



Laurentian University McEwen School of Architecture

SUDBURY, ON

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Introduction

Located in Sudbury, Ontario, Laurentian University's McEwen School of Architecture is the first new school of architecture to be built in Canada in 40 years. Its mandate is to provide a uniquely integrated, uniquely focused education to Indigenous, Anglophone, and Francophone students. It is the only school of architecture outside of Québec to offer French-language studio courses, and the first to include offices for Indigenous Elders, who play a central role in the school.

The curriculum addresses resilient architecture and fabrication techniques for northern latitudes, with an emphasis on Indigenous culture, wood construction, local ecologies and resources, and design for the impact of climate change. The school is a didactic instrument with structural and HVAC design elements purposefully exposed in each of the various buildings.

The multi-phase development of the McEwen school began with the adaptive reuse of the site's two existing heritage structures. The two-storey CPR ticket and telegraph building (circa 1914) became faculty offices and a boardroom, and the single-storey market building became a temporary studio before ultimately transforming into the fabrication laboratory once the new studio spaces were constructed.

Phase two of the project included the construction of a 36,480 ft² steel-and-concrete Studio Wing, and the new 15,670 ft² CLT Library Wing which is the focus of this case study. By combining the two repurposed heritage buildings with 52,150 ft² of new construction, the McEwen School of Architecture demonstrates the properties of wood, steel, concrete, and masonry construction, and illustrates to students the structural potential and aesthetic qualities of each.



“The building itself offers an excellent learning opportunity; you can see how it works. It’s great for future building designers to be able to see that structure. Ideally, all buildings for architecture and engineering programs could be used as teaching tools like this one.”

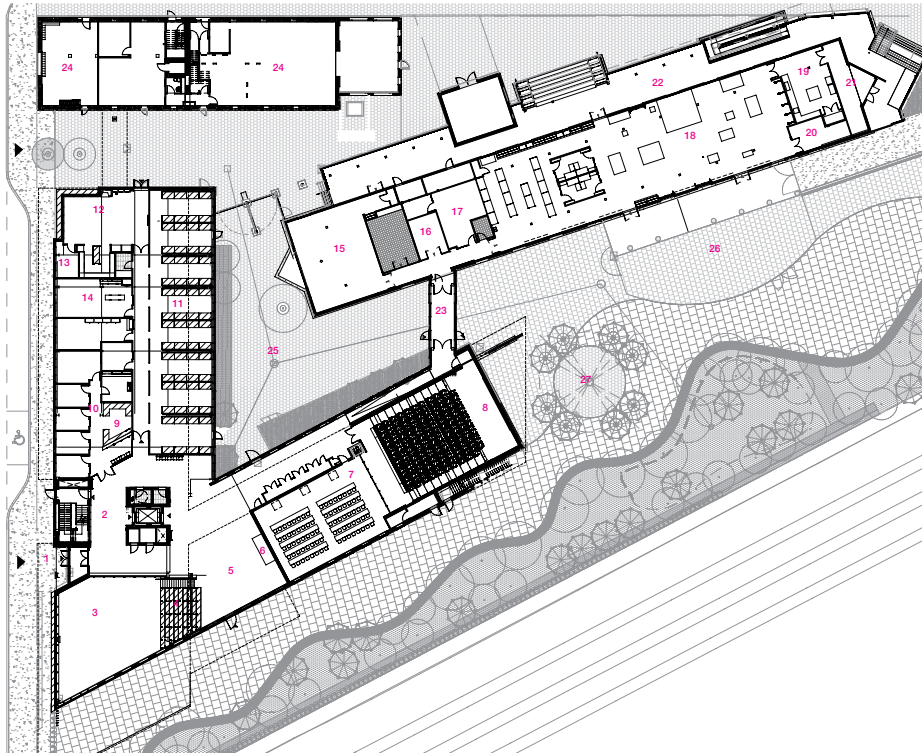
Cory Zurell, PhD, P.Eng., Blackwell



Design Rationale

Mass timber construction figures prominently in the design of the McEwen School of Architecture for several key reasons. First, wood has historically been a principal building material of many northern Ontario Indigenous peoples, and the aim of providing a culturally relevant building influenced the selection of wood and other material components on this project. Second, Laurentian University embedded fundamental northern Ontario Indigenous perspectives into the McEwen’s curriculum, and the architects sought to design an architecture school that supported this innovative

mandate. Third, new developments in the types of wood products available for construction provided an opportunity to employ and celebrate contemporary wood technologies. Solid-sawn dimensional timbers like the posts and beams used a century ago to construct the Market Building are no longer readily available and are expensive. The exposed structure of the new Library Wing introduces students to engineered wood products, showcases a modern design solution using glulam and CLT, and inspires students to consider new ways of building with wood.



**Ground Floor Plan Rendering:
LGA Architectural Partners**

- 1 Entry
- 2 Entrance Lobby
- 3 Drawing Studio
- 4 Seating/Steps
- 5 Atrium
- 6 Fireplace
- 7 Classroom
- 8 Lecture Hall
- 9 Administration
- 10 Offices
- 11 Undergraduate Studio 1
- 12 Student Lounge
- 13 Student Association
- 14 Staff Lounge
- 15 Cultural Room
- 16 Digital Fabrication Lab
- 17 Computer Room
- 18 Wood Shop
- 19 Metal Shop
- 20 Spray Room
- 21 Gallery
- 22 Exterior Fabrication Deck
- 23 Link
- 24 Future Program Space
- 25 Courtyard
- 26 Outdoor Fabrication Workshop
- 27 Exterior Ceremonial Fireplace
Gathering for Indigenous Practice

“We really feel that, given the nature of the design-build curriculum at McEwen, it was so important for the building to be a platform for experimentation. We wanted a school where students could hammer and glue and tape. This building heals itself. It’s full of creative experiments and hands on learning.”

Janna Levitt, LGA Architectural Partners

An Innovative, Northern Campus

While Laurentian University’s main campus is on Sudbury’s outskirts, the McEwen campus is strategically situated downtown. The school functions as a catalyst for urban regeneration and as an educational hub for the region in addition to serving as a teaching laboratory for the advancement of sustainable, community-based design in northern climates.

The McEwen campus occupies a wedge of land between the rail line and western edge of Sudbury’s downtown. It includes two repurposed heritage buildings – the masonry Telegraph Building and the post-and-beam Market Building – in addition to the newly constructed studio and library wings. Construction was phased over several years and began with the renovation of the two heritage buildings so that the school could open while the second phase of construction proceeded on the two new wings.

In the final phase, the spaces that served as classrooms when the school first opened were converted into wood, metal, wet lab, and digital workshops.

The new Library and Studio wings are connected to the heritage buildings to shelter an outdoor courtyard (often used as a ‘workshop’) and ceremonial fire pit, enabling their year-round use. The architect also developed a ‘plug and play’ approach in which infrastructure is exposed and labelled. This turns the entire campus into a teaching tool for architecture students and facilitates the swapping out of building system technologies when more efficient products become available.



Cross-Laminated Timber

Cross-Laminated Timber (CLT) panels are large engineered wood products manufactured by laminating multiple layers of dimensional lumber with adhesives in configurations of 3-, 5-, or 7-layer thicknesses where alternating layers are positioned at 90 degrees from the adjacent layers. Originally developed in the 1990s, the first industrial-scale (CLT) manufacturing facilities were established in Europe in the early 2000s. Interest in the use of CLT has continued to grow rapidly in North America, as more mass timber buildings are realized with this high-performance material.

CLT's structural properties and dimensional stability make it a product that is well suited for floors, walls and roofs. In some applications, such as the McEwen Library Wing, the panels may be left exposed on the interior, a treatment that delivers desirable aesthetic benefits and cost

savings. In the library wing, exposed CLT panels provide 75% of the interior finishes for walls and ceilings.

From a structural standpoint, the McEwen School of Architecture's most innovative component is the mass timber library wing. A century ago, massive dimensional timber was widely used as a construction material in the region. Today, large solid sawn timbers have been replaced by engineered wood products, such as glulam and CLT, that make extremely efficient use of our timber resource and achieve superior strength and performance.

The prefabricated CLT panels used on this project also helped accelerate the build time and meet the northern Ontario construction challenges of a short building season, a small labour pool of skilled local trades, and high transportation costs.



Worker attaches a glulam post to the crane in preparation for hoisting.



CLT structure of the library wing under construction. The entire wood structure took a small erection crew just two weeks to assemble.

Construction Photos: Sarah Hicks, Ontario Wood WORKS!

Fabrication & Installation

The CLT panels were pre-engineered by the consultants using an integrated BIM process, and the BIM model was shared with the fabricator. The panels were designed and fabricated to fit together like a kit of parts. Although the floor spans required for the stacked library and lecture theatre exceeded conventional limits for CLT construction, the team successfully achieved these longer spans with a hybrid design that combined CLT shear walls, floors, ceilings and roof with glulam beams.

The timber installation contractor used the REVIT model created by the

design team to generate a SOLIDWORKS version of the wood frame and the team worked together to coordinate the details. The model was used by the timber supplier to control the CNC machines that cut, drilled, kerfed and routed the wood into finished, prefabricated pieces.

Once the components for the whole library wing were fabricated, they were numbered and delivered to the site in sequence, ready to install. The pre-cut panels required no additional onsite work. Erection of the wood structure and envelope went quickly, completed in only two weeks.



A Sustainable Design Manifesto

The team felt that LEED® and other certification programs were not relevant to the realities of constructing and operating a building in the North, nor did these programs incorporate an Indigenous framework, so they worked with Ted Kesik, a sustainable systems design consultant and professor at the University of Toronto's John H. Daniels School of Architecture, to develop a "Sustainable Design Manifesto" that specifically addressed Sudbury and a more northern context.

One aspect of the manifesto was the ideal of "passive survivability". This refers to a building's ability to maintain critical life-support conditions if services such as power, heating fuel, or water are lost. In the aftermath of climate disasters around the world, there is a growing sentiment that passive survivability should become a standard design criterion for houses, apartment buildings, schools and certain other building types that are commonly designated as shelters.

Applying and analyzing relevant traditional "passive" design strategies to determine the optimum orientation and massing for the two new wings was the starting point for maximizing energy efficiency and occupant comfort. The McEwen School incorporates many systems that contribute to its passive survivability including a high-performance building envelope comprised of insulated wall panels with an R-value of 30, and an insulated roof assembly over the CLT deck with an R-value of 40. Also central to the realization of this outcome are the building's strategic orientation of glazing for abundant natural light and maximum solar gain for warmth in winter, natural ventilation (stack effect), and the uncommon addition of a delightful wood burning fireplace in the atrium of the Library wing.

The design of the entire school complex embodies the concept of survivability: the combination of robust structure and super-insulated envelope ensures that the school can remain occupied in the event of power failures, which are expected to become more frequent, particularly at northern latitudes, as a result of climate change.



Fireplace Photo: Megan McIlvenna, Ontario Wood WORKS!

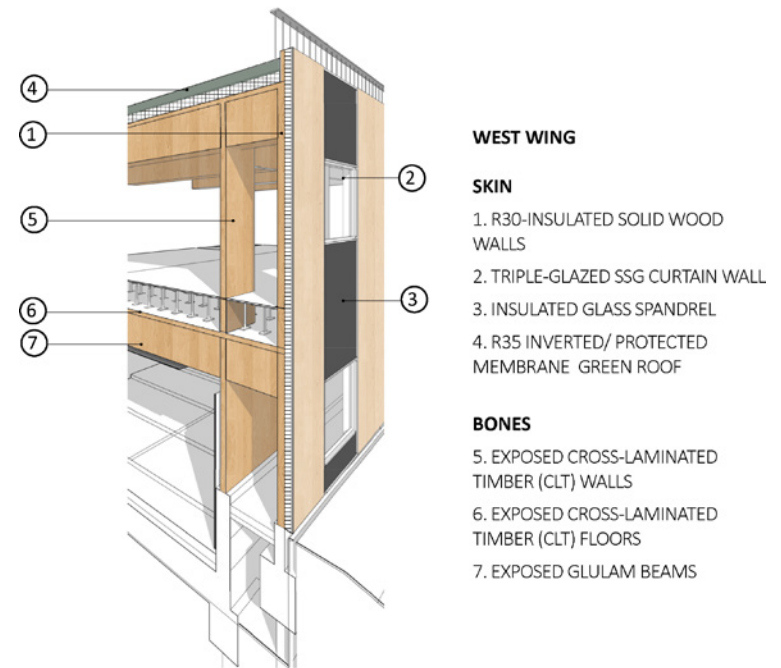
Building Envelope & Energy Performance

The Library Wing is clad in BIM-modelled, prefabricated CLT panels and unitized glazing panels, and is entirely mass timber construction. 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 creating significant thermal bridging. Energy modelling studies indicate that the McEwen will require 44 per cent less operational energy than the code standard minimum.

Fire Performance

The 15,670 ft² (1456 m²) Library Wing at the McEwen School of Architecture is a sprinklered, 2 storey structure, of heavy timber construction, with a mezzanine in the north wing. The major occupancy of the building is Group A, Division 2, up to 2 storeys, increased area, sprinklered (OBC 3.2.2.26). As such, it is permitted to be of combustible construction provided the building area is not greater than 2400m² (for a 2 storey building), the combustible floor assemblies are fire separations and have a fire-resistance rating of 45 minutes or longer, and combustible load-bearing walls, columns and arches supporting a floor assembly have a fire resistance rating of 45 minutes or greater.

The building meets all code requirements and the mass timber elements are permitted to be exposed in the majority of the structure with the exception of the library's CLT floor deck. The library has a raised access floor that effectively creates a combustibile concealed space which, according to NFPA 13 Standard for Installation of Sprinklers, must either be sprinklered, filled with noncombustible insulation, or have all surfaces limited to a flame spread rating of 25 or less. For any combustibile concealed space that is not protected by automatic sprinklers, then the OBC requires that the space be limited in size and be provided with adequate fire blocking, depending upon the flammability of the exposed surfaces in the space. In this case, the CLT deck and knee walls within the concealed space were lined with sheet metal to both avoid the need for sprinklers and to allow for the larger size of the concealed space. The original intent was to use cement board, but this was changed to sheet metal to gain the space needed to accommodate the HVAC equipment.




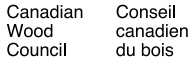
Sheet metal lines the CLT deck and kneewalls of the library's raised access floor.

Construction Photo: José Castel-Branco, LGA Architectural Partners






Carbon Calculation

To access the Canadian Wood Council's free Carbon Calculator online, please visit: www.cwc.ca/carboncalculator



Carbon Summary



Results:

-  Volume of wood products used:
550 cubic meters (19,423 cubic feet)
-  U.S. and Canadian forests grow this much wood in:
1 minutes
-  Carbon stored in the wood:
492 metric tons of carbon dioxide
-  Avoided greenhouse gas emissions:
190 metric tons of carbon dioxide
-  Total potential carbon benefit:
682 metric tons of carbon dioxide

Equivalent to:

-  144 cars off the road for a year
-  Energy to operate 72 homes for a year

Project Name: McEwen School of Architecture, Library Wing
Date: March 6, 2019

Results from this tool are based on wood volumes only and are estimates of carbon stored within wood products and avoided emissions resulting from the substitution of wood products for non-wood products. The results do not indicate a carbon footprint or global warming potential and are not intended to replace a detailed life cycle assessment (LCA) study. Please refer to the References and Notes' for assumptions and other information related to the calculations.

“We chose to celebrate the cultures co-existing in the Sudbury community – Indigenous, Anglophone and Francophone – to create a building and precinct that would simultaneously allow each cultural group to identify with spatial aspects of the new school. The design is also universal, in that most places in the world are addressing the forces of climate change and grappling with how to create a compelling curriculum for a post-colonial society.”

Janna Levitt, LGA Architectural Partners

Conclusion

The use of CLT and other wood products has significantly enhanced both the performance and the ambience of Laurentian University's new architecture school. It projects a sense of warmth and a connectedness to the landscape that are very much in keeping with the school's mandate

and northern Ontario's building traditions and climate. Though specifically designed for its immediate context, the design is also universal, in that most places in the world are addressing the forces of climate change and striving to achieve designs that have the capacity to meet these changing needs.



Project Team

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