BROCK COMMONS TALLWOOD HOUSE

UNIVERSITY OF BRITISH COLUMBIA
VANCOUVER, B.C., CANADA

Brock Commons Tallwood House is an innovative tall wood student residence at the University of British Columbia (UBC). It is the tallest contemporary mass timber hybrid structure of its kind in the world standing at 18 storeys in height.

Photo courtesy of Brudder

HEIGHT
54 metres / 178 feet / 18 storeys

GROSS AREA
15,115 m² / 162,700 ft²

COMPLETION
August 2017

OWNER
University of British Columbia

ARCHITECT
Acton Ostry Architects Inc.

TALL WOOD ADVISOR
Architekten Hermann Kaufmann ZT GmbH

STRUCTURAL ENGINEER
Fast+Epp

FIRE SCIENCE | BUILDING CODE
GHL Consultants Ltd.

BUILDING SCIENCE
RDH Building Science

MECHANICAL | ELECTRICAL | SUSTAINABILITY
Stantec

CONSTRUCTION MANAGEMENT
Urban One Builders

PROJECT MANAGEMENT
UBC Properties Trust

CLT AND GLULAM MANUFACTURER
Structurlam Products

WOOD INSTALLER
Seagate Structures

PROJECT OVERVIEW

Brock Commons Tallwood House is a new 18-storey mass timber hybrid residence at the University of British Columbia.

As part of UBC's mandate to increase student housing on campus, Brock Commons has capacity for just over 400 upper year and graduate students. Each unit contains a kitchen and bathroom, with floorplans ranging from single bed studios to 4-bed accommodations.

Study and social spaces are located on the ground floor with a student lounge on the 18th floor, where the wood structure has been left exposed for demonstration purposes.

UBC's building requirements reflect the university's commitment to sustainability. Wood, a renewable material, was chosen in part to reflect this commitment, and the building was also designed to meet Leadership in Energy and Environmental Design (LEED) Gold certification.

Extensive construction planning and detailed coordination of the prefabricated elements and installation activities all contributed to a successful project proving the case for tall wood buildings.

Photo courtesy of Brudder

"Wood is increasingly recognized as an important, innovative and safe building material choice. This new tall wood building reflects UBC's leadership in sustainable construction and our commitment to providing our students with more on-campus housing."

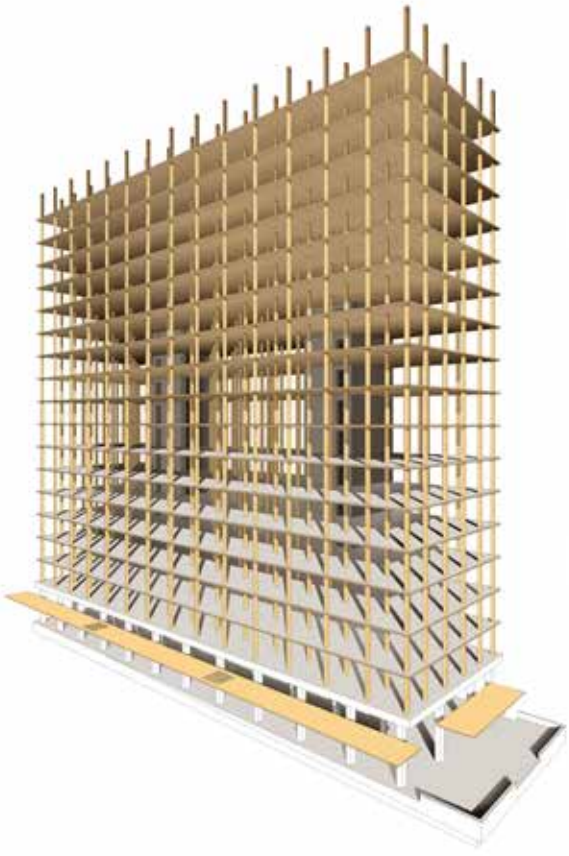
***Santa J. Ono**, President,*
University of British Columbia

BUILDING AND STRUCTURE

Brock Commons is a hybrid structure, comprised of 17 storeys of mass timber construction above one storey of concrete and two concrete stair cores serving all floors. The podium level is wrapped with curtain wall glazing and glass spandrel panels. An extensive cross laminated timber (CLT) canopy runs the length of the building.

The floor structure is comprised of 5-ply CLT panels supported on glue laminated timber (glulam) columns on a 2.85 X 4.0 metre grid. This results in the CLT panels acting 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 also provides a bearing surface for the CLT panels.

