

Construction Underway on World's Tallest Timber Tower

Construction of the 18 storey Brock Commons Student Residence at the University of British Columbia in Vancouver, Canada got underway in November 2015. When completed in the summer of 2017 the 53m tall high-rise building will provide housing for 404 students and be the tallest mass wood building in the world.

The \$51.5 million project 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 consultants.

A key mandate for the innovative project is to demonstrate the viability of mass wood structures for BC's development and construction industries. This has been achieved with a hybrid design that combines the benefits of mass wood and concrete to achieve an economical structural system that is comparable in cost to that of traditional concrete and steel structures.

Hybrid Structural System

The hybrid structural system is comprised 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.

Glulam columns with quick-to-install steel connectors provide a direct load transfer between the columns and support 5-ply cross laminated timber (CLT) panels on a 2.85m x 4.0m grid that acts as a two-way slab diaphragm, similar to a concrete flat-plate slab. The robust structure will be the first in British Columbia to be built to meet new seismic design requirements for the 2015 National Building Code of Canada.

Prefabricated Facade

The prefabricated facade is made up of 8m long steel stud framed sections with pre-installed windows. The cladding has been revised from metal to high-pressure laminate panels consisting of 70% wood-based fibers with a striated pattern of blonde wood and charcoal-coloured panels. Glazing wraps the corners to dematerialize the edges and a metal cornice crowns the building.

An extensive CLT canopy runs the length of the building base, which is wrapped with curtain wall glazing and translucent blue glass spandrel panels.

It is projected that the prefabricated mass wood structure and prefabricated facade will be erected at a rate of one floor per week, resulting in time savings for the overall construction process.



northwest view of prefabricated facade

Brock Commons Phase 1
University of British Columbia, Vancouver, Canada

Construction Strategy

A key design and construction strategy for the project was the recognition that the level of prefabrication available in British Columbia is not as extensive as that which is available in Europe. However, the speed and skill of residential trade contractors in Vancouver is considerable. In response, the design and construction approach takes best advantage of local prefabrication and trades.

Primary prefabricated components are the CLT slab panels, glulam columns, steel connectors and the facade. The prefabricated components will be erected atop a concrete base and stair cores.

Proof of Concept Mock-up

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

In addition to the steel connector component, a wood-to-wood column connection was tested and proved to be very effective; however, the columns required a larger cross section, which would have added cost to the project.

Shortly after the erection of the structural mock-up, three full-size mock-ups of potential prefabricated facade systems were installed for assessment. The systems included a wood framed panel, a steel stud framed panel, and a precast concrete sandwich panel. The steel stud facade system was selected in consideration of cost and the experience of the subcontractor.

After the first few floors of the mass wood structure and the facade have been erected, work will begin on the building systems and components housed inside the structure.

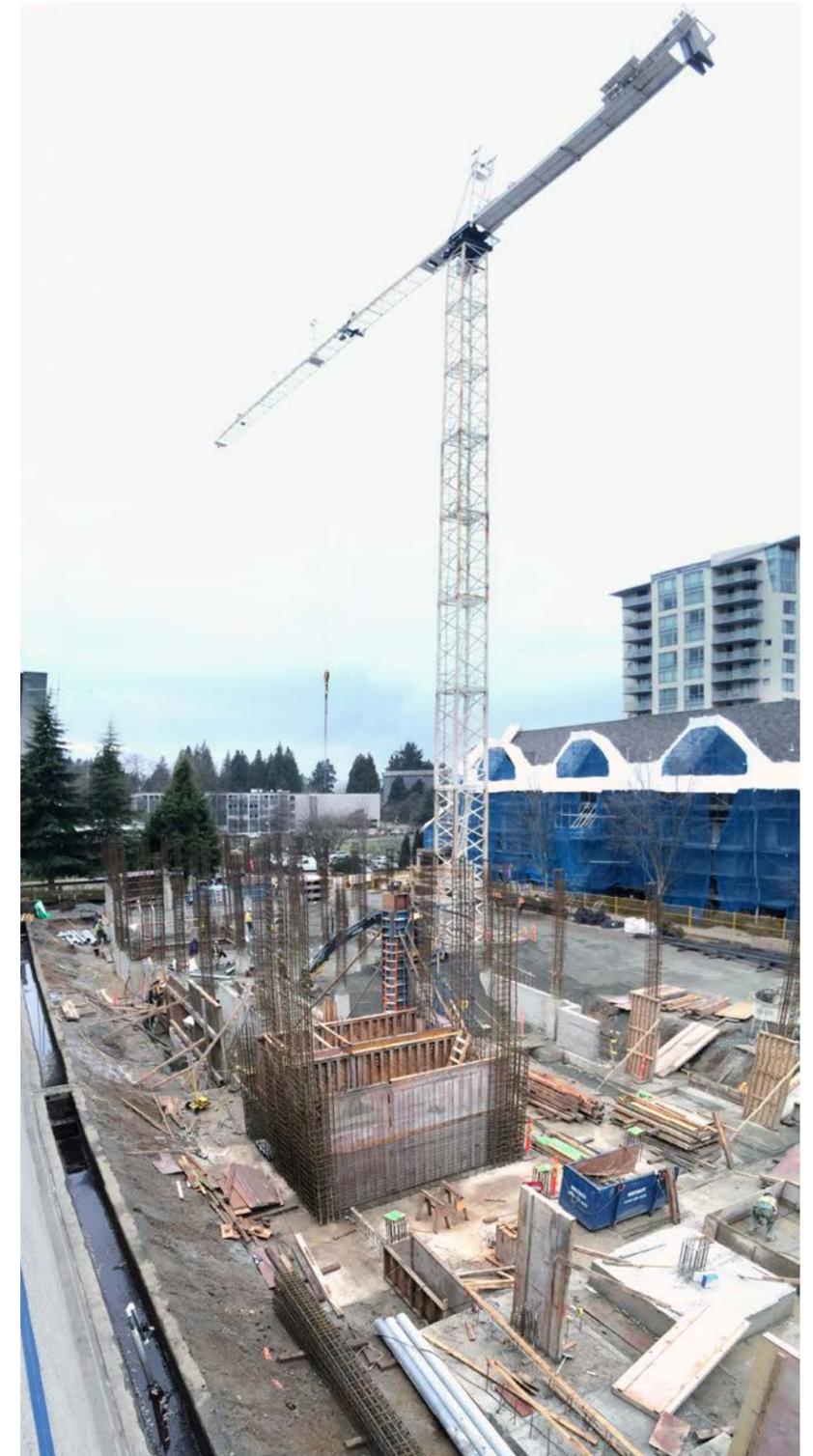
The mechanical, electrical and sprinkler systems are similar to those used for other student resident buildings on the UBC campus, with allowances made for axial shortening of the structure. The remainder of the interior systems will be constructed in a manner typical for high-rise residential buildings in Vancouver.



July 2015 glulam columns and steel connectors for mockup



July 2015 erection of mass wood structural mockup



January 2016 concrete construction underway

Approvals Process and Fire Safety

To facilitate the approvals process, strict fire protection methods were put in place for the project, arguably making it safer in terms of life safety than a comparable building with a concrete or steel structure.

Since the mass wood structure is significantly higher than the six storeys currently permitted by the building code for wood buildings, the project required a Site Specific Regulation (SSR) from the British Columbia Building Safety & Standards Branch. With the project being the first of its kind, the structural and fire safety design utilized a conservative approach to facilitate the approval process to align with the project schedule. The SSR 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, fire fighting and approvals processes.

The mass wood structure is encapsulated with multiple layers of gypsum board to achieve required fire resistance ratings and to facilitate the approvals process. The majority of wood columns are located within demising walls with a few standalone columns located at each end of the floorplate. For demonstration purposes, wood columns will be left exposed in a student amenity space located on the 18th floor.

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. To facilitate the approvals process the typical one hour fire separation between suites was increased to two hours.

