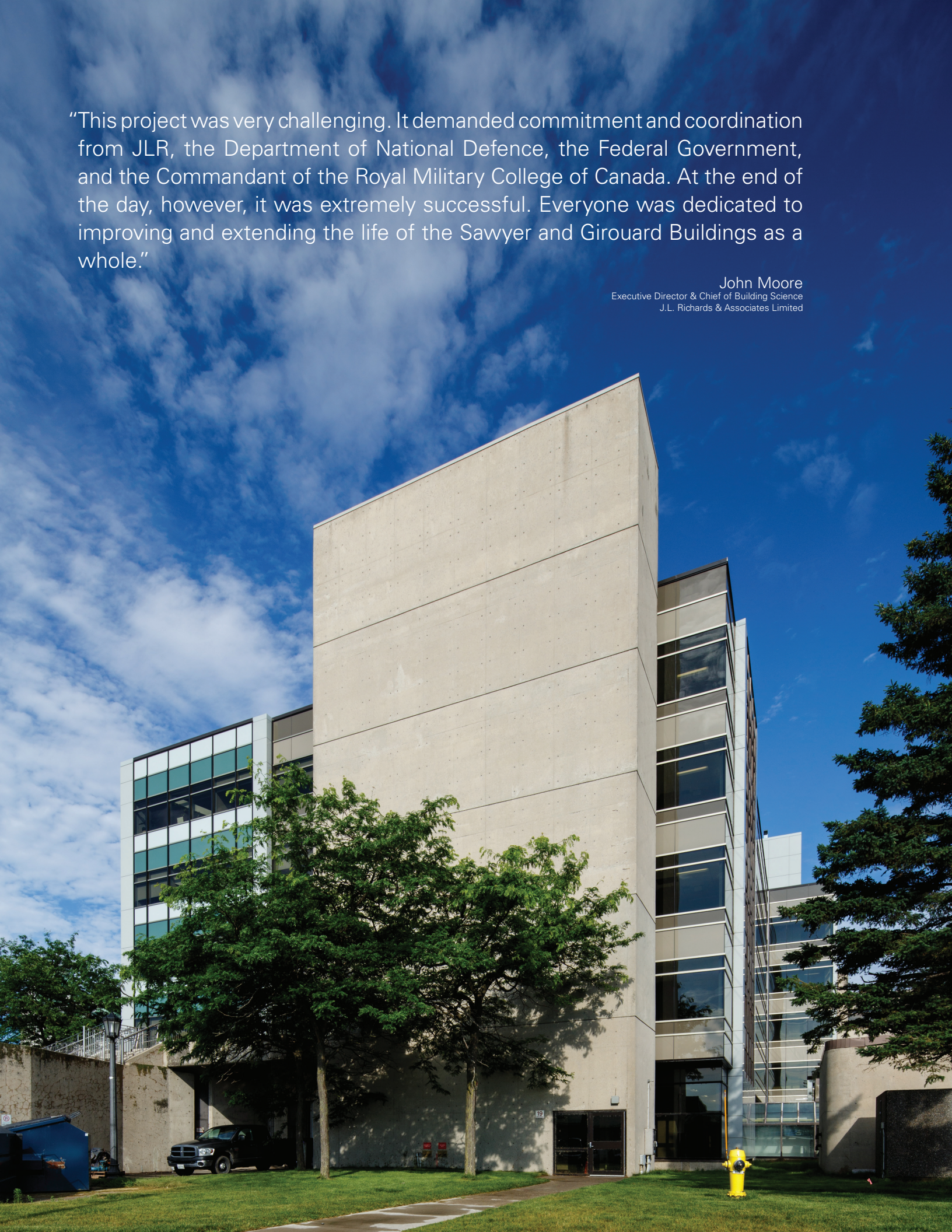
The Sawyer and Girouard Buildings at the Royal Military College of Canada were in a severe state of deterioration as a result of a leaky building envelope and inadequate ventilation and heating systems. Staff and students experienced uncomfortable temperature swings and risked exposure to hazardous chemicals.

JLR provided prime consultant services for a $125M retrofit which dramatically improved the condition of the buildings while protecting this environmentally and historically sensitive site.

Before

"This project was very challenging. It demanded commitment and coordination from JLR, the Department of National Defence, the Federal Government, and the Commandant of the Royal Military College of Canada. At the end of the day, however, it was extremely successful. Everyone was dedicated to improving and extending the life of the Sawyer and Girouard Buildings as a whole."

John Moore
Executive Director & Chief of Building Science
J.L. Richards & Associates Limited



Innovation

J.L. Richards & Associates Limited (JLR) was retained as the prime consultant for the retrofit of the Sawyer and Girouard Buildings at the Royal Military College of Canada (RMC) in Kingston, Ontario. Established in 1876, the College specializes in undergraduate and post-graduate university training for military officers, and is the only federal institution with degree-granting powers in Canada.

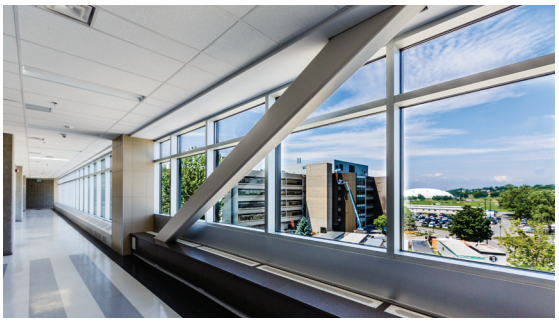
The facility houses a wide array of classrooms, administrative spaces, laboratories, and even a nuclear reactor. The 18,000 sq.m. complex was constructed during the 1980s and is configured in seven distinct modules. All modules were in an advanced state of deterioration due to a leaky building envelope and inadequate ventilation and heating systems. These conditions were adversely affecting the health and safety of the staff and students.

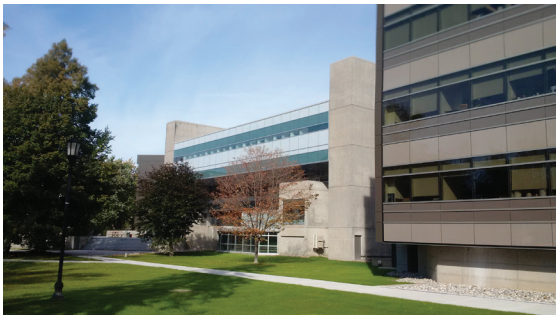
Of critical importance to the Canadian Military was the requirement to develop a retrofit program that could be implemented without disrupting the undergraduate teaching program. This was addressed through the development of a multi-year, module-by-module retrofit plan, supported by the construction of a flexible swing-space capable of temporarily housing any of the varied building functions, including lecture halls, laboratories, and workshops.

Starting in 2010 with the construction of the swing-space and continuing in sequential phases over the following seven years, JLR spearheaded the retrofit project, providing complete architectural, engineering, and design program management services. In addition to the replacement of the building envelope and major upgrades to the HVAC systems, the project scope included the installation of new fire protection systems, seismic reinforcing of the building structure, updated telecommunications infrastructure, accessibility upgrades, and the renewal of the electrical distribution system. This $125M project was implemented through a construction management process with Defence Construction Canada and EllisDon. It was completed in September 2017, on time and on budget.

A novel seismic bracing technology originally developed in Japan, referred to as "Buckling Resistant Braces", was employed for seismic reinforcing of the building. This elegant single-beam brace system is tuned to the exact load requirement, simplifying the connections at each floor slab and reducing the extent of foundation work when compared to traditional X-braces.

At the time, this was a relatively new technology in Canada, and proved to be a cost-effective and minimally intrusive approach to addressing safety concerns in this earthquake-sensitive zone.





Complexity

The project faced a number of highly complex problems including:

- Undertaking a comprehensive renovation program while maintaining a full undergraduate teaching program;
- Replacing the building envelope with modern materials while respecting the heritage of the campus and surrounding environment;
- Phasing the HVAC systems and seismic retrofit such that each module could be made fully operational at the end of each phase of construction; and
- Planning and executing the renovation of the swing-space to address the diverse teaching program requirements of each of the building modules.

These problems were overcome through a collaborative team effort involving JLR, Defence Construction Canada (client), the Department of National Defence (owner), EllisDon (construction manager), and the builder. Together, this team resolved the logistics for the swing-space and planned each phase to ensure that the undergraduate program would not be affected. EllisDon also assisted JLR in assessing the buildability of the proposed retrofit.

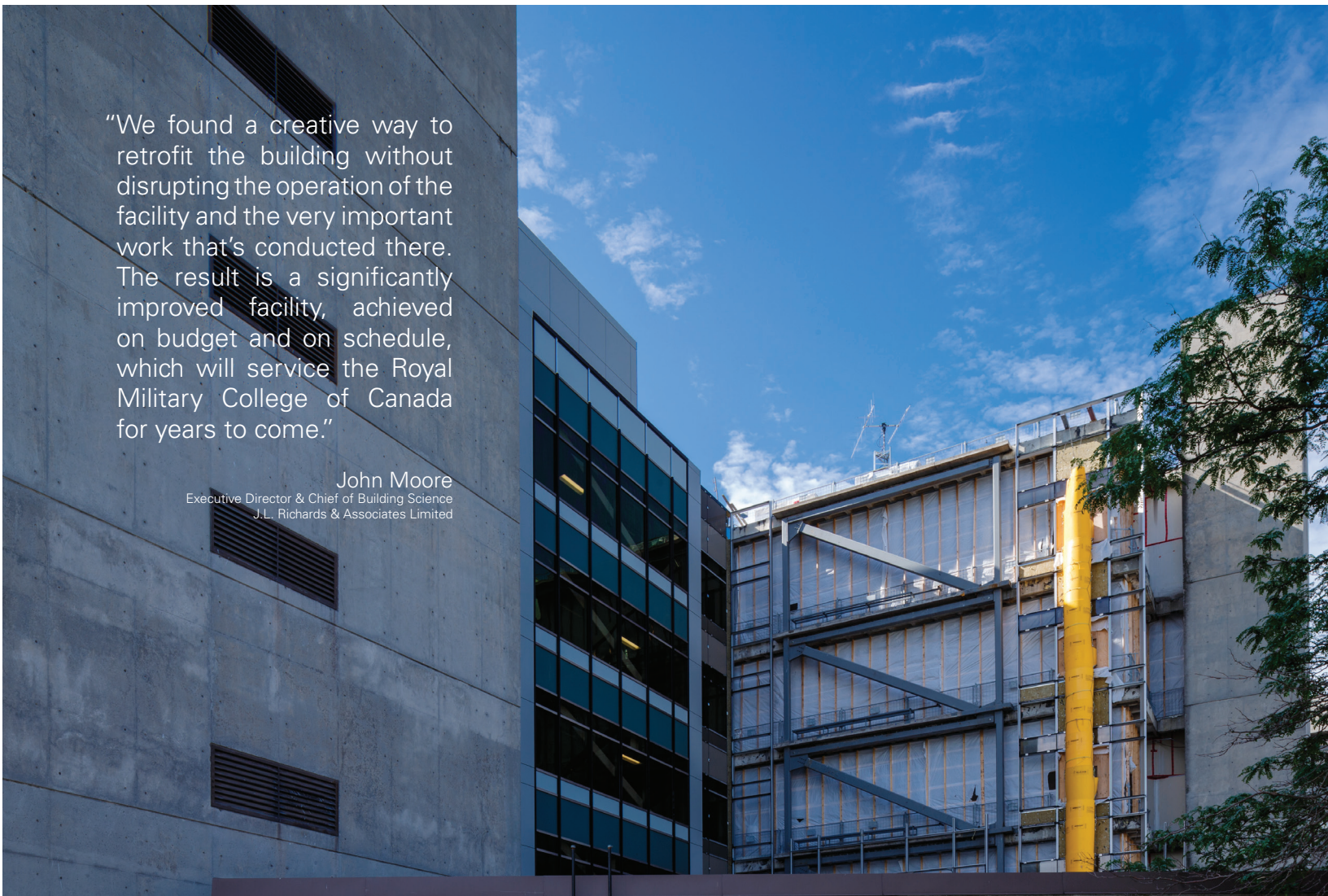
The development of the new façade was undertaken through a series of rendering studies which examined options for colour, massing, and shapes of the mullions, glazing, and spandrel panels. As the team worked towards a conceptual solution, a scale model of the entire complex was produced to validate the colour selection and overall design. The final colour selection was made in consultation with RMC facilities staff.

Social & Economic Benefits

The project was executed over a seven-year timeline, which is unusual for a construction project of this size. This approach provided an estimated 300 person-years of direct employment to the Kingston region over that time period, while injecting over $60M directly into the local economy. The length of the project, combined with the broad range of associated employment opportunities, provided an excellent opportunity for Kingston area residents to gain work experience in a high value sector of the economy.

Spinoff benefits to local businesses had a multiplying effect on the local economy, creating additional employment in the service, material supply, and construction sectors. The retrofit project was developed around meeting the LEED Silver sustainable design principles, which included the recycling of demolition and construction waste. This initiative had a substantial impact on the local recycling industry due to the amount of demolition and construction waste generated by the project.

The development of the swing-space for this project will also serve as a legacy resource for the RMC.



"We found a creative way to retrofit the building without disrupting the operation of the facility and the very important work that's conducted there. The result is a significantly improved facility, achieved on budget and on schedule, which will service the Royal Military College of Canada for years to come."

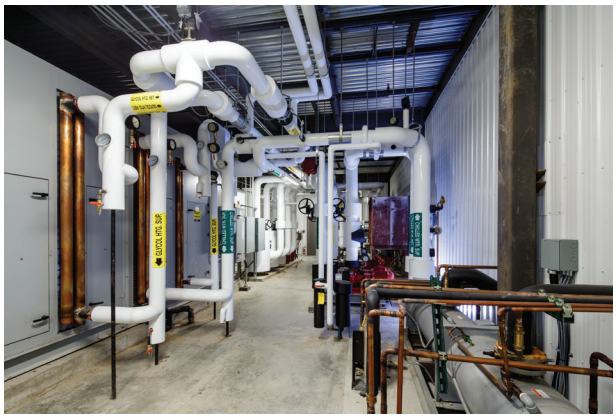
John Moore
Executive Director & Chief of Building Science
J.L. Richards & Associates Limited

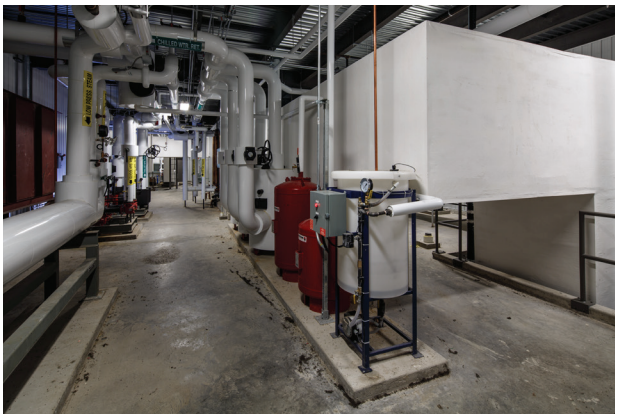
Enviromental Benefits

The Sawyer and Girouard Buildings sit on a significant, scenic historical site in Kingston. They are surrounded by important landmarks, including Fort Henry (a naval port constructed during the War of 1812), the Saint Lawrence River (home to several threatened and endangered species), and two National Historic Sites of Canada: The Royal Naval Dockyard and the Point Frederick Buildings. JLR was mindful of the fragility of this location, and made every architectural and engineering decision carefully in order to preserve the ecology and history of the site.

The retrofitted buildings were designed according to LEED Silver Standards, with an intention to operate efficiently for years to come. LEED principles include the use of locally sourced materials, low VOC paints and finishes, LED Lighting with day-lighting controls, low water consuming fixtures, a complete building automation control, and variable air flow ventilation systems with heat recovery.

From a building operations perspective, efficiency improvements will have a significant environmental impact. The new plumbing fixtures will reduce water consumption by over 70 per cent, and the highly efficient ventilation, LED lighting, and automated control systems will combine to reduce energy consumption and green house gas emissions for the complex by more than 50 per cent.





Client's Needs

The client's main goal was to improve the appearance and safety of the deteriorating buildings without disrupting the schedules of its students and academic programs – a daunting and difficult task that required careful planning by the project team.

In order to meet this goal, a phased retrofit plan was developed and implemented in which each building module was sequentially vacated, gutted, and renovated. The sequence of the renovation was developed to ensure each space would be fully functional when re-occupied. To accommodate the displacement of students, a flexible swing-space that operated as classrooms, lecture halls, and laboratories was constructed on site. The swing-space was renovated each year to accommodate the needs of the occupants of the module being displaced.

The RMC is located on an archaeologically-sensitive area, so it was also important to the client that JLR protect and maintain the integrity of the site. In constructing the swing-space, building services were run above the ground in order to avoid disturbing artifacts that are buried on site. The new water and sewer lines were placed on top of the ground and covered with insulation and gravel, and heated with tracer lines so that they would not freeze. This approach allowed the lines to be carefully removed at the end of the project without disrupting the soil itself.

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