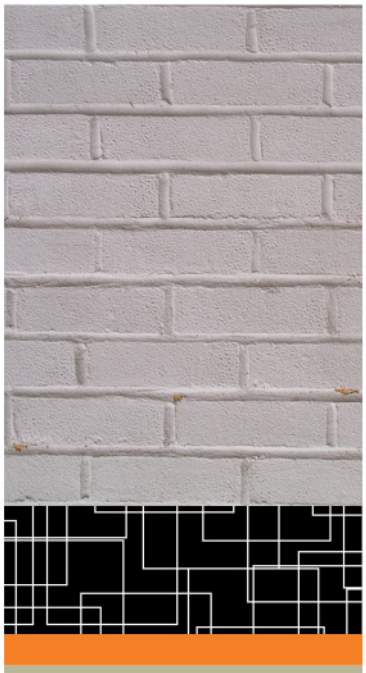
GENIVAR

ALGONQUIN COLLEGE
PERTH CAMPUS RENEWAL, PERTH ON

OFFICIAL PROJECT BINDER –
CANADIAN CONSULTING ENGINEERING AWARDS 2013

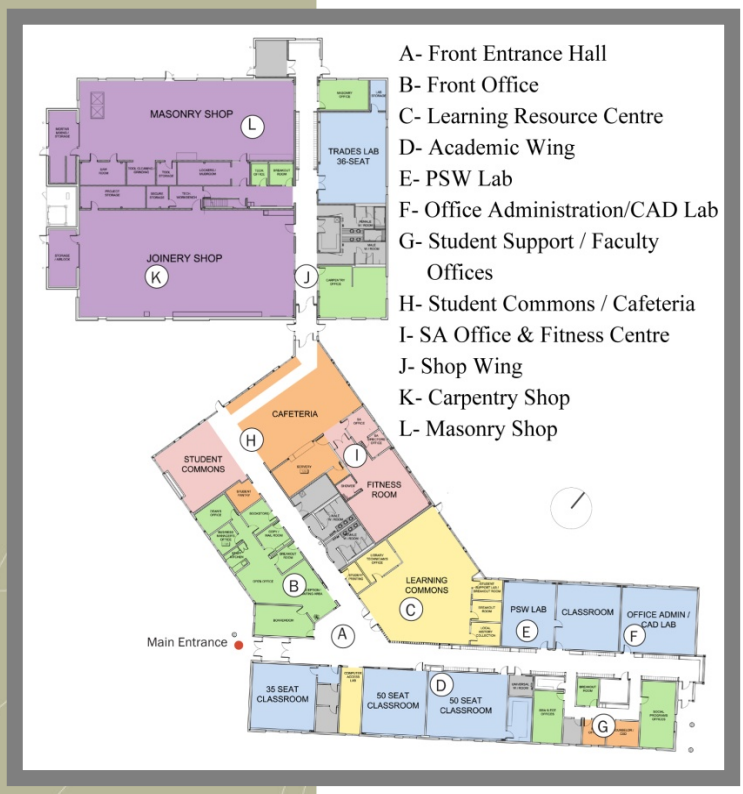


PROJECT DESCRIPTION

The Algonquin College Perth Campus is situated in the Lanark County and has been a hub in the community for education and gatherings for many decades. It desperately needed a new complex to replace an aging and faltering existing building to continue being an integral part of the community and to meet the increased interest in their heritage masonry, carpentry and advanced housing programs.

The new 3,900 m^2 (42,000 ft^2) building is situated on a five hectare rural site and is comprised of two wings: an academic wing and a construction wing. The academic wing includes state-of-the-art classroom, student amenities such as a library, cafeteria commons room and a physical health centre, and administration offices. The construction wing houses two large workshops and trades laboratories for the specialized programs in heritage carpentry and masonry and for the advanced housing programs that focus on green building construction methods.

GENIVAR's involvement included civil, electrical, mechanical engineering and sustainability services. Some of the sustainable strategies include efficient mechanical and electrical systems, numerous water conservation strategies, site-friendly stormwater management, a superior building envelope, and a healthy indoor environment. The result is a LEED® Gold certified learning facility that is comfortable, easy to maintain and operate, and very energy efficient.



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INNOVATION

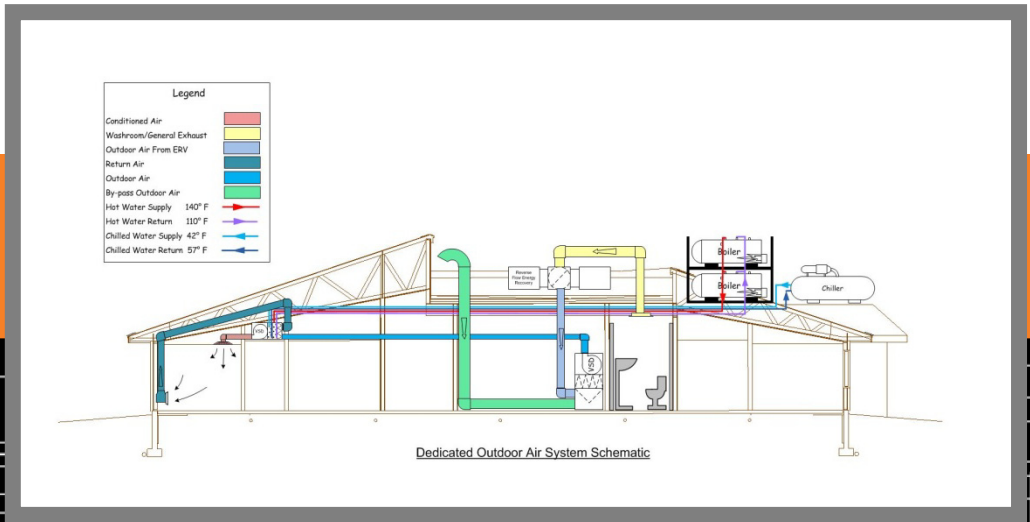
The integrated effort from all disciplines resulted in a student-centric building sensitive to its environment and projected to achieve a 49% reduction in annual energy costs compared to similar facility designed to the standards of the Model National Energy Code for Buildings.

The mechanical design includes a dedicated outdoor air system (DOAS) with variable volume and a reverse flow heat recovery unit supplying ventilation air at near 90% efficiency. Outdoor air is supplied to individual fan coils for each space which allows the systems to be turned off in each classroom based on usage saving on operation and outdoor air. Space heating and cooling is accomplished from a central plant via 95% efficient condensing boilers and an air-cooled frictionless centrifugal chiller with a IPLV 0.57kW/ton. Domestic hot water is generated by a condensing hot water heater with a thermal efficiency of 94%. Finally, potable water consumption is reduced by over 60% through a combination of low-flow fixtures and a rainwater harvesting system to redirect captured rain from the roof to the flush fixtures.

The electrical design features an overall lighting power density of only 9 W/m^2 leveraging the ample natural day lighting in combination with T5 high output fluorescents in the taller shops areas and T8 linear fluorescents in the remaining spaces. Additional controls allow occupants to tailor their lighting needs based on ambient conditions. Exterior lighting was kept to a minimum in keeping the campus' rural setting.

Nearly half of the property lies within a floodplain protected by the local conservation authority, and with poor infiltration conditions, the civil design had definite challenges. A number of stormwater management strategies, such as on site retention and bioswales and a rainwater harvesting system, were implemented to control water at the surface.

The project also implemented several other sustainable initiatives including: operable windows for natural ventilation; abundant natural daylight and views; native/adaptive landscaping eliminating the need for irrigation; careful selection of low-emitting products with a focus on improving indoor air quality; implementation of a building durability plan; a wood frame construction using FSC certified wood; resource conservation; and a high performance building envelope



Dedicated Outdoor Air System Schematic

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COMPLEXITY

A major challenge on the project was the limited options for positioning the new building due to the existing building needing to remain fully operational until the completion of the new facility and a significant portion of the site being unusable due to it being within a flood plain. Combined with the poor infiltration of the soils and no municipal storm sewers, these conditions presented a complexity as stormwater had to be managed at the surface with very few workable scenarios for retention/infiltration and placement of the new building. GENIVAR provided fulltime construction supervision to ensure that the added complexity of the partial occupancy of the existing building and the site stormwater management did not compromise the project, and that both the design and LEED® goals would be met through this added coordination between engineers and contractors.

From a mechanical perspective, the widely varying occupant load and mixed use nature of the building spaces presented a challenge to properly ventilate the buildings while achieving a high level of energy efficiency, further endorsing the designers' choice of a dedicated outdoor air system. Advanced controls that incorporate class schedules, and the use of occupancy sensors to vary the amount of outdoor air based on occupancy, were required to optimally control and schedule the ventilation air to handle the wide range of occupants at different times of day.

The ventilation design strategy was further improved by implementing low level returns in the classrooms in order to increase the air change effectiveness from a conventional Ez value of 0.8 and increased it to 1.0. This engineering strategy decreased the amount of outdoor air required in the classrooms by 20% which saved energy, and it improved indoor air quality.

The electrical lighting design was more complex than a typical design, due to the high lighting levels required in the workshop areas, the use of low wattage lighting and high performance ballasts helped achieve an overall lighting power density of less than 9 W/m^2. The exterior lighting design was targeted for the LEED® Sustainable Sites Credit 8, and it had to meet an LZ2 zoning requirement of first ensuring that less than 2% of the initial fixture lumens are not emitted 90° or higher, and that the horizontal and vertical lux at the property boundary was not higher than 1.1 lux, and not higher than 0.11 lux at 3 m from the site boundary. The GENIVAR design achieved zero lux at the boundary far exceeding the LEED® LZ2 requirements.

GENIVAR was responsible for the energy model documenting the energy cost savings for LEED® Energy and Atmosphere prerequisite two and credit one. It was demonstrated that the Algonquin Perth Design achieved 51% cost savings relative to an MNECB reference model which accounted for 7 LEED® points.

Another significant challenge for the entire project team was delivering a minimum LEED® Gold certification on a project in a rural context and a very limited budget relative to the program scope.

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SOCIAL AND ECONOMIC BENEFITS

Algonquin College has been a cornerstone of Perth and Lanark County for decades. The Algonquin College Perth campus was in desperate need of a new modern facility to continue serving the community and students. They also had a vested interest in creating a building that could be a legacy to their heritage carpentry, masonry and advanced housing programs. These programs are an integral part of the community's success as masonry and carpentry projects completed by students are found throughout Perth and the surrounding Lanark County. The new state-of-the-art student focused facility ensures the continued success Algonquin, their programs, and the community involvements, by providing students with an intimate, friendly, modern and healthy setting for learning in a hands-on environment. The entire community also benefits as the new building also provides meeting places for numerous local groups and businesses.

ALGONQUIN COLLEGE

LANARK COUNTY

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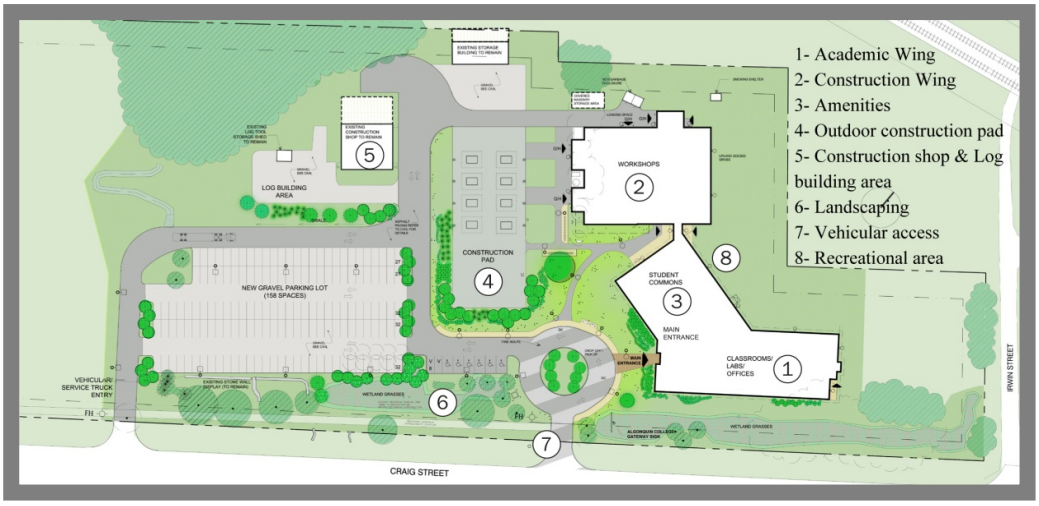
ENVIRONMENTAL IMPACT

The Algonquin Perth Campus Renewal addresses sustainability in a number of ways thanks to its environmentally-responsible design and sustainable building practices. From an energy standpoint, it is estimated that the new building's energy efficient design will result in over 270 tons of CO_2 in greenhouse gas reductions compared to a conventionally-designed building. This has been accomplished by reducing the natural gas demand by over 50% and by reducing the electrical demand by over 45% compared to a conventional building. To further reduce its carbon footprint, the college purchased renewable energy credits equivalent to 50% of its energy demand for the first 2 years. Protection of the ozone is accomplished by not using CFC-based or HCFC-based refrigerants in any of the mechanical equipment. The building also has a dust collector to capture particulate matter from the technical shops.

Water management and conservation are addressed through a number of strategies. For one, the sustainable stormwater management and site maintenance strategies implemented reduce the amount of suspended solids and minimize pollution and eutrophication of waterways from excess nutrient pollutants such as nitrogen and phosphorus. To reduce the amount of potable water used, the building includes a rainwater harvesting system that captures enough rainwater from the roof for nearly half of the sewage conveyance needs. The water use demand is also very low thanks to low-flow plumbing fixtures including duel-flush toilets, low-flow urinals of only 0.9 LPF, 1.9 LPM lavatory faucets, and 5.6 LPM showerheads. The site is also covered with drought tolerant landscaping native or adaptive requiring no irrigation. All these water-conserving strategies combine for an estimated water use reduction of greater than 60%.

The architectural and structural design also helped reduce the environmental impact of the building by favoring locally sourced building materials with recycled content; a low embodied energy, wood based structure made from lumber certified by the Forestry Stewardship Council; and low-emitting materials with little to no volatile organic compounds.

The design also focused on providing an improved indoor environment for the building occupants. This was accomplished through a variety of initiatives including: generous availability of natural daylight and views to the outside; open, inviting spaces; selective sourcing of materials to reduce effects from off-gassing; operable windows to increase options for fresh air; and improved and effective outdoor air delivery. All of which combines to ensure better indoor air quality, health and well-being of the occupants.



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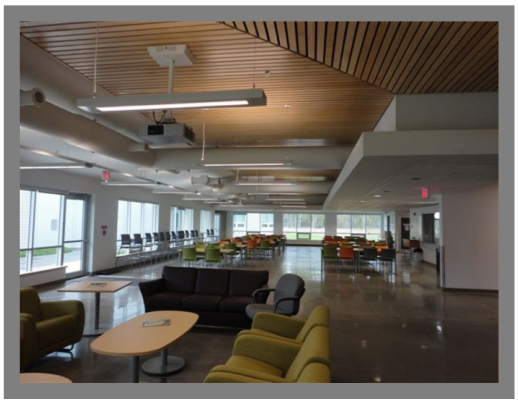
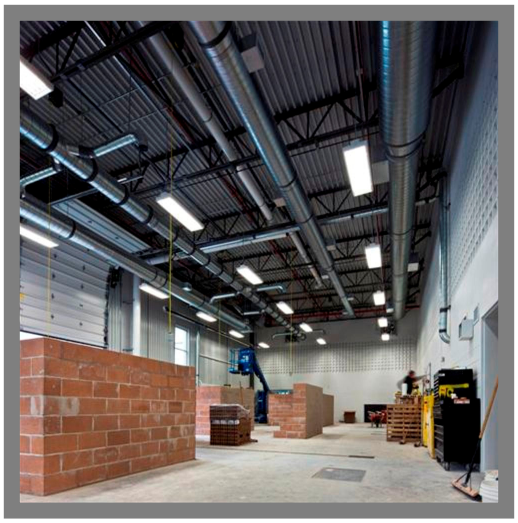
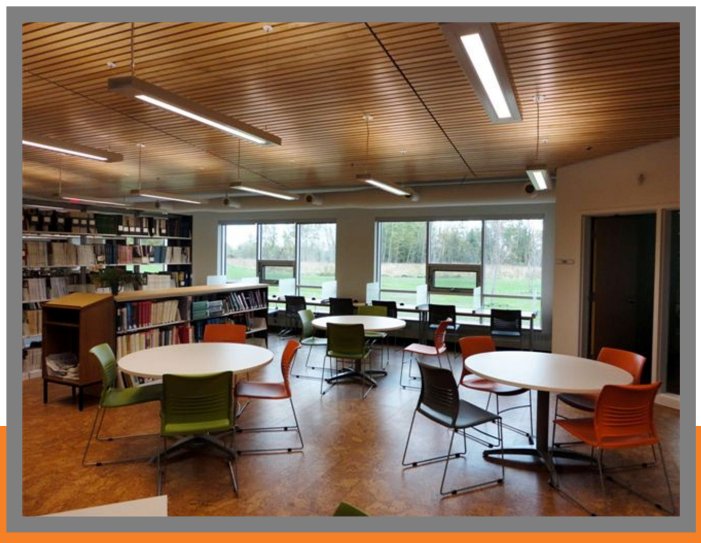
MEETING THE CLIENT'S NEEDS

From the early stages, Algonquin College established that their new Perth Campus would be a student focused learning facility integrated with the community, featuring traditional materials, and exemplary sustainable design. They also wanted a building that would make a statement of permanence, foster innovation, and remain flexible to respond to the needs of the local community, while drawing students locally and from afar. There was also a strong desire for the new facility to fully embrace and incorporate the latest in the spirit of sustainability and energy efficiency. To make this visioning a reality, GENIVAR and the remainder of the design team collaborated in an integrated design process including numerous design charettes involving student, community, teaching and administrative stakeholders. This process, along with the attention to detail of all involved resulted in the successful construction of the community's first LEED® Gold-certified building.

ALGONQUIN COLLEGE







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