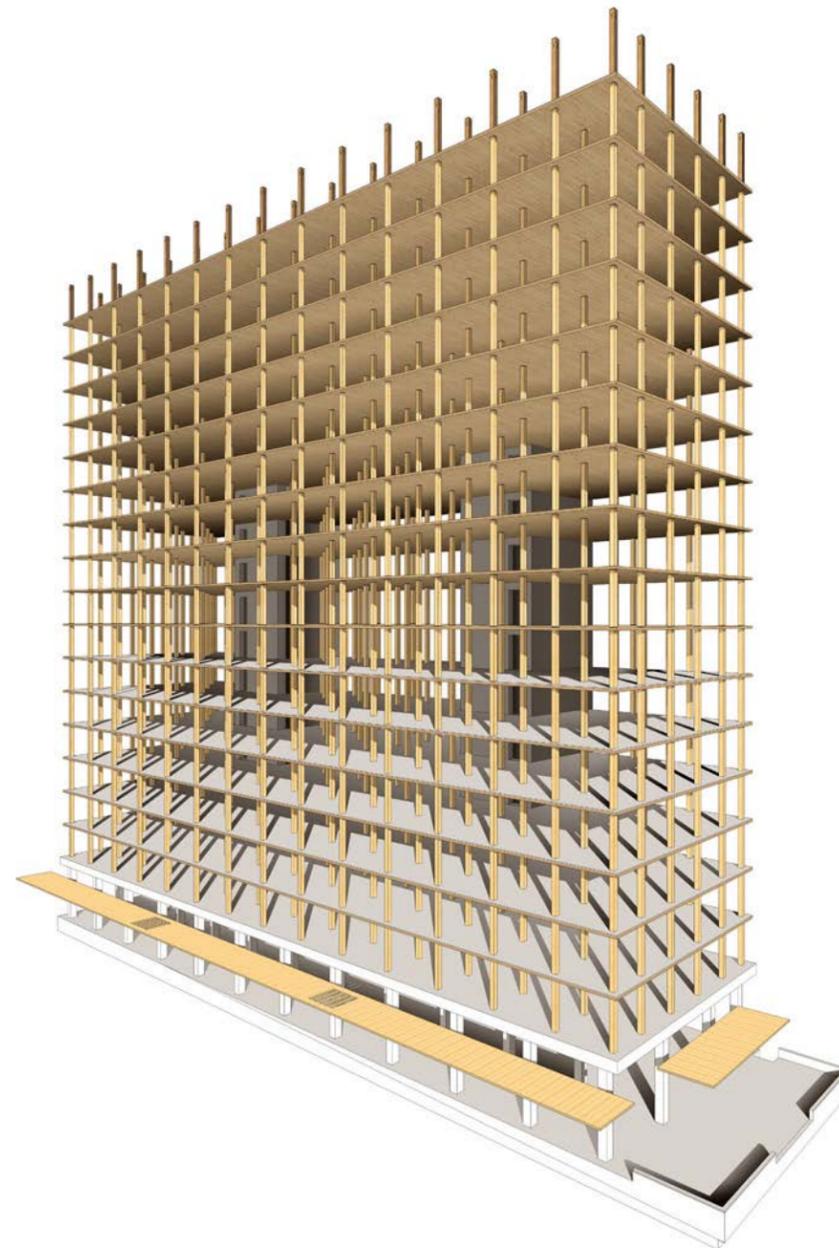
An automatic sprinkler system with a back-up water supply offers additional protection for occupants and firefighters for events that might originate during an earthquake.

Looking forward, once projects such as Brock Commons are completed, more testing of mass wood assemblies is available, and information from monitoring research programs is analyzed, it is anticipated that building codes for tall wood structures will be revised to appropriately reflect the unique properties and characteristics of mass timber.

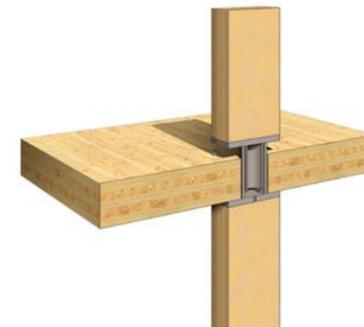
Sustainability

Brock Commons has been designed to target LEED Gold certification and to conform to ASHRAE 90.1-2010. The building will connect to the UBC district energy system and is projected to achieve up to 25% energy savings over a typical building of the same use.

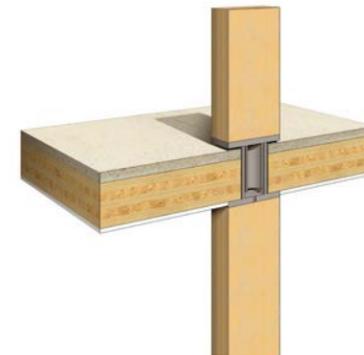
Advances in wood technology and manufacturing make tall wood buildings not only possible but also safe and cost effective, while providing a way to lessen the carbon footprint of the built environment. The mass timber structure for Brock Commons reduces the volume of concrete that would typically be used by 2,650 cubic meters, which is equivalent to reducing up to 500 tonnes of CO² emissions.



hybrid mass timber and concrete core structure



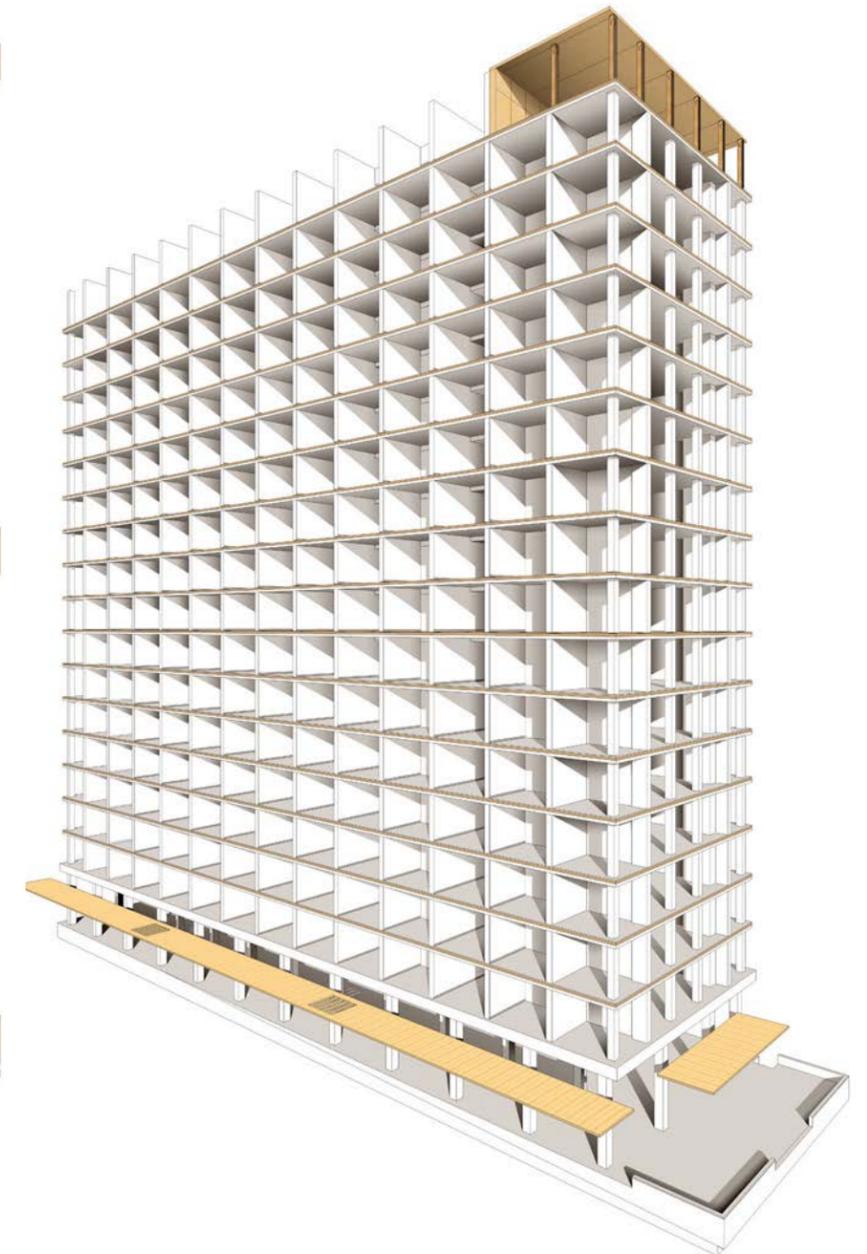
CLT floor slabs with glulam columns and steel connectors



partial encapsulation during construction



completed construction

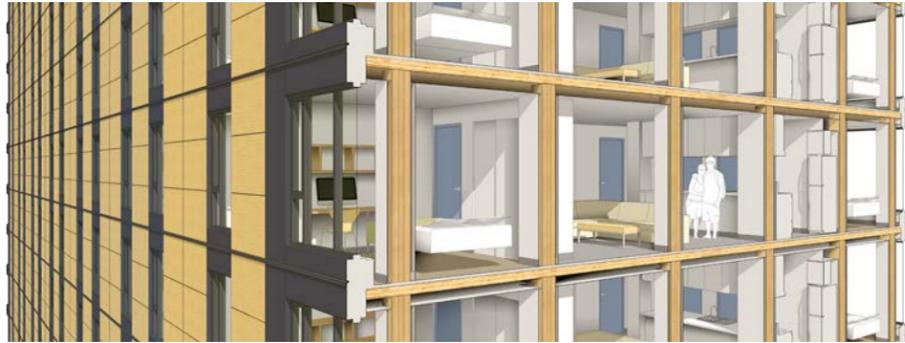


encapsulated structure

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University of British Columbia, Vancouver, Canada



exposed mass wood structure



encapsulated mass wood structure



concrete structure and CLT canopy

Brock Commons Phase 1

University of British Columbia, Vancouver, Canada



plaza and student study space



student residence entrance and study space

Brock Commons Phase 1

University of British Columbia, Vancouver, Canada



southeast view

“Brock Commons will demonstrate that mass timber structures offer an economically viable alternative to concrete and steel while providing a way to lessen the carbon footprint of the built environment.”

Russell Acton, Principal
Acton Ostry Architects Inc.

“This beautiful, new tall wood building will serve as a living laboratory for the UBC community. It will advance the university’s reputation as a hub of sustainable and innovative design, and provide our students with much-needed on-campus housing.”

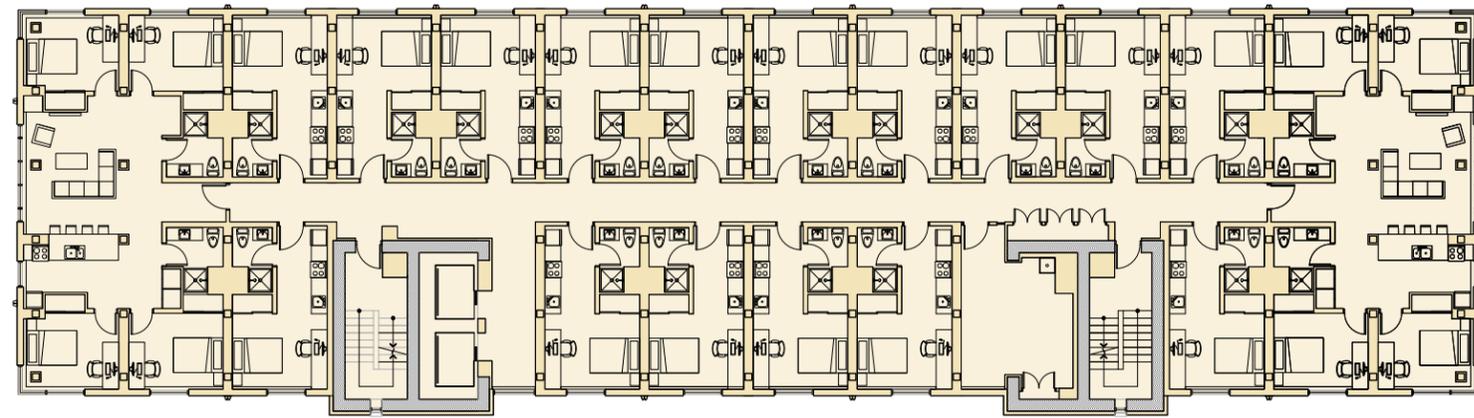
Martha Piper, Interim President
University of British Columbia

“As the tallest wood building in Canada, this project will serve as a great example of the research and technology that is involved in taking wood construction to new heights – resulting in innovative solutions that are safe, sustainable and viable.”

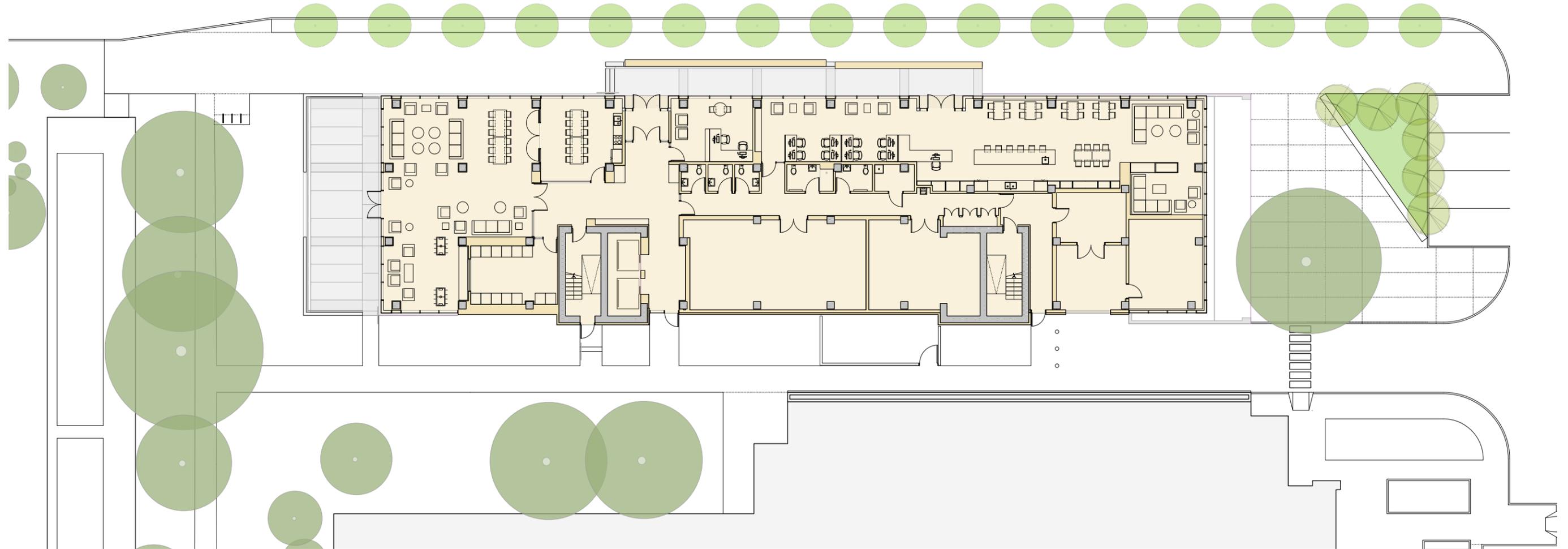
Michael Giroux, President
Canadian Wood Council

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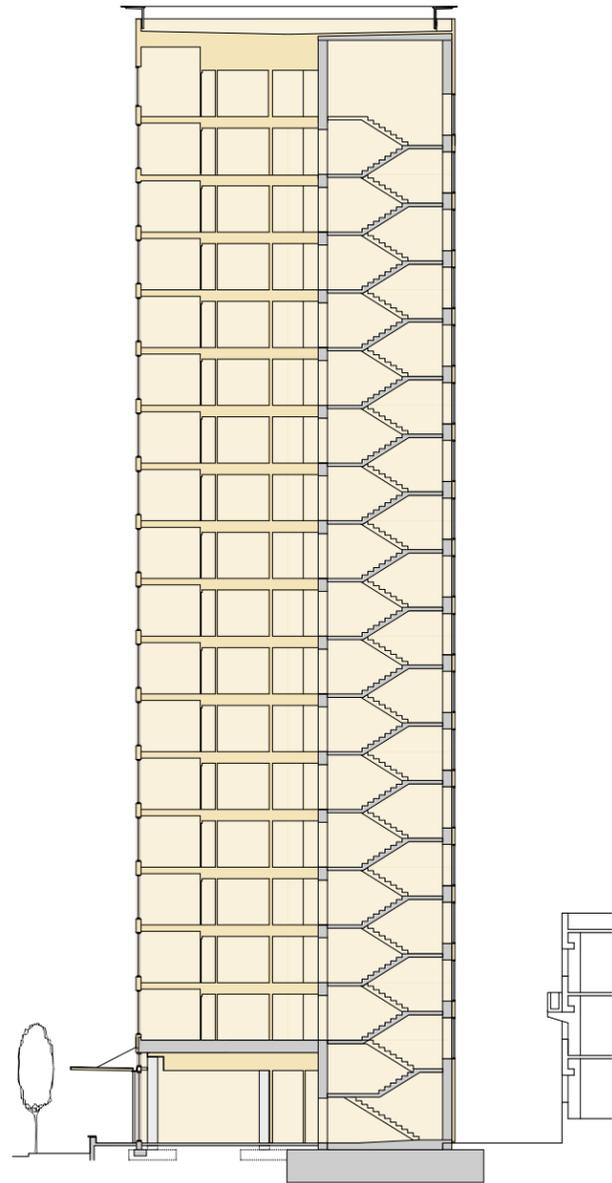
typical floor plan



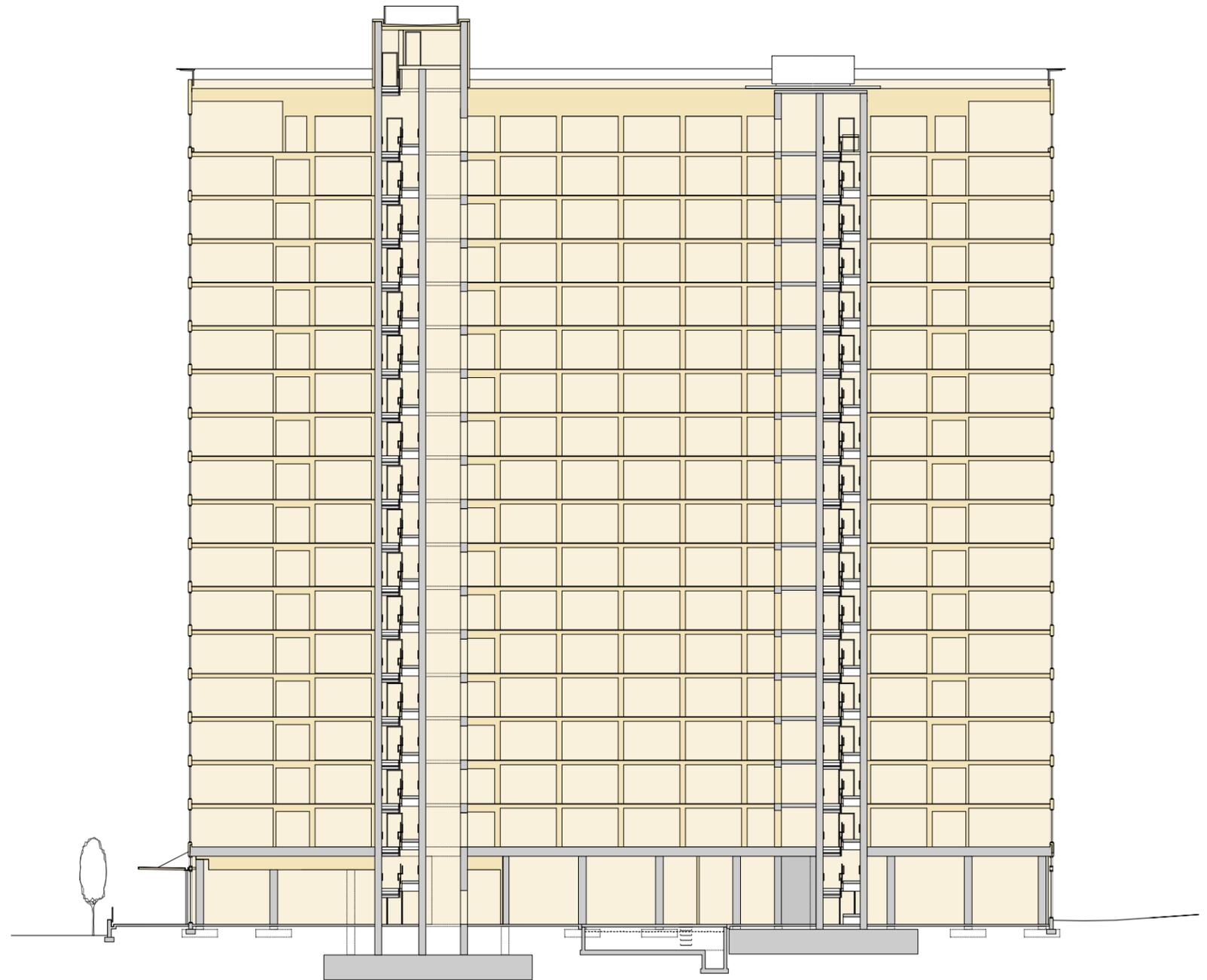
main floor plan

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lateral section



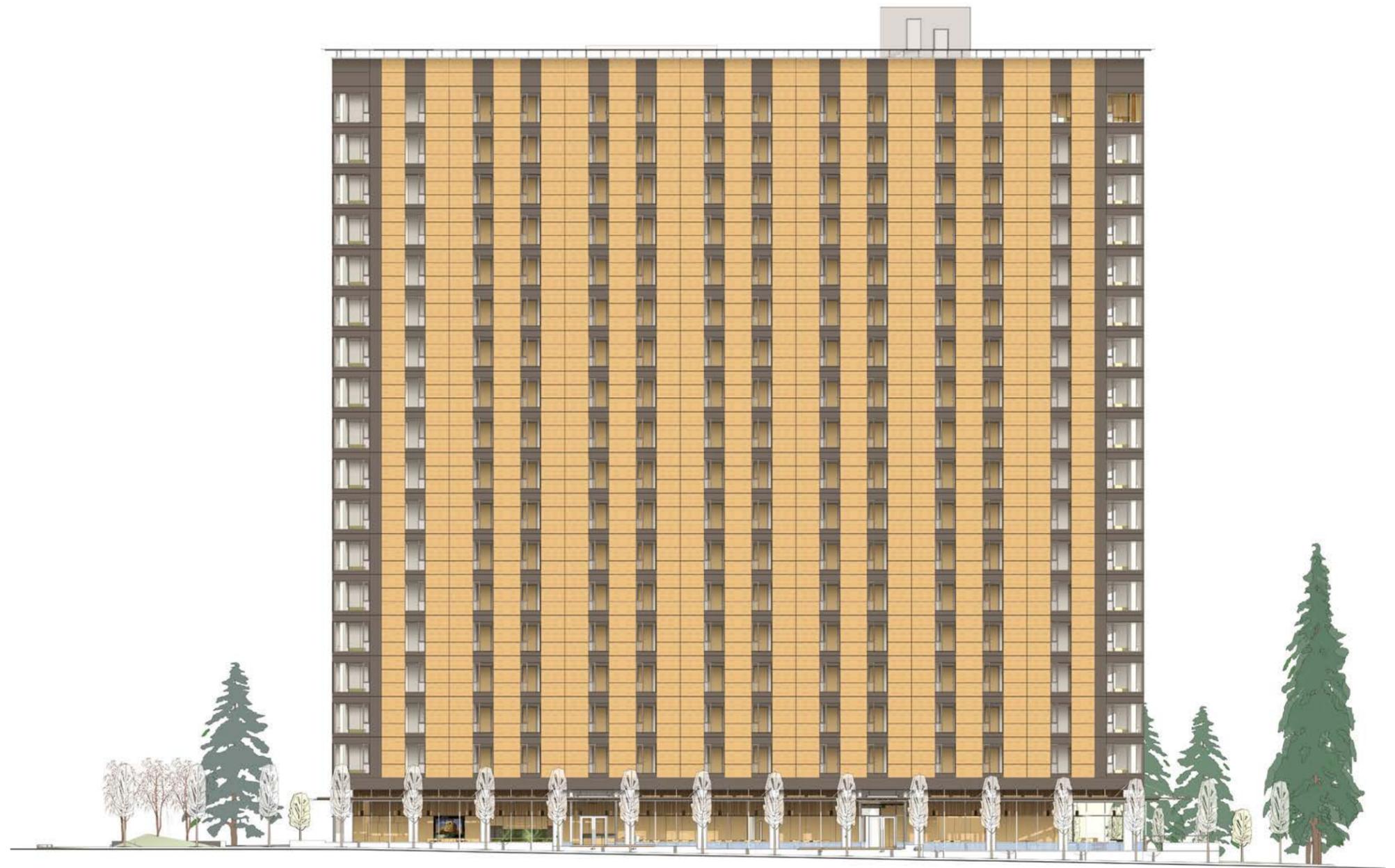
longitudinal section

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west elevation



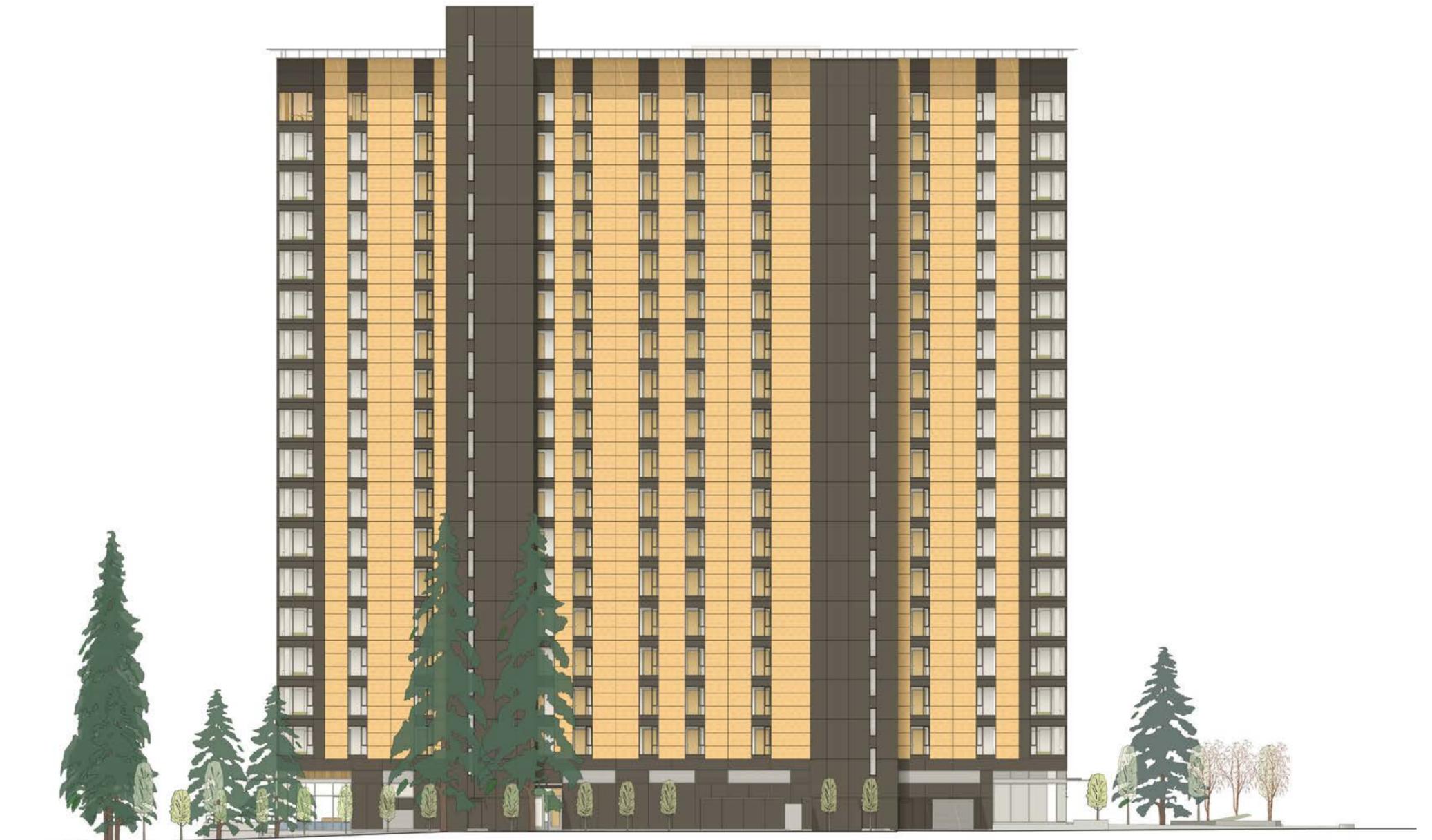
north elevation

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east elevation



south elevation

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Architect

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

Virtual Design Modeling

Cadmakers Inc.

Energy Modeling

EnerSys Analytics Inc.

Acoustics

RWDI

Landscape

Hapa Collaborative

Civil

Kamps Engineering Limited

Geotechnical

Geopacific Consultants Inc.

Construction Management

Urban One Builders

Project Management

UBC Properties Trust

Owner

University of British Columbia



student residence entry and study space

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