The roof is made of prefabricated sections of steel beams and metal decking, with the roofing membrane pre-applied to achieve quick water tightness during construction. The building envelope is a prefabricated panel system clad with wood fibre high-pressure laminate.

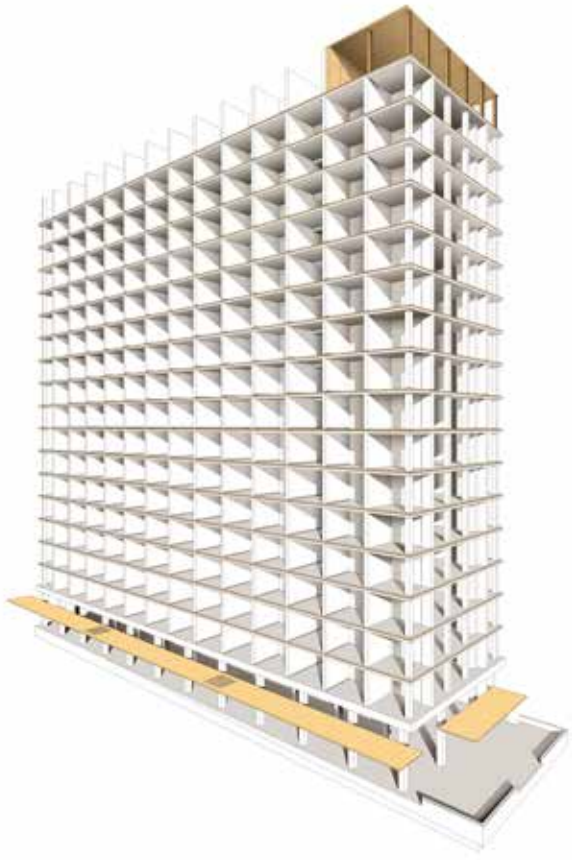


mass timber hybrid structure and concrete core

CLT floor slabs with glulam columns and steel connectors

partial encapsulation during construction

completed construction



encapsulated structure

Rendering courtesy of the University of British Columbia and Acton Ostry Architects Inc.

The overall simplicity of the design of Brock Commons is broadly recognized as being key to the affordability, safety and efficient construction of the building.

SAFETY AND PERFORMANCE

The fire safety design of Brock Commons underwent a peer-review process involving a panel of leading fire safety experts, scientists, authorities having jurisdiction and firefighters.

In a fire, heavy timber chars on the outside, while retaining strength, slowing combustion and allowing time to evacuate the building. Brock Commons has been designed to meet the one and two hour fire ratings required for this type of building, exceeding fire standards for a concrete or steel structure.

The CLT and glulam components used in the project have been enhanced through complete encapsulation, with three to four layers of fire-rated Type X gypsum board, dependent on location.

The building is comprised of a series of repetitive, highly compartmentalized small rooms so that in the event a fire originates in one suite, it is extremely likely the fire would be contained in the compartment in which it originated. A back-up water supply and emergency power supply is installed so the sprinkler system will function even if the building loses its standard water and electrical supply, such as in the event of an earthquake.

From a seismic perspective the building exceeds code requirements. The concrete cores will provide resistance to the lateral loads while the lighter weight of the mass timber structure will result in the building experiencing lower seismic forces than a conventional equivalent all-concrete building—a key considerations in a seismic zone such as coastal British Columbia.

lateral section

longitudinal section

Rendering courtesy of the University of British Columbia and Acton Ostry Architects Inc.

Photo courtesy of Brudder

BROCK COMMONS CONSTRUCTION

Aside from providing much needed student residence spaces, Brock Commons showcases mass timber as a practical building material in a high-rise application and demonstrates an innovative and sustainable way to improve the performance of buildings.

The overall simplicity of the design of Brock Commons is broadly recognized as being key to the affordability, safety and efficient construction of the building.

The design approach emphasized the project as a whole rather than viewing it as a set of separate building components, systems or applications. An integrated design process, involving the construction trades in the design process and strategically maximizing prefabrication opportunities within the building, streamlined the construction process and addressed supply chain considerations such as materials sourcing, coordination, costs, and scheduling.

Key elements of the preconstruction planning included an integrated design workshop; virtual design and construction modeling as well as a full-scale, two-storey proof of concept mock-up. The mock-up was built off-site to test and validate the construction of the hybrid structural system and prefabricated mass timber and building envelope components.

Using a crew of nine, the mass timber construction was completed less than 70 days after the prefabricated components arrived on site, approximately two months faster than a typical project of this size. Prefabrication also reduced on-site waste by about two thirds.

Construction of Brock Commons demonstrated that its innovative mass timber-hybrid structural system is economically viable, repeatable and adaptable to other building types and uses.

2 FLOORS COMPLETED PER WEEK

6-12 MINUTES TO INSTALL ONE CLT PANEL

5-10 MINUTES TO INSTALL ONE GLULAM COLUMN

BENEFITS OF MASS TIMBER CONSTRUCTION

- light weight with ability to incorporate long, unsupported span distances
- cost savings and faster speed of construction
- smaller crew sizes and safer work site
- less traffic and ability to access constricted urban sites
- reduced noise impact on neighbours
- lower environmental impact and reduced waste

"A key achievement for the Brock Commons project is the design of an innovative mass timber structural system that is genuinely economically viable, repeatable and adaptable to other building typologies and uses. This project will positively impact the wood, development and building industries in British Columbia."

***Russell Acton**, Principal, Acton Ostry Architects Inc.*

BUILDING WITH MASS TIMBER

The use of a hybrid mass timber and concrete structure was explored by the design team to assess the technical and economic viability for the project. Comprehensive analysis showed the additional cost for research, design and construction of this first of its kind building to have an "innovation premium" of approximately eight percent.

The cost differential is anticipated to decline as mass timber high rise design and construction practices become more established. External funding sources for the project fully cover the additional cost for innovation, and ensure that rental rates for suites in Brock Commons will be equivalent to other student residences of similar suite type and size on campus.

CROSS LAMINATED TIMBER

CLT is a wood panel typically consisting of three, five or seven layers of dimension lumber oriented at right angles to one another and then glued to form structural panels with exceptional strength, dimensional stability and rigidity.

GLUE LAMINATED TIMBER

Glulam is composed of dimension lumber, specifically selected and positioned based on performance characteristics, and then bonded together with durable, moisture-resistant adhesives. The grain of all laminations runs parallel with the length of the beam.

Assembly of Brock Commons CLT panels. Photo courtesy of Brudder

ESTIMATED ENVIRONMENTAL IMPACT OF WOOD USE

- Volume of wood products used: 2,233 cubic meters of CLT and Glulam
- U.S. and Canadian forests grow this much wood in: 6 minutes
- Carbon stored in the wood: 1,753 metric tons of CO_2
- Avoided greenhouse gas emissions: 679 metric tons of CO_2
- Total potential carbon benefit: 2,432 metric tons of CO_2

THE ABOVE GHG EMISSIONS ARE EQUIVALENT TO:

- 511 cars off the road for a year
- Energy to operate a home for 222 years

**Estimated by the Wood Carbon Calculator for Buildings, cwc.ca/carboncalculator.*

**CO2 refers to CO2 equivalent.*

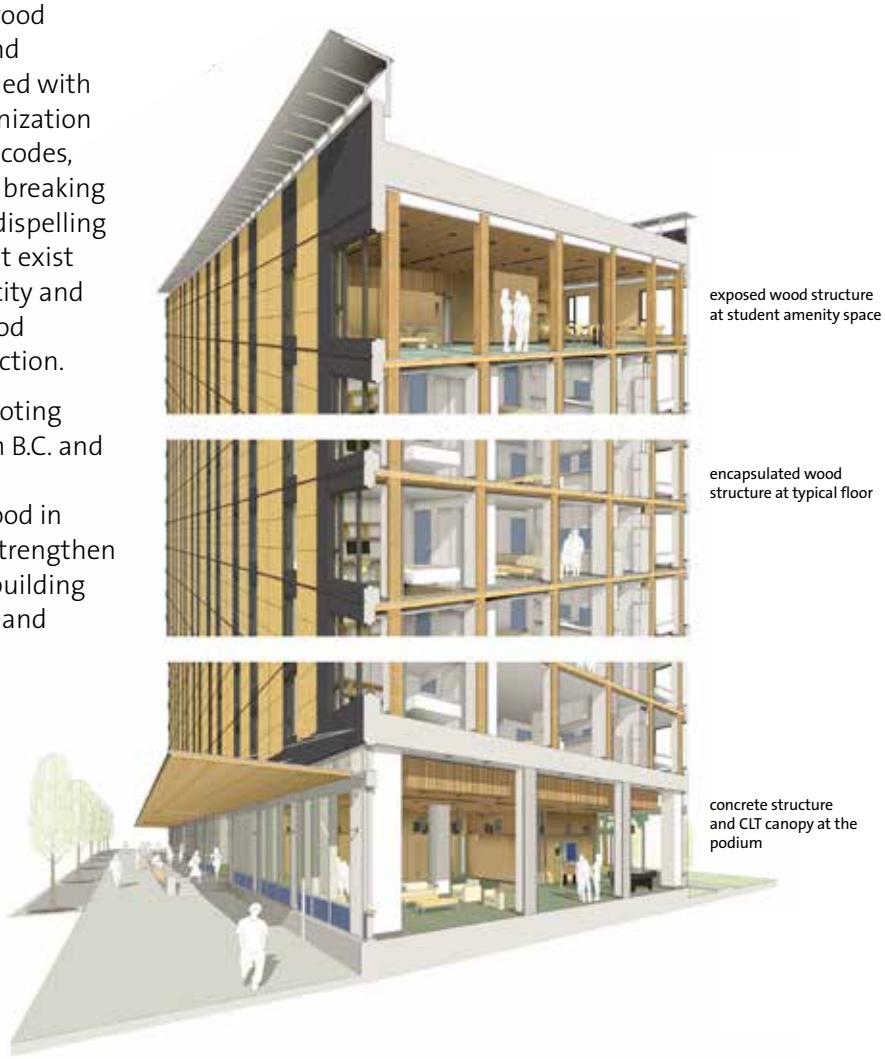
ABOUT TALL WOOD BUILDINGS

Modern mass timber products and systems such as glulam, CLT and structural composite lumber, allow us to construct taller and larger wood buildings. Around the world, 13 tall wood buildings (seven storeys or taller) are currently underway while 19 have been completed over the past five years.[1]

Wood is increasingly being recognized by the construction sector as an important, innovative and safe construction choice. The environmental benefit of tall wood buildings, through lower embodied energy and carbon stored in the wood, plays an important role in sustainable development and climate change mitigation.

Advancements in wood product research and development, coupled with the ongoing modernization of building and fire codes, contribute towards breaking down barriers and dispelling misconceptions that exist regarding the capacity and performance of wood products in construction.

Adopting and promoting these approaches in B.C. and encouraging the consideration of wood in buildings helps to strengthen the B.C. forest and building sectors both locally and internationally.



Rendering courtesy of the University of British Columbia and Acton Ostry Architects Inc.

Photo courtesy of naturally:wood

WOOD PRODUCTS AND SUSTAINABLE FORESTS

Canada is recognized as a global leader in sustainable forest management and has more land independently certified to international forest certification programs than any other jurisdiction in the world.

Certification gives added assurance that Canadian forest products are from legal, sustainable sources and are managed to consider environmental, social and economic values.

The range of engineered and mass timber products from Canada offer incredible design versatility and high-performance options for any building project, residential or commercial. B.C. is a leader in wood building systems and technologies, with projects showcased across the province. Many, such as Brock Commons Tallwood House, are garnering international attention, creating new market opportunities for B.C. wood products and building technologies.

Tall wood structures, built with renewable wood products from responsibly managed forests, such as those in Canada, can help transform a construction industry that is increasingly focused on accelerating the adoption of more sustainable practices in the built environment.

THE UNIVERSITY OF BRITISH COLUMBIA

Natural Resources Canada | Ressources naturelles Canada

BRITISH COLUMBIA www.gov.bc.ca

BSLC

Forestry Innovation Investment

Canadian Wood Council | Conseil canadien du bois

Fast + Epp structural engineers

ACTON OSTRY ARCHITECTS INC

The wood grain featured in this factsheet is Douglas fir.

FOR MORE INFORMATION

This profile is published by Forestry Innovation Investment, the Government of British Columbia's market development agency for forest products.

For more information on B.C. forests and products, and innovative use of wood in buildings, visit www.naturallywood.com.

For more information on building with wood in Canada and the National Building Code visit www.cwc.ca.

For more information on mass timber and tall wood buildings in North America and around the world, visit www.rethinkwood.com/tall-wood-mass-timber.

naturallywood.com

Endnote: [1]Looking Up: Tall Wood Buildings Around the World. reThink Wood. www.rethinkwood.com/sites/default/files/Tall_Wood_Buildings_Around_the_World_Mass_Timber_Gallery.pdf