

 **Laurentian University**
Université Laurentienne
McEWEN SCHOOL OF ARCHITECTURE
ÉCOLE D'ARCHITECTURE



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McEwen School of Architecture at Laurentian University

Sudbury, Ontario Canada

A state- of-the-art facility that supports the integration of opportunities for learning about building systems and their inter-relationships

The McEwen School of
Architecture features a
pioneering application of cross
Laminated Timber (CLT) –
one of the first applications of
this system in Ontario





SUMMARY

LGA Architectural Partners required AECOM's engineering design services to create a state-of-the-art School of Architecture. The facility integrates the innovative use of three major structural systems including concrete, steel and Cross Laminated Timber (CLT). The CLT was pre-engineered by AECOM and unconventional techniques were used to overcome challenges in site conditions. The facility retains its heritage element, provides a new revenue source for the local economy and perpetuates the process it was created to achieve – functional and innovative design based on a socially and environmentally sustainable design approach.



INNOVATION

As one of Canada's most innovative educational buildings, the McEwen School of Architecture is a prime example of an innovative approach to design. The innovative use of three major structural systems, including concrete, steel and Cross Laminated Timber (CLT) illustrates the characteristics of each system within the building and how each correlates to various components of the other building systems. The School features a pioneering application of CLT systems for the structure of the Library – Theatre wing. This is one of the first applications of this system in Ontario and is intended to showcase and consequently generate a market for this type of system in eastern Canada.

AECOM's integrated engineering team provided civil, structural, mechanical, electrical engineering and acoustic and sustainability advisory services for all project phases. The CLT was pre-engineered by AECOM using an integrated BIM modelling process. This BIM model was shared with the fabricator for use in manufacturing the components. These were designed and fabricated to fit together like a kit of parts. The prefabricated CLT panels used on this project also mitigated the northern Ontario construction challenges of a short building season, a small labor pool of skilled local trades, and high transportation costs. Delivered to the site numbered and ready to install, the panels required no additional onsite work. Structure and enclosure were completed in only two weeks.





The Library Wing is clad in BIM-modelled, prefab CLT panels and unitized glazing panels, and is entirely a mass timber construction. The blending of natural wood design and modern concepts is key to the facility's appeal and functionality. One of wood's great advantages is that it is the only structural building material that, in a cold climate, can move seamlessly between the warm interior and the cold exterior without thermal bridging. LGA Architectural Partners won the Ontario Wood WORKS! 2017 prize for their focus on integrating woodwork into modern Canadian teaching and design. The facility perpetuates the process it was created to achieve – functional and innovative design based on a sustainable design approach.

3-D analysis, modelling and drawing production was used to simulate the performance of the multiple systems for the construction and final phases producing an approach to identify challenges. Unconventional techniques were used to address and overcome challenges in site conditions such as micropile foundations to address geotechnical conditions.



COMPLEXITY

AECOM provided all of the engineering services including civil, structural, mechanical and electrical engineering and provided concept, preliminary and detailed design and construction documents. AECOM also assisted in the tendering process and provided construction administration services. Specialties also include sustainability and acoustic advisory services. The challenges of this project arose during design and execution phases.

Challenges addressed include:

- **The mixed use of various systems**, the complexity of the structural layout and unconventional design elements including the large structural wood wing and raised floor in the library as well as the complex design connecting existing and new elements. 3-D structural models were built and analyzed, simulating the behavior of multiple systems in various construction phases, as well as in the completed state. All design drawings were also modelled and produced in 3-D;
- **The mixed applications of various structural systems** also required unique designs of connections and interfaces, which were developed and analyzed during the design phase;
- **Difficult geotechnical conditions and high groundwater** created major challenges during the design and construction phase of the project. The use of micropiles — a foundation type selected as a result of the challenging site conditions and constraints — came to be the most optimal foundation system. This system also addressed the need to protect the existing historic buildings and ensured the foundation would sustain the vibrations of nearby passing trains;
- **Difficulties in construction of the foundation system** were further aggravated by high variations in soil conditions that were discovered during construction. Detailed modelling, adjustments and pile-group coordination were conducted during the construction phase to overcome the challenges.



SOCIAL AND/OR ECONOMIC BENEFITS

The Laurentian University McEwen School of Architecture is the first new school of Architecture to open in Canada in 45 years. The school focuses on Northern culture, sustainable design and design/build in local communities, and represents the only tri-cultural school of its kind in Ontario. It is also the University's first satellite campus.

Involving many stakeholders, the school interconnects Laurentian University, the Greater Sudbury community, the Province and Canada. It is the first school of its kind in Northern Ontario providing benefit to students, the local community and economy. The facility brings new function to its original two existing buildings, while retaining its heritage element and highlights Indigenous design while providing a new revenue source for the local economy. The emphasis on sustainable and socially-minded design provides a unique educational opportunity for students incorporating these principles in their own design work for surrounding communities.

By meeting the demand for more places for architecture students to learn, the school supports Laurentian University's ability to evolve as an important hub for Northern Ontario. The school also helps revitalize the downtown area, contributing to the healthy social, intellectual, and cultural growth of the community.

McEwen students have been involved in many high-profile projects and in only three years, these students have been recipients of many prestigious national and international awards for their design work. Successes include taking first place at the 2016 Bergen International Wood Festival in Norway. The significance of this specialized program has, within a short time, led to wide public acknowledgement and also promotes working with northern communities to shape the local community.

The School offers a Bachelor of Architectural Studies program and more recently introduced the Master of Architecture program in Fall 2017, reaching the School's full complement of 400 students. The expanded program will encourage students to study and stay in the North and will attract students from other regions.

ENVIRONMENTAL BENEFITS

Designed to a significant level of sustainability – LEED Gold Standard – The McEwen School of Architecture offers many energy-efficient systems that support the region's commitment to protecting the environment and teach students about sustainable design. Sustainable strategies include rainwater harvesting, a vegetated roof, a high performance envelope, underground storm water management storage with natural percolation, and several renewable energy technology demonstration projects including solar photovoltaic, solar thermal and wind turbine installations and a Variable Refrigerant Volume system for the mechanical system heating and cooling.



The mechanical system design takes advantage of the high performance building envelope which features triple glazing and extensive glass features to allow sunlight to penetrate the structure for added day lighting and heating in the cold northern climate.

The electrical power distribution system includes energy efficient lighting and occupancy sensor control in addition to occupant manual override to allow more flexibility in the use of the spaces while maintaining energy efficiency.

The integration of indigenous and natural materials in building and site design material selection is a key component to the sustainability design. The school is also positioned to take advantage of a future co-generation plant on a contiguous site and has the potential to become one of the first netzero buildings in Canada's north.

In addition to innovative sustainable strategies to design buildings using renewable resources for the future, the School emphasizes reuse and revitalization through the incorporation and renovation of two heritage buildings. These buildings remain as integral components of the architectural campus.



MEETING CLIENT'S NEEDS

The principal objective of AECOM's client, LGA Architectural Partners was the creation of a state-of-the-art facility to support the integration of opportunities for learning about building systems and their inter-relationships. This objective is reinforced by a significant commitment to sustainable factors with an emphasis on demonstrating, through the design, how the combination of building systems is a more effective means of achieving healthy, energy-efficient buildings than through the discrete performance of individual systems.

AECOM's success in delivering this project to LGA benefited from a strong collaborative team approach to issues, schedule challenges, and remedial actions to achieve a positive and rewarding impact as a landmark for its surrounding academic community and ultimately, for the City of Sudbury. Its introduction into the downtown core of the community is viewed as a bold move by the University to integrate a major new building within the urban fabric of the City. The settlement of the site with the building components were accomplished over three years.

The implementation of a functional, innovative design based on sustainability and a linked building system approach resulted in the 72,000 square foot state-of-the-art facility in Sudbury's downtown core. Derived from a depth of expertise and experience in building science and sustainable design, the school meets a significant level of sustainability (LEED Gold) with the potential to become one of the first netzero buildings in Canada's north. Meeting numerous environmentally and socially driven design efforts, the facility exemplifies success.









About AECOM

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