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Opened in July 2017, Brock Commons Tallwood House is a 404-bed student residence located on the Point Grey campus of the University of British Columbia in Vancouver. The building was the first to be completed under the 2013 Tall Wood Building Demonstration Project Initiative sponsored by Natural Resources Canada to further the regulatory and commercial acceptance of tall wood buildings.

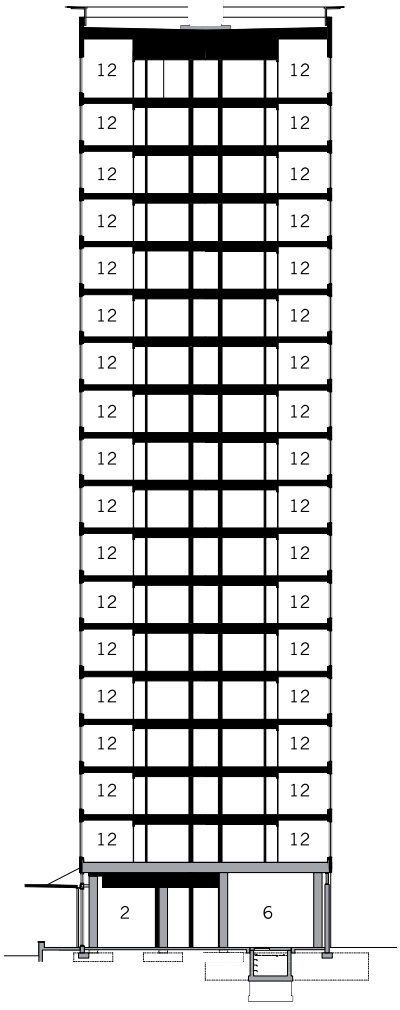
With a height of 53 metres and a floor area of 14,115 square metres, the building exceeds the maximum height for combustible construction under the British Columbia Building code. This required the creation of a site-specific regulation (SSR) to demonstrate that the structure would meet or exceed the performance criteria for a non-combustible building of the same size and type.

With an exceptionally tight schedule, the key to realizing this project was to minimize the time required for SSR approval. This informed the decision to design a building that in all respects followed the proven formula (comprising concrete frame, steel stud walls, drywall finishes and dropped ceilings) used for high-rise construction in Vancouver – the one exception being the use of a fully encapsulated mass wood structure to substitute the traditional cast-in-place concrete.

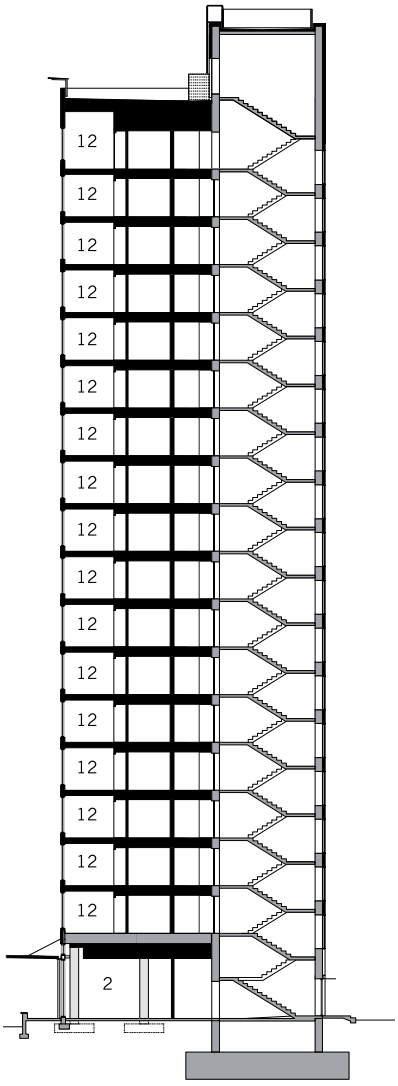
With considerable past experience of mass wood projects (including the Earth Sciences Building pp ??-??), the client began by assembling an experienced multi-disciplinary team of design and construction professionals, to ensure that the technical and cost risks associated with the project could be identified and resolved at the design stage.

Social space on the ground floor

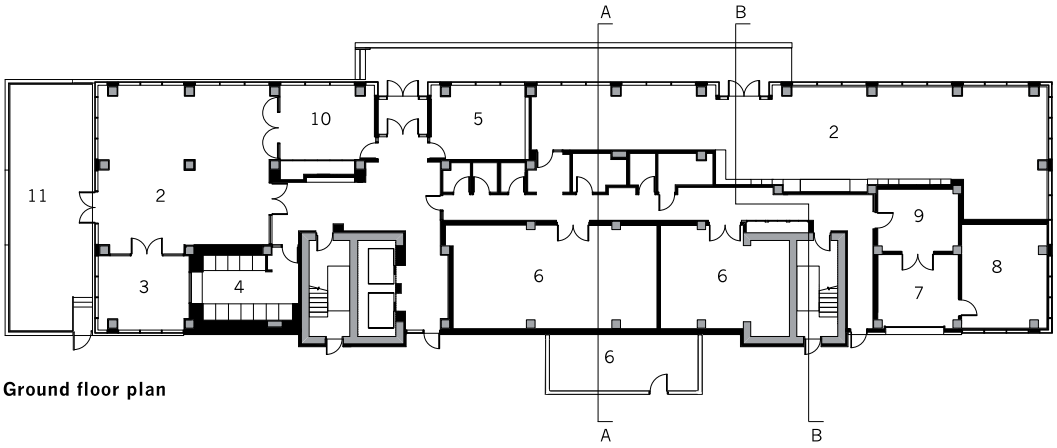
1 Lobby
2 Residential social space
3 Activity room
4 Laundry
5 Meeting room
6 Mechanical services
7 Loading dock
8 Electrical services
9 Recycling and reuse collection
10 Kitchen
11 Raised terrace
12 Single-bedroom unit
13 Four-bedroom unit
14 Services



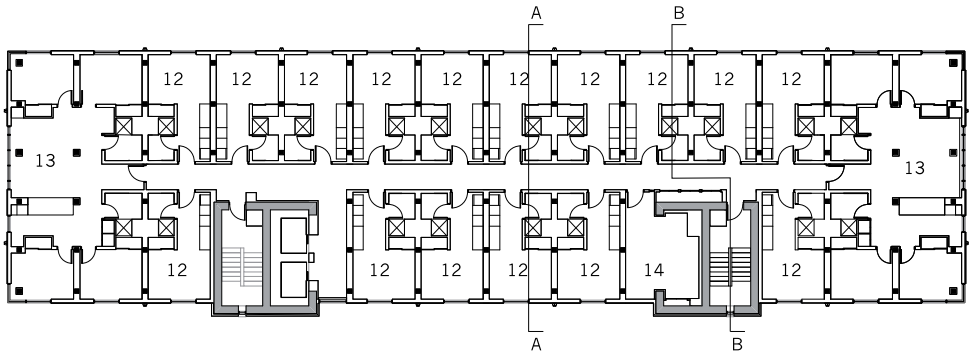
Section AA



Section BB



Ground floor plan



Typical floor plan

1 Lobby
2 Residential social space
3 Activity room
4 Laundry
5 Meeting room
6 Mechanical services
7 Loading dock
8 Electrical services
9 Recycling and reuse collection
10 Kitchen
11 Raised terrace
12 Single-bedroom unit
13 Four-bedroom unit
14 Services

CONCEPT

Using a 'keep it simple' approach, the project team worked toward a practical and efficient hybrid structural solution with the minimum possible number of components, all based on a floor plan that would maximize the economic benefits of repetition.

Levels two through 17 include 16 single-bedroom units and two four-bedroom units per floor, while level 18 includes one four-bedroom unit, 16 single-bedroom units and a student lounge. The shared units contain a common space, a kitchen, two bathrooms and four separate bedrooms, while the studio units each contain a walk-through kitchen, a bathroom and a bedroom. Public amenity, assembly, study and service spaces are located on the ground floor.

The façade features vertical striations of punched windows, alternating with wood fibre-based prefabricated cladding panels in a charcoal or light wood finish. A CLT canopy runs the length of the podium, and a metal cornice crowns the building.

Inside, warm wood finishes are used in the ground floor social and study spaces, glulam columns are left exposed in the upper level amenity lounge, hallways feature wood doors, and elevator lobbies are finished in the same wood fibre cladding panels used on the exterior.

Glulam post installation

Residential floor interior prior to gypsum board encapsulation

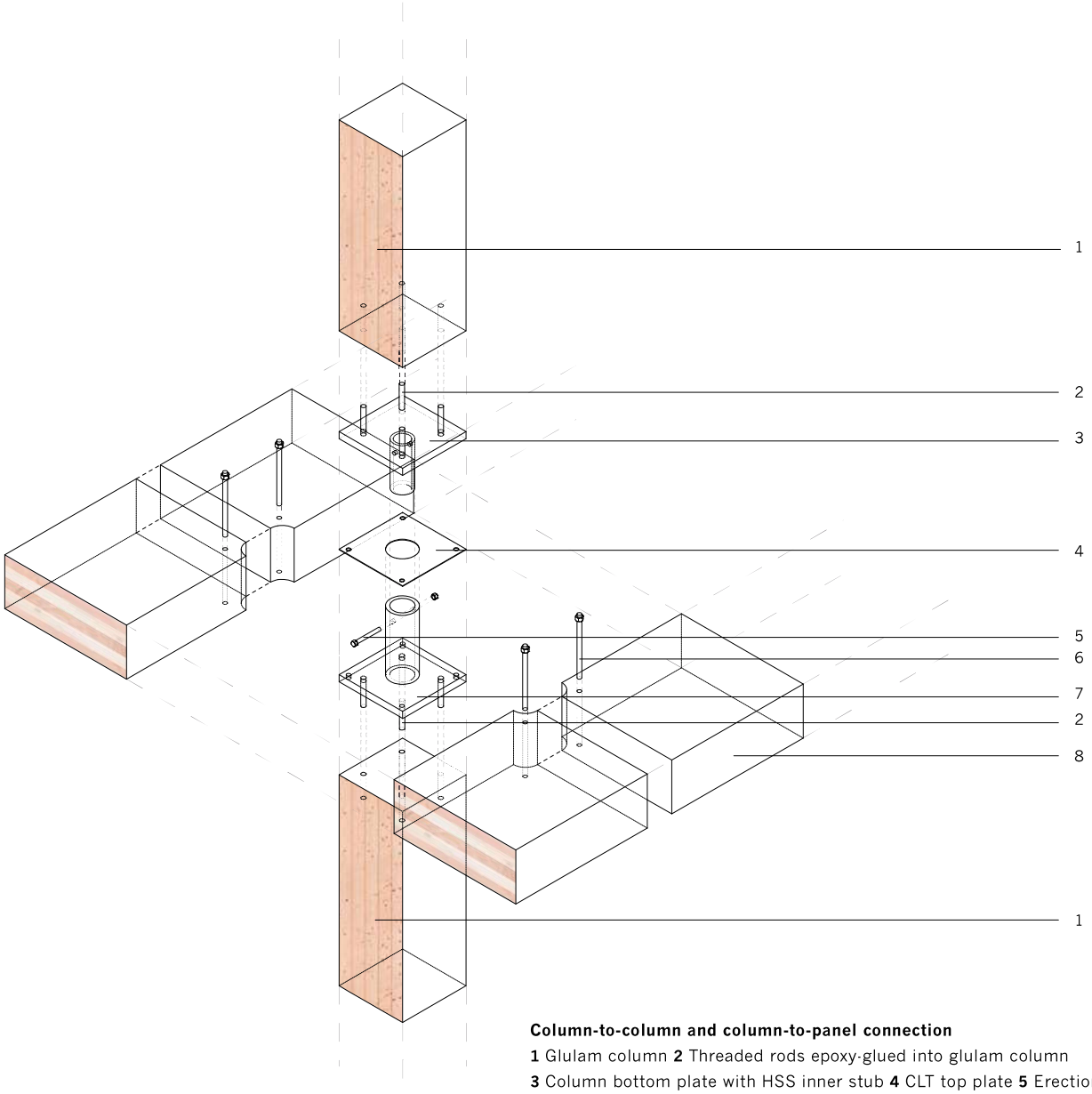
CLT panel installation

CONSTRUCTION

The project team explored several structural solutions, before deciding on a hybrid system that optimizes the performance of different structural materials. As a result, the building has a concrete raft foundation; a concrete ground floor structure and two concrete service cores that rise through all 18 storeys. The 17-storey mass wood structure is built up from the second-floor slab and tied into the concrete cores that transfer lateral loads to the ground. The roof consists of open web steel joists and profiled metal decking. The vertical wood structure typically comprises of CLT floor panels supported on glulam columns, with PSL columns used at the lower floors, where high structural loads demand greater strength. Since the studio units have a width of only 3 metres, it was possible to use two-way spanning CLT panels throughout – a first for a building of this type. This eliminated the need for beams, thereby reducing the floor-to-floor height, enabling two additional floors to be added within the overall height limit and greatly simplifying the installation of building systems. The entire wood structure, with the exception of some columns on the top floor, was encapsulated in multiple layers of type-X gypsum wallboard.

Glulam post installation

CLT panel installation



Column-to-column and column-to-panel connection
1 Glulam column **2** Threaded rods epoxy-glued into glulam column
3 Column bottom plate with HSS inner stub **4** CLT top plate **5** Erection bolt
6 Threaded rods **7** Column top plate with HSS outer stub **8** CLT panel

The CLT panels are point supported on steel connectors that join the glulam columns together vertically. The panels are connected with recessed plywood strips that are screwed in place to 'stitch' each floor into a continuous diaphragm. Surface mounted steel drag straps transfer lateral loads into the concrete cores and the floors are finished with a concrete topping.

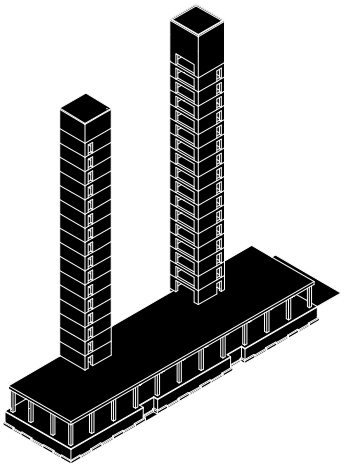
The glulam columns, cross-laminated timber floors and prefabricated façade panels were erected in only 66 days. This was achieved through careful planning, made possible by an integrated design process. The project team used a single 3D model to resolve coordination conflicts and to optimize the construction sequence. This enabled a just-in-time delivery schedule, with components loaded onto trucks in reverse order, so they could be lifted off and installed efficiently, minimizing crane time. The cladding panels were designed to be installed and sealed without the need for exterior scaffolding – an innovation that saved both time and cost.

CONCLUSION

While cost and time constraints led the project team to an encapsulated rather than exposed wood solution, the building nonetheless sequesters the equivalent of 1753 metric tonnes of carbon dioxide and avoids the production of 679 metric tonnes of greenhouse gas emissions that would have been associated with a concrete equivalent.

The 'keep it simple' approach used on this project, utilizing to the greatest extent possible the fast, familiar and efficient trade practices of standard high-rise construction, has resulted in a Tall Wood building delivered at a cost premium of only 7%. This fact has undoubtedly drawn the attention of mainstream developers in North America, who have traditionally been highly risk averse and heavily reliant on tried and tested methods of construction.

In this context, Brock Commons Tallwood House has broadened the conversation, shifting the perception of Tall Wood buildings from the exceptional and extraordinary to something more prosaic and ordinary.



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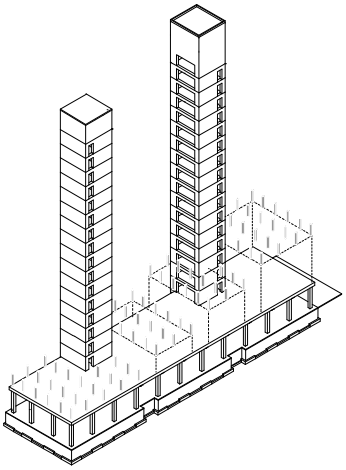

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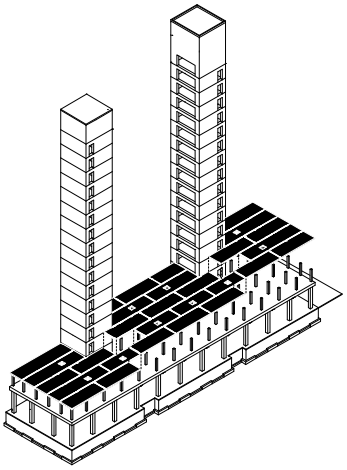
Construction sequence
1 The concrete base and core are poured **2** The glulam columns are placed onto either the concrete base or the floor panel below **3** The CLT floor panels are placed onto the glulam columns **4** Each floor is constructed in the same manner, taking about 9 weeks altogether to complete.



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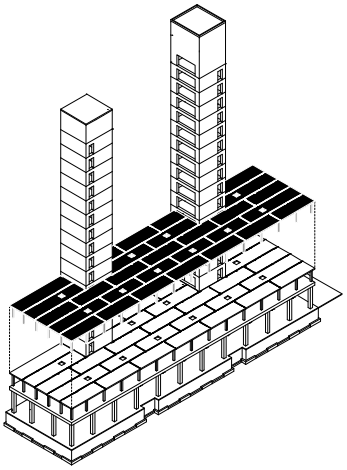

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Timber erection sequence from week one to week nine