BROCK COMMONS TALLWOOD HOUSE: EXTRAORDINARILY ORDINARY

World's Tallest Mass Timber Tower

At 18 storeys and 53 meters in height, Brock Commons Tallwood House is a 404-bed student residence building located on The University of British Columbia Point Grey campus in Vancouver, BC, Canada that officially opened for students in July of 2017. The project is the first completed in Canada under the 2013 Tall Wood Building Demonstration Project Initiative sponsored by Natural Resources Canada. Brock Commons 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 which maximize carbon sequestering and reduction of greenhouse gas emissions in cities.

Extraordinary for its height—which makes Brock Commons the world's current tallest mass timber tower—the building is also extraordinary for the speed at which its structure of glue laminated timber, cross laminated timber (CLT), and prefabricated facade went up in only 66 days. At 2,233 cubic meters, the building utilizes an extraordinary amount of timber that stores an impressive 1,753 metric tons of carbon dioxide and avoids production of 679 metric tons of greenhouse gas emissions. Another extraordinary achievement is that the innovative project demonstrates a mass wood building can be comparable in cost to a traditional concrete building.

To make the building possible the provincial government of British Columbia issued a site-specific regulation that allowed Brock Commons to use mass timber in a high-rise application, which resulted in a building that is even more resistant to fire than an equivalent concrete or steel tower. Russell Acton, principal of Acton Ostry Architects states, "Key to receiving approvals and realizing economic viability for the timber tower was a "keep it simple" design approach that makes the building appear ordinary—extraordinarily ordinary—through the encapsulation of the wood structure with gypsum board."

The rectilinear slab-form reflects the massing and character of existing Modernist buildings on the UBC campus. The facade is made up of prefabricated panels with pre-installed windows. There are four distinct L-shaped corner panels with corner-wrapping windows. A high-pressure laminate cladding, consisting of 70 per cent wood fibers and thermosetting resins, creates a pattern of alternating light wood and charcoal-coloured vertical striations. A metal cornice crowns the building.

Social and study spaces are located at the ground floor level and at the uppermost floor where the glulam column structure has been left exposed. An extensive CLT canopy runs the length of the curtain wall base, revealing the warm wood finishes of the amenity spaces within. The elevator lobbies at the student living levels are clad with the same material used at the exterior. Hallway finishes feature natural wood doors and a palette of rich umber and ochre carpet and paint accents. The 305 studio and quad-unit interiors are spare and simple with bright white finishes and warmly-hued carpet and countertops. The quintessential west coast ocean and mountain views are spectacular.

The growth of mass wood in the building industry is still in its infancy and will require time to achieve comparable resolution of design, construction and cost optimizations that have evolved over decades for concrete and steel. For the industry to grow, mass wood buildings must become a genuine option and preferred choice for owners, architects, developers and builders; they must be affordable to design and to build. Russell Acton explains, "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 is exposed or not." Acton concludes, "It will be the continued evolution of simple, straight forward, extraordinarily ordinary mass wood buildings, such as Brock Commons, that will be the foundation upon which mass wood will make a genuine and meaningful contribution to the future sustainability of our cities."

Brock Commons Tallwood House was designed by Acton Ostry Architects of Vancouver, BC with Architekten Hermann Kaufmann of Austria as tall wood advisors, Fast + Epp as structural engineers and GHL Consultants Ltd. as fire science and building code consultant. The project development manager was UBC Properties Trust and construction management was by Urban One Builders.

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Structure

The structural system is a hybrid consisting of a one storey concrete podium, two concrete cores and 17 storeys of mass timber topped with a prefabricated steel beam and metal deck roof. Vertical loads are carried by the timber structure, while the two concrete cores provide lateral stability. The mass wood structure is comprised of five-ply, 169mm thick, CLT panels supported on glulam columns on a 2.85 x 4m 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.

Construction

To test the speed and efficiency of the erection of the mass timber structural system, a full-scale, two-storey, proof of concept mock-up was constructed in July 2015. Erection of the structure went smoothly and assembly proved to be faster than was initially projected.

The concrete foundation and ground floor structure, transfer slab and two free-standing cores were constructed in 2016 during the winter and in advance of the wood structure, which was erected during the summer in 66 days at a rate of two floors plus prefabricated facade per week and resulted in four months of time savings for the overall construction process.

Cost

In 2017, the construction cost for a comparable building with a concrete structure was approximately $215 per square foot. Brock Commons was constructed for approximately $230 per square foot, which is well in alignment with market costs for such a building type. The additional cost is attributable to an innovation premium associated with constructing a first-of-its-kind building. It is anticipated that construction costs will reduce over time as approval requirements for mass wood structures are adopted in future building codes, there is greater competition in the mass wood building supply industry, and comparable resolution and optimization of design and construction considerations evolve to the level that already exists for concrete and steel.

Sustainability

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/m^2/year. The building is connected to the UBC district energy system, which supplies heating for the ground floor amenity spaces, while heating for the resident units is provided by electric baseboard heaters. The carbon stored in the mass timber structure, plus avoided greenhouse gas emissions, results in a total estimated carbon benefit of 2,432 metric tons of CO_2, which is equivalent to taking 511 cars off the road for a year. In comparison to typical construction, there was 65% less waste produced, recycling was 94% efficient, and trucking was 87% less. The wood used is replenished by Canadian and U.S. forests in just six minutes.

Approvals Process & Fire Safety

Brock Commons required a site-specific regulation from the British Columbia Building Safety & Standards Branch. A conservative structural and fire safety design was utilized to facilitate the approval process to align with the project schedule. The approval process included peer reviews involving panels of leading structural engineers, fire safety experts, scientists, authorities and firefighters. Although construction of the first floor and cores could technically be constructed utilizing mass timber, concrete was used in the interest of familiarity regarding life safety, firefighting and approvals processes.

The mass wood hybrid structure is encapsulated with multiple layers of gypsum board to achieve required fire resistance ratings and to facilitate the approvals process; excluding the wood structure at the 18th floor student amenity space, which is left exposed for demonstration purposes. Since the building is comprised of a series of repetitive, highly compartmentalized units, it is extremely likely that a fire event would be contained in the compartment in which it originated. An automatic sprinkler system with a back-up water

supply offers additional protection for occupants and firefighters for events that might originate during an earthquake.

External Funding

External funding to cover the innovation gap for the first-of-its-kind project was provided by Natural Resources Canada through the 2013 Tall Wood Buildings Demonstration Project Initiative, as well through the support of The Province of British Columbia, the Binational Softwood Lumber Council, and FPInnovations.

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Acton Ostry Architects Inc.

Tall Wood Advisor
Architekten Hermann Kaufmann ZT GmbH

Structural
Fast + Epp

Fire Science & Building Code
GHL Consultants Ltd.

Building Science
RDH Building Science

Mechanical, Electrical & Sustainability
Stantec

Mass Wood Erection
Seagate Structures

Mass Wood Supply
Structurlam

Concrete Formwork
Whitewater Concrete Ltd.

Virtual Modeling
Cadmakers Inc.

Energy Modeling
EnerSys Analytics Inc.

Acoustics
RWDI

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Geotechnical
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Construction Management
Urban One Builders

Development Management
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Owner
University of British Columbia