



EXECUTIVE SUMMARY

Completed in 2017, Brock Commons Tallwood House is an 18-storey, 404-bed student residence located at the University of British Columbia in Vancouver, BC. The project is the first to be completed under the 2013 Tall Wood Building Demonstration Project Initiative sponsored by Natural Resources Canada.

At 53 metres, Brock Commons is the world's tallest mass timber tower. The LEED v4 Gold target project aspires to be a model for a future that features extraordinarily ordinary mass wood buildings that are quick, clean and cost effective to construct and that maximize carbon sequestration and the reduction of greenhouse gas emissions.

At 2,233 cubic metres, the building utilizes an extraordinary amount of timber that stores 1,753 metric tons of carbon dioxide and avoids the production of 679 metric tons of greenhouse gas emissions, which is equivalent to taking 511 cars off the road for a year. Another extraordinary achievement is the innovative project demonstrates that a mass wood building can be comparable in cost to a traditional concrete building.

Sustainable strategies include renewable and regional available resource; carbon sequestration; lighter structure requiring smaller foundation and therefore fewer materials; prefabrication capabilities, faster installation and reduced construction waste; and deconstructability, reuse and recycling potential.



9 weeks of construction

Strategic Decisions

Brock Commons Tallwood House is extraordinary for the speed at which its glue laminated columns, cross laminated floor panels, and prefabricated facade were erected—in just 66 days, at a rate of two floors per week.

Mass wood construction is in its infancy. For the industry to grow and evolve, tall timber buildings must become commonplace and ubiquitous, which will only happen if they are affordable to design and to build. To be truly environmentally meaningful, mass wood structures must be incorporated into buildings of all types and sizes, from the audacious to the everyday, whether the wood structure is exposed or not.

Using a “keep it simple” design approach, the innovative mass timber structural system proved to be economically viable, repeatable, and adaptable to other building types and uses. The project was delivered on time and on budget, demonstrating that encapsulated mass timber buildings can be constructed quickly and economically, while delivering significant environmental benefits.

The total construction cost was \$40.5 million or \$248/gsf, which includes a 7% first of its kind innovation funding premium. When the premium is deducted, the cost is \$37.5 million or \$230/gsf. At completion, a comparable concrete building would have cost \$232/gsf. Price parity is within reach. It will be the continued evolution of extraordinarily ordinary tall wood buildings that will be the foundation upon which mass wood will make a genuine and meaningful contribution to the future sustainability of cities.

Energy

Brock Commons targets LEED v4 Gold certification, conforms to ASHRAE 90.1-2010 and has a building energy target set by the UBC Sustainability Office of 135 kWh/m²/year. The building is connected to the UBC District Energy System (DES), which supplies heating for the service water heating and ground floor amenity spaces. Heating for the resident units is provided by electric baseboard. The energy supplied by the DES accounts for 63% of site energy use with 30% of the heat coming from the Bioenergy Research Demonstration Facility (BRDF). The BRDF facility provides 5% of campus electrical needs, which means 5% of the electricity used is from a renewable source.

LED lighting is utilized throughout to reduced energy use and maintenance. Dual technology low voltage sensors ensure lights are turned off when no motion is detected, and indoor photo sensors control lighting zones adjacent to windows when sufficient natural light is available. Occupancy sensors installed in corridors and stairwells turn off 50% of the lighting when the spaces are unoccupied.



cross laminated panels



glulam columns



mass wood structure

Materials & Resources

The wood used at Tallwood House was sourced from B.C.'s sustainably managed forests, where less than one third of one per cent of public forests are harvested annually, with a legal requirement to regenerate all harvested areas. Mass wood construction helps reduce greenhouse gas emissions created by the built environment since wood stores carbon and is less carbon intensive to produce than other building materials.

Regional materials usage by value was 38%, recycled materials content was 19%, and 76% less waste was generated compared with similar type projects on campus.

Life Cycle

The high attention to the life cycle of Brock Commons resulted in a building with a holistically low carbon footprint, both on the embodied as well as on the operational life cycle stages. When using ATHENA to perform a 60-year cradle-to-grave Life Cycle Analysis, Brock Commons demonstrates an exceptionally low embodied carbon intensity of 236 kg CO₂-eq/m² Global Warming Potential (GWP). Compared to a similar, conventional concrete structure, Brock Commons achieved 43% savings on GWP, 60% on Ozone Depletion Potential, 47% on Eutrophication Potential and 35% on all other environmental indicators, achieving exemplary performance on LEED v4 Materials and Resources Credit 1.

The mass wood structure is comprised of five-ply, 169mm thick, CLT panels supported on 265mm x 265mm glulam columns (265mm x 215mm above the 9th floor) on a 2.85 metre by 4.0 metre grid. The CLT panels act as a two-way slab diaphragm, which eliminates the need for load-carrying beams. To avoid a vertical load transfer through the CLT panels, a steel connector allows for a direct load transfer between the columns and provides a bearing surface for the CLT panels.

The facade consists of 22 steel stud-framed prefabricated panels per floor, typically measuring 8 metres wide by 2.7 metres high, for a total of 374 panels. The windows

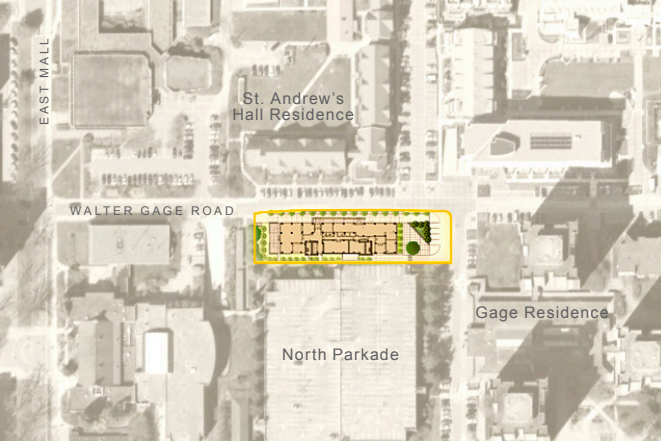
are preinstalled into the facade, which are clad with high pressure laminate panels manufactured with 70 percent wood fibre and thermosetting resins. The mass wood structure and facade were erected by a crew of nine workers in 66 days. There are 29 CLT panels per floor for a total of 464, with 78 glulam columns per floor for a total of 1,302.

The use of prefabricated timber and steel construction components ensures flexibility of use and adaptability to other functions over the life of the building, after which demountability, repurposing, and recyclability of the components will be achieved.

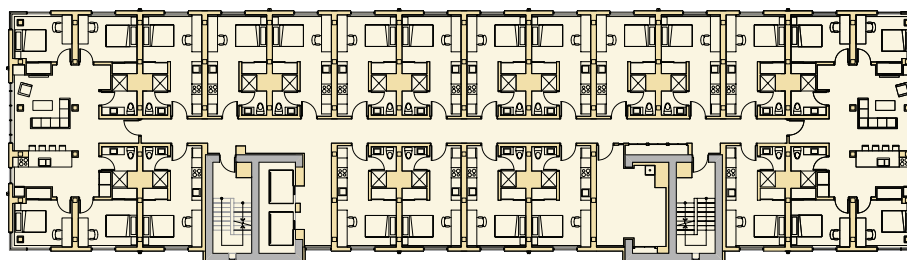
Education & Information

A key mandate of the UBC Campus as a Living Lab Initiative is to support education and learning opportunities with others. For Brock Commons Tallwood House, education and outreach took on multiple forms. A research team, led by a UBC Sustainability Initiative, studied the design, construction and performance of the project, interviewing project team members and compiling documentation. The information was used to produce case studies, fact sheets, construction timelapse videos, and education modules that were completed with the support of Forestry Innovation Investment and hosted on their website at: www.naturallywood.com/emerging-trends/tall-wood/ubc-brock-commons.

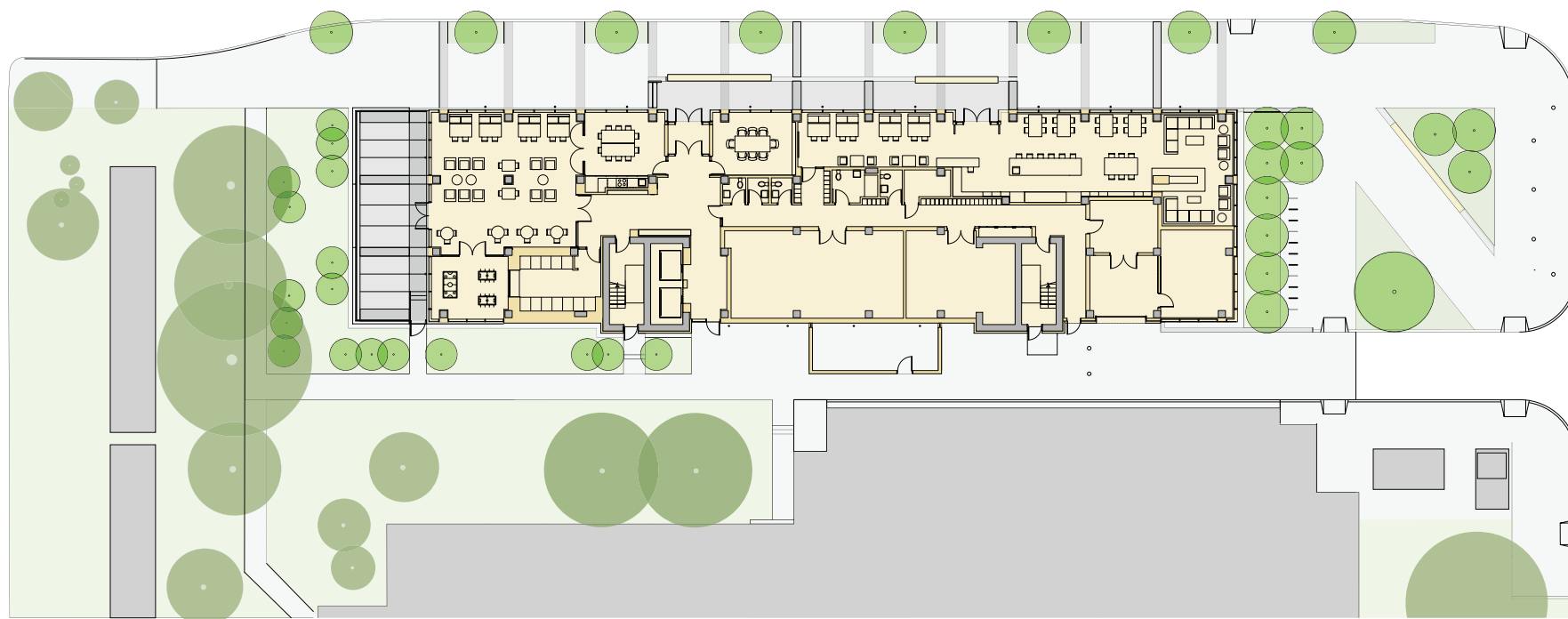
During construction an education and outreach centre was established adjacent to the site. The centre contained models, storyboards, a full-size detail of the mass timber connection detail, an interactive 3D PDF, fact sheets and case studies about the project. Over 1,300 people from around the world visited the centre, including government officials, design and construction professionals, forestry industry representatives, academics and students. Information on Brock Commons is now included in UBC's sustainable building tours. A permanent display of the models and information boards is set up in the building. Project team members and UBC staff regularly present at academic and professional conferences.



context

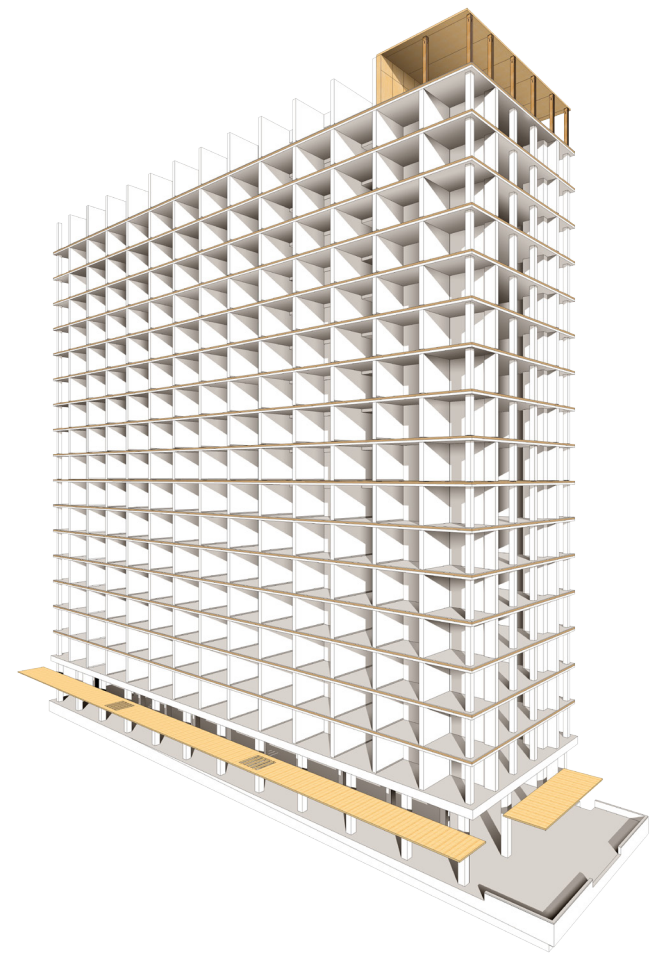
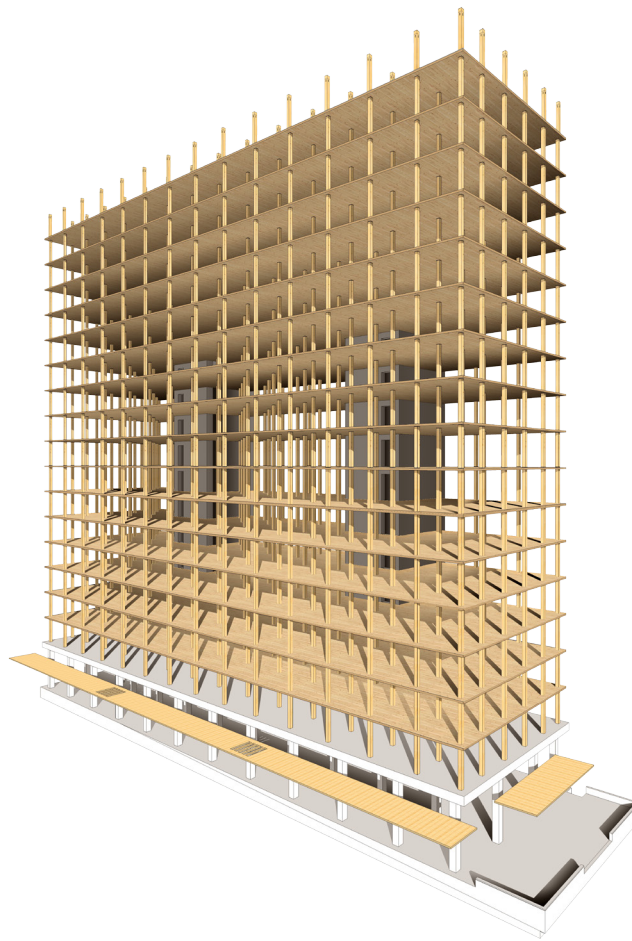


plans





encapsulation





prefabricated facade



entry



amenity







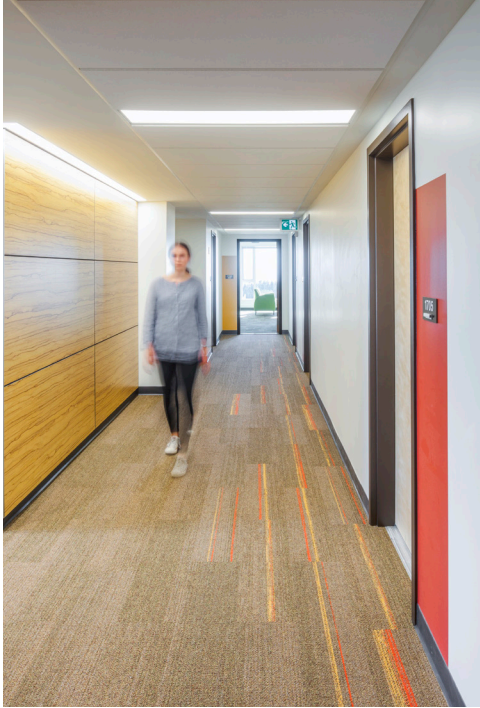
upper lobby



quad kitchen



quad bedroom



circulation



studio bedroom



studio kitchen

