MORRISON HERSHFIELD

WII GYEMSIGA SIWILAAWKSAT STUDENT BUILDING TERRACE, BC

COAST MOUNTAIN COLLEGE

Photo Credit: CMTN & Bruce Denis

2022 CANADIAN CONSULTING ENGINEERING AWARDS
CATEGORY: A. Buildings

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CANADIAN CONSULTING engineer

WII GYEMSIGA SIWILAAWKSAT STUDENT BUILDING

LOCATION: Terrace, British Columbia

COMPLETED BY: 2021

TO BE ENTERED IN CATEGORY: A. Buildings

FIRM NAME: Morrison Hershfield

ROLE IN THE PROJECT: Building Envelope Consulting and Energy Modeling, including Thermal Comfort Analysis and Building Envelope Airtightness Testing.

>> Wii Gyemsiga Siwilaawksat Exterior Envelope.
Photo Credit: CMTN & Bruce Denis

SUMMARY

Wii Gyemsiga Siwilaawksat Student Building is a new, state-of-the-art residence at Coast Mountain College's campus in Terrace, BC. The building integrates light wood framed modular student housing units with a site-built, mass timber central atrium. It embraces First Nations' culture and exceeds goals for durability and energy efficiency. Morrison Hershfield's extensive energy modeling and rigorous airtightness testing resulted in a high-performing building envelope that contributes significantly to the new residence being net-zero ready. It exceeds BC Energy Step Code 4 energy efficiency requirements in a particularly cold Northern Coastal Climate.

Q.1
INNOVATION

The Wii Gyemsiga Siwilaawksat Student Building replaces four aging student housing buildings at Coast Mountain College's campus in Terrace, BC. The existing buildings were constructed in the 1970s and were beyond their useful life.

The new three-storey 230,000 SF building embraces First Nations culture and exceeds goals for durability and energy efficiency. The building combines light wood framed modular student housing units grouped around a site-built, mass timber central atrium. It houses a large cultural space, 108 student rooms, two visitor suites, an elder suite, two shared kitchens, two collaboration areas, a cultural room, a computer lab, an esports room, two shared kitchens and bike storage.

The College engaged a design-build team to deliver this new and innovative volumetric modular and mass timber hybrid student building under a fast-tracked design-build model. Morrison Hershfield was retained by the Prime Consultant, hcma Architect+Design, for building envelope and energy modeling on the project, including thermal comfort analysis and building envelope airtightness testing. The team worked collaboratively to deliver a cost-effective, highly efficient building on an accelerated schedule and on budget.

The fast-tracked design and construction phases required adaptable high-performance building envelope assemblies meeting precise thermal performance and airtightness targets.

>> Airtightness Testing

By integrating the energy consulting process with the design process, a larger variety of design options and choices for achieving (and exceeding) energy performance targets were available early in the design, for cost impact comparisons. Key envelope, mechanical and electrical parameters for energy efficiency were optimized with a focus on providing practical solutions for integrating the unconventional structure.

Extensive energy modeling and rigorous airtightness testing resulted in a high-performing building envelope that contributes significantly to the new residence being net-zero ready. Thermal component modeling was undertaken to input assembly performance and overall thermal bridging impact into the energy model. Since two very different types of construction were used, there were many more assemblies than conventional construction. In many ways there were two variations of a typical assembly with different r-values, which eventually came together onsite. Integration was necessary to meet the performance targets for this project.

Wii Gyemsiga Siwilaawksat satisfies the BC Wood First Act and exceeds the energy efficiency threshold for BC Energy Step Code 4 in a particularly cold, Northern Coastal Climate (Zone 6) - notable for a new building designed and constructed on a fast-tracked schedule using a non-conventional design approach. Technical excellence, innovation and exceptional collaboration were required to maximize the potential of this impressive building, designed and built in 17 months.

Wii Gyemsiga Siwilaawksat satisfies the BC Wood First Act and exceeds BC Energy Step Code 4 energy efficiency for a Northern Coastal Climate.

Photo Credit: CMTN & Bruce Denis

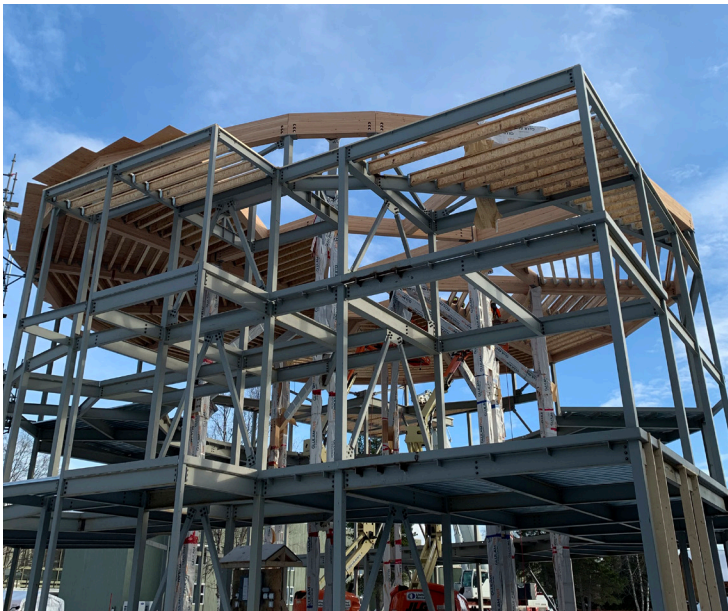
Q.2

COMPLEXITY

The fast-tracked design build of the Wii Gyemsiga Siwilaawksat Student Building represents a non-conventional approach to construction, integrating wood framed modular units with a mass timber atrium. The modular portion of the building envelope was partially completed in the factory, then tied into the atrium and finished onsite. Innovation and extensive collaboration were integral to achieving the ambitious energy target of Step Code 4 and other project goals.

Building envelope: The building envelope of the volumetric modulars was partially completed in the factory and tied into the atrium and finished onsite. The envelope encompasses the site-built structures and volumetric modulars having proprietary structurally insulated wood/metal panels (SIP) for floors and roofs. Air, vapour and moisture control detailing improvements were needed to integrate proprietary SIP panels with the conventional envelope system and coordinate various high-performance assemblies to reduce thermal bridging between site built and factory-built construction.

As an example, the modular SIP roofs were both the interior ceiling finish and partial thermal barrier. An air and vapour barrier was installed above in conjunction with additional insulation completing a conventional roof assembly. Interior air and vapour control was critical, especially where the assembly transferred across the corridors and stair cores, which were infilled between the modulars after they were stacked. Thermal performance calculations were completed to inventory the thermal bridging of assemblies and predict the effective performance to be constructed. High-performance building envelope detailing was achieved through enhanced planning and review.



Cladding design: The cladding design consists of custom metal brake-shape profiles in repeated patterns forming the closed joint rainscreen system. Fabrication, sequencing and flashing details were developed and coordinated on-site to complete the façade – building envelope. Energy modeling optimized design and justified an aggressive low air leakage target to reduce cost and simplify exterior insulation and cladding connections.

Site-Specific Foundation: An unconventional and innovative site-specific foundation was designed for airtightness and constructed as an above-grade insulated void system for the residential wing volumetric modulars and aligned to the raised slab on compacted fill for the central atrium assembly. This enabled a rapid start to construction and fast-tracked approvals to start modular manufacturing.

Energy modeling & thermal component modeling: Integral to achieving high-performance, optimizing the design and justifying an aggressive low air leakage target to reduce cost and simplify exterior insulation and cladding connections. Many thermal performance scenarios were analyzed (using PathFinder) to find trade-offs to rationalize the range of target metrics. For example, various exterior insulation depths and clip systems were compared with varying levels of airtightness to formulate the final design which balanced performance with cost.

Building Envelope Airtightness: The BC Building Code requires building envelopes to have continuous air barriers. The integrity of assemblies, materials, and sealants that come together to form the building's air barrier can only be measured with a building envelope airtightness test. Rigorous whole building airtightness testing required extensive planning and coordination. Early construction planning guidance/site visit audits, and training months in advance ensured successful onsite execution. The airtight building envelope was verified by airtightness (blower door) test conducted in compliance with ASTM E779 standards.

Building envelope airtightness testing was conducted immediately prior to occupancy to confirm that Step Code 4 energy efficiency was achieved. It is notable that the project achieved near Passive House level of airtightness without using Passive House certified systems, materials or products.

STRATEGIC APPROACH

A strategic approach to achieving project milestones allowed design to progress quickly so that onsite and offsite construction could occur simultaneously.

- Air barrier terminations were pre-stripped in the modular factory and tied into on site.
- The Atrium building and the entire shared foundation was constructed before the modulars arrived onsite, and the residential corridors and stair cores were infilled after.
- Innovative site-specific foundation design enabled rapid start to the construction, avoiding winter delays and fast-tracking the approvals for the start of modular manufacturing.
- Building envelope of modulars was partially completed in the factory (Edmonton, AB) and finished onsite.

Q.3

SOCIAL AND/OR ECONOMIC BENEFITS

Wii Gyemsiga Siwilaawksat translates to "where learners are content or comfortable." The new student building strikes a balance between reflecting First Nations culture and modern construction that achieves energy standards close to Passive House targets.

The building provides energy efficient, comfortable, culturally supportive and affordable on-campus student housing, a priority for Coast Mountain College. Its high-performance envelope, with an air barrier of high integrity, plays a vital role in lowering the building energy expenditure on HVAC, reducing utility bills, reducing noise and better managing indoor temperature for improved comfort.

Wii Gyemsiga Siwilaawksat student building exceeds the threshold for BC Energy Step Code 4, meeting advanced energy efficiency standards using low carbon building materials key to British Columbia's long term climate strategy (CleanBC). The project matched leading edge construction technology with a significant First Nations consultation process to ensure a culturally supportive environment, as 21 of the 34 communities the College serves are Indigenous. The central atrium acts as a modern Longhouse for celebrations. The artwork in the building tells the story of First Nations in the region and was completed by students, alumni and instructors affiliated with college.

One student commented that students staying in residence deserve safe, comfortable and healthy housing.

"Mental health and study capabilities drastically improve for students when they can sleep and live safely and comfortably. I'm excited to see how the new facilities will help Coast Mountain students." Lenda Girard, Coast Mountain College Student Union organizer.

Q.4

ENVIRONMENTAL BENEFITS

Buildings are a significant consumer of energy. Incorporating energy efficient design strategies early in the design process allows for a significant reduction in energy use. Integrating the energy consulting process with the design process offers choices for achieving (and exceeding) energy performance targets and allows for the optimization of key envelope, mechanical and electrical parameters, The result is a building that exceeds BC Energy Step Code 4 energy efficiency in a particularly cold, Northern Coastal Climate (Zone 6).

Wood is a natural, renewable and sustainable construction material. Building with wood makes good sense from an economic, environmental and aesthetic point of view. The student building combines wood-framed volumetric modulars and heavy timber and satisfies the BC Wood First Act.

Wii Gyemsiga Siwilaawksaat Student Building achieved energy standards close to Passive House building targets and is net zero ready.

Energy-saving design strategies include:

- High performance envelope with triple-glazed windows. Thermal comfort analysis informed design strategies to mitigate summer overheating since there is no air conditioning in suites.
- Significant attention to thermal bridging mitigation of walls (R-22.5 effective).
- Minimum R-40 roof.
- Extremely airtight, high performing building envelope.
- Greenhouse gas emissions savings using electric baseboards in suites, coupled with substantial load reductions from an efficient envelope and heat recovery savings to minimize energy use and heating load.
- Ventilation air heat recovery in suites and atrium.
- Natural and high-performance lighting.

The final-construction Wii Gyemsiga Siwilaawksat Student Building envelope airtightness in terms of air permeability at 75 Pa, was measured to be 0.25 L/s/m^2 (0.05 CFM/ft^2) @ 75 Pa.

Photo Credit: CMTN & Bruce Denis

Q.5

MEETING CLIENT'S NEEDS

Wii Gyemsiga Siwilaawksat Student Building is an innovative and culturally supportive facility that benefits Coast Mountain College students, staff, visitors and the entire community. The design-build was successfully delivered within a tight occupancy schedule using non-traditional construction that combines modular wood frames and mass timber. The building envelope airtightness achieved for the new residence greatly exceeds the airtightness targets for Step Code 4 compliance with the BC Energy Step Code for a Northern Coastal Climate.

A strategic approach to achieving project milestones allowed design to progress quickly so onsite and offsite construction could occur simultaneously. Air barrier terminations were pre-stripped in the modular factory and tied into on site. The Atrium building and the entire shared foundation was constructed before the modulars arrived onsite, and the residential corridors and stair cores were infilled after. Innovative site-specific foundation design enabled rapid start to the construction, avoiding winter delays and fast-tracking the approvals for the start of modular manufacturing. The building envelope of the modulars was partly completed in the factory (Edmonton, AB) and finished onsite.

Wii Gyemsiga Siwilaawksat welcomed students in January 2022.

Energy efficiency, durability and high-quality construction were key considerations. The resulting state-of-the-art facility exceeds goals for durability and energy efficiency and provides students with a comfortable and culturally supportive home away from home. The new residence is net-zero ready thanks in large part to the resulting high-performance building envelope, achieved through extensive energy modeling and rigorous airtightness testing.

MORRISON HERSHFIELD