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Timber-Reinforced Concrete Composite Construction System and Brock Commons Student Residence Example

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Abstract

A composite structure is a building made from a combination of materials, such as steel, concrete and timber. These systems offer a more efficient construction method by utilising the superior properties of different materials. This study explains the timber-concrete composite construction system and its advantages using the Brock Commons Student Residence project in Canada as an example, and reveals the reasons for its selection. The timber-concrete composite system was chosen for Brock Commons due to the need for rapid construction, the abundance of timber production in Canada, the limited space available for a construction site given the building's location, and its sustainability advantages. Consequently, the seventeen-storey dormitory building was completed within seventy days. The building is economical, sustainable, environmentally friendly, lightweight and earthquake-resistant. Due to its prefabricated elements, on-site traffic is also minimised. The building uses a laminated timber column and floor system with two reinforced concrete cores.

Keywords: *Composite material, Timber-concrete composite construction system, Metal fasteners, Laminated timber structural element.*

Ahşap-Betonarme Kompozit Yapım Sistemi ve Brock Commons Öğrenci Yurdu Örneği

Öz

Kompozit yapılar, yapı taşıyıcı sisteminde aynı anda betonarme, çelik ya da ahşap gibi farklı yapı elemanları birlikte kullanılarak inşa edilen yapılardır. Farklı malzemelerin görece üstün özelliklerinden faydalanılarak oluşturulan bu tür sistemler daha verimli bir yapım sistemi sunmaktadır. Bu çalışmada amaç Kanada' da yapılmış olan Brock Commons Öğrenci Yurdu projesi üzerinden betonarme-ahşap kompozit yapım sistemini ve avantajlarını açıklayıp tercih nedenlerini ortaya koymaktır. Yurt binasının kısa sürede inşa edilmesi gerekliliği, Kanada'daