Algonquin College, Perth Campus

Canadian Wood Council
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ALGONQUIN COLLEGE

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Introduction

Algonquin College is a major provider of post-secondary education in Eastern Ontario, with campuses in Ottawa, Perth and Pembroke. The Perth Campus is located in the Town of Perth, approximately 65 km west of Ottawa. In keeping with Perth's historic involvement with the Rideau Canal World Heritage Site, the Perth Campus' area of excellence is heritage preservation training, which draws students from the local community and from around the world.

In 2009, planning began for a new building capable of accommodating more students. During construction of the new building, comprised of the Academic Hall and the Construction Wing **(Figure 1)**, classes continued in an old building that was subsequently demolished. A new outdoor construction pad is located over the footprint of the old building. The new building was ready for classes in September 2011, one year after the start of construction.

The town of Perth has a rich history, reflected in the nineteenth-century mills and factory buildings along the Tay River, Victorian storefronts and grand, century-old, timber-frame buildings. The Algonquin College Perth Campus building sought to blend with this fabric through the use of traditional forms, locally sourced materials, and wood-frame construction.

FIGURE 1 Site plan perspective

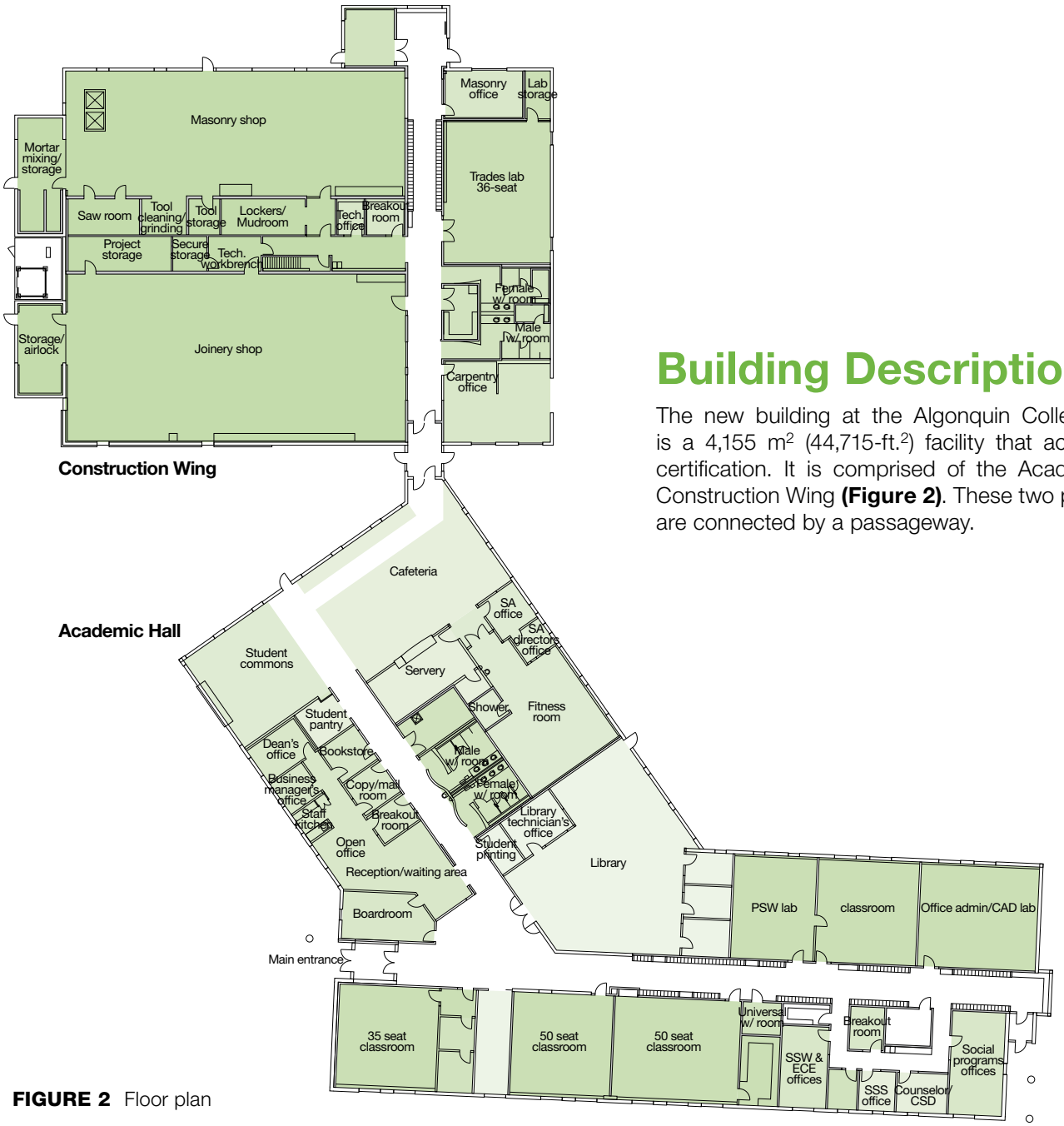

FIGURE 2 Floor plan

Building Description

The new building at the Algonquin College Perth Campus is a 4,155 m^2 (44,715-$ft.^2$) facility that achieved LEED Gold certification. It is comprised of the Academic Hall and the Construction Wing **(Figure 2)**. These two parts of the building are connected by a passageway.

The Academic Hall is a single-storey, 2,463-m^2 (26,500-ft.^{2}) wood-framed structure with a concrete slab on grade for the ground floor. It is comprised of state-of-the-art classrooms and specialty laboratories supporting programs such as social service work, personal health care and office administration. The building is designed for future expansion towards the northeast. Since part of the site is located in a flood plain, the area for future expansion is limited. Amenities include a student commons, cafeteria, lounge, library, fitness facility and computer access centre. The Academic Hall is a wood-frame building and the focus of this case study.

The Construction Wing is a single-storey, 1,693-m^2 (18,215-ft.^{2}) pre-engineered structure, with a steel-frame roof and wall system. It is comprised of two large workshops and a trades laboratory used by the Heritage Carpentry and Heritage Masonry programs that focus on restoration and craftsmanship, as well as the Advanced Housing program that focuses on green building construction methods.

Photo: DoubleSpace

Academic Hall Structure

The exterior walls of the Academic Hall are 38x140 mm (2x6 in.) wood-frame with plywood sheathing **(Figure 3)**. The stud cavity houses 140 mm (5-1/2 in.) of open-cell spray foam insulation with an additional 50 mm (2 in.) of rigid insulation on the exterior, providing a total effective insulating value of RSI 5.3 (R 30). The exterior cladding is primarily wood siding with sections of masonry veneer. Wood-frame exterior and interior walls are used to resist lateral forces induced by wind and earthquake. The wood cladding was also used on the Construction Wing to provide a unified appearance.

Durability is achieved with plywood shearwalls and abuse-resistant drywall (dense gypsum core reinforced by glass fibre) in corridors, rounded corner guards on drywall, and rubber-base floor moulding.

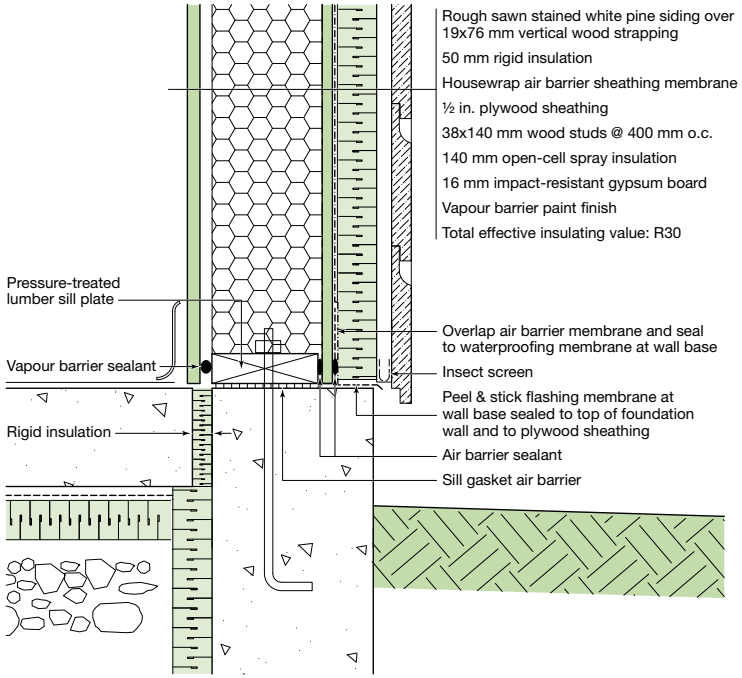

FIGURE 3 Exterior Wall Detail

The Canadian Wood Council has created this online tool to help designers select wood-frame wall assemblies that comply with national energy efficiency requirements for each climate zone in Canada. While the focus is compliance with 2010 National Building Code (NBC) December 2012 amendments for houses and 2011 National Energy Code for Buildings (NECB) for larger buildings, the calculator is a handy reference for complying with any building code. It is available at: www.cwc.ca/index.php/en/resources/wallthermaldesignmainpage

Over the classroom portion of the Academic Wing, a system of engineered wood trusses was used. The trusses are supported by load-bearing wood-stud walls along the corridors and exterior walls. **Figure 4** is a cross-section through the main entrance showing the trusses. For the library and student lounge areas, a system of timber beams and rafters supported on steel/wood columns was used. **Figure 5** shows the truss arrangement. Areas without trusses were framed on site with timber beams and rafters, supported on steel/wood columns. Wood was used on the ceiling areas to add warmth to the space.

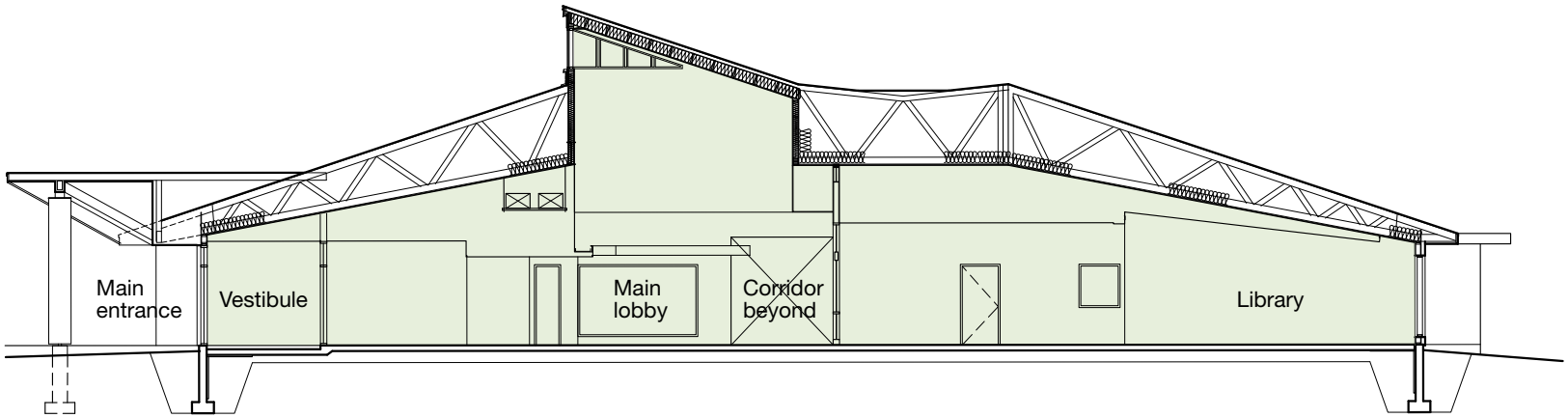

FIGURE 4 Cross-section through the Academic Hall Main Entrance

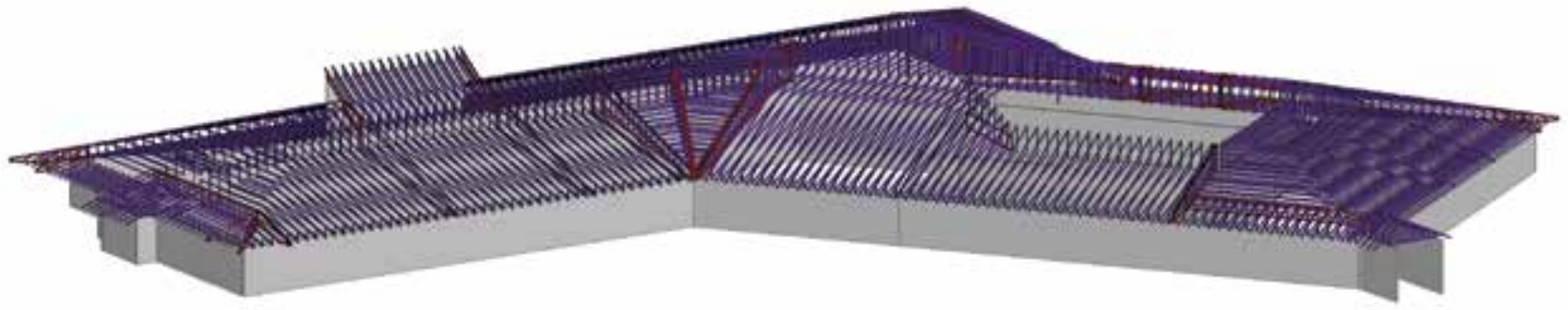

FIGURE 5 Academic Hall truss arrangement (viewed from the west)

Three-hundred millimetres (12 in.) of blown-in cellulose insulation in the roof provides an insulating value of RSI 7.0 (R-40) **(Figure 6)**. Sealed sheets of polyethylene provide the air/vapour barrier.

In addition to the structural use of wood for walls and roof, wood was used extensively in a decorative capacity to provide visual interest and enhance appearance. The entrance to the building is demarcated by a “tree-trunk” column which stands as a sculptural form to prop up the roofline and invite entry.

The wood siding is rough-sawn white pine that was pre-finished on all sides prior to installation. This siding and the wood columns were sourced and milled within a few kilometres of the site. Cladding the exterior walls and soffits in wood achieved a warm and welcoming aesthetic that integrates well into the local fabric.

Inside the building, maple wood slats on the ceilings in the cafeteria, entrance lobby and resource centre reduce noise levels and create a comforting atmosphere. Classrooms feature maple-cased return air plenums at the exterior wall. Solid-core wood doors, built-in wood benches, wood-framed glazed partitions, and millwork are found throughout the building. Some special areas of the school interior were left for the students to complete as part of their program studies.

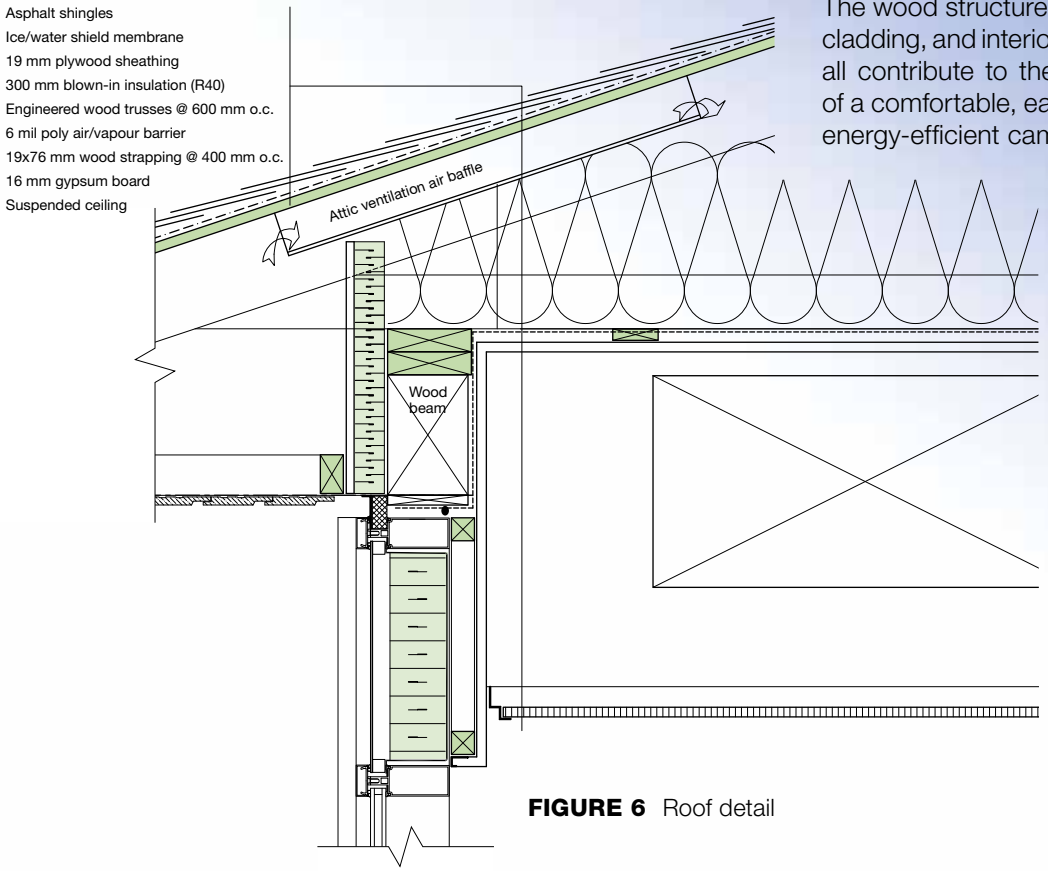

FIGURE 6 Roof detail

The wood structure, exterior cladding, and interior finishes all contribute to the realisation of a comfortable, easy-to-maintain, energy-efficient campus building.

Photo: DoubleSpace

Meeting Building Code Requirements

The building is 1-storey in height and its area is approximately 4,155 m^2 (44,715 $ft.^2$). It contains a non-residential college and is an assembly occupancy classified as a Group A, Division 2 major occupancy. This meant that combustible construction was permitted and sprinkler protection was required. No fire-resistance rating was required for the roof because the building is fully sprinklered.

Photo: DoubleSpace

Since the building is fully sprinklered, the fire department access is only required to the principal entrance of the building. The design occupant load for the Perth campus building is 400 persons.

With the exception of service rooms, all other areas of the building were required to provide a barrier-free path of travel suitable for wheelchairs.

Environmental Features

The majority of the wood structure was sourced from FSC-certified distributors and retailers, further reducing the environmental impact of the construction. Selective sourcing of the other materials yielded over 17.5% total recycled content. Efforts were also taken to reduce the negative impact of transporting materials to the site by sourcing over 55% of all building materials (by cost) regionally. These factors contributed to the achievement of LEED gold for this facility.

The selection of wood and related building materials contributed significantly to the points achieved in the LEED Resource Conservation category. The floors are polished concrete, which reduced the need for adding floor finishes, and cork flooring was used in the library. The general contractor also did its part by diverting over 92% of all construction and demolition waste from landfills.

In terms of energy efficiency, the high performance building envelope has on average RSI 5.3 (R-30) walls, and an RSI 7.0 (R-40) roof. Triple-glazed windows on the north façade reduce heat loss in winter, and deep overhangs and a reflective roof cover limit solar heat gain in summer. The white roof membrane on flat roof areas reduces heat island effect. The flat roof of the Construction Wing was designed to support the load of photovoltaic panels, which are planned to be added in the future.

The mechanical systems include centralized condensing boilers, a high-efficiency, frictionless centrifugal chiller, and a dedicated outdoor air system with 85% efficient reverse flow heat recovery. Heat is provided from ceiling diffusers and return air plenums are located at exterior walls.

There are operable windows in the classrooms and offices, clerestory windows in corridors, and daylight in all occupied spaces. Lighting throughout the building is a combination of T8 linear fluorescent lighting and TS high output lighting.

As a result of these strategies, the facility will cost 51% less to heat, cool and power than a similar facility designed to the standard of the Model National Energy Code for Buildings and reduce greenhouse gas emissions by an estimated 216 tons a year. This strategy earned the project 7 LEED points.

Thanks to a 2,000 L rainwater harvesting system used to flush the toilets and water-efficient plumbing fixtures such as dual-flush toilets and low-flow urinals, the building will reduce its water use by more than 60% compared to a conventional design. Other notable water conservation efforts include drought-tolerant landscaping and water bottle refilling stations for the occupants.

To improve the indoor air quality, all of the materials used in the construction contained very low or no volatile organic compounds (VOCs). To help maintain a high level of indoor air quality throughout the life of the building, a comprehensive green housekeeping policy has been adopted by the college.

Low VOC finishes such as exposed concrete, cork, linoleum, carpet tile, paint, and wood were used. The exterior is clad with local white pine and stone. There is recycled content in the floor slab, drywall and ceiling tiles. The wood-frame structure and the cellulose insulation used in the attic result in a low embodied energy content.

Solid Wood and Climate Change

Using sustainably harvested wood products that store carbon, instead of non-renewable, energy-intensive building materials that require large amounts of fossil fuels to manufacture, can help slow climate change. Trees provide the only major building material grown by energy from the sun.

Though processing the wood into building products does require energy, albeit less than competing materials, the needs of the mills are often supplied by using the biomass waste generated by the manufacturing process. At the end of their service lives, forest products can be reclaimed for reuse, recycled or used as a carbon-neutral source of energy. The wood volumes, not including finishing products, used in the Algonquin Perth Campus Academic Hall were:

Roof trusses	148.0 m^3
38x140 mm (2x6 in.) wall stud framing with 19x64 mm (1x3 in.) strapping	60.1 m^3
LVL headers/beams	4.6 m^3
Wall/roof sheathing	64.3 m^3
Total	**277.0 m^3**

Photo: GRC Architects

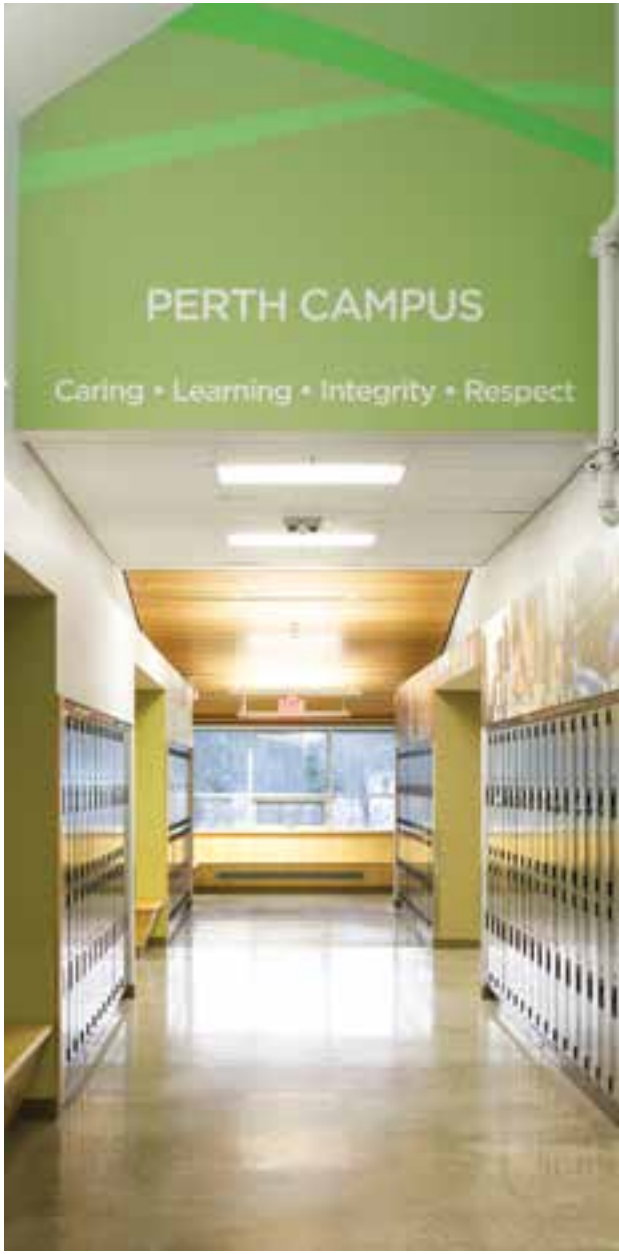

Photo: DoubleSpace

Carbon Summary

Results

Volume of wood products used:
277 cubic meters (9782 cubic ft) of lumber and sheathing

U.S. and Canadian forests grow this much wood in:
1 minute

Carbon stored in the wood:
210 metric tons of carbon dioxide

Avoided greenhouse gas emissions:
447 metric tons of carbon dioxide

Total potential carbon benefit:
657 metric tons of carbon dioxide

Equivalent to:

126 cars off the road for a year

Energy to operate a home for 56 years

Project Name: Algonquin College, Perth Campus
Date: February 26, 2014

Results from this tool are estimates of average wood volumes only. Detailed life cycle assessments (LCA) are required to accurately determine a building's carbon footprint. Please refer to the References and Notes' for assumptions and other information related to the calculations.

Photo: DoubleSpace

The on-line Carbon Calculator tool (www.cwc.ca/index.php/en/resources/electronic-tools) calculates the amount of carbon that is not released to the environment when wood construction is used instead of other major building materials. The carbon calculation for the Perth Campus building is shown on the left. The carbon benefit of the wood structure is equivalent to taking 126 cars off the road for one year or, expressed differently, the energy to operate a home for 56 years.

For more information about the benefits of using Canadian forest products visit: **www.feel-good.ca**

Conclusion

Awarded LEED Gold, the Algonquin College Perth Campus Academic Hall is bright, comfortable, easy to maintain and operate, and very energy-efficient. Sustainable strategies include resource conservation measures, efficient mechanical systems, locally sourced wood products, a superior building envelope, numerous water conservation strategies and a healthy indoor environment. The use of wood was cost-effective, met all health and safety requirements and created an interior atmosphere that is bright and positive.

Photo: DoubleSpace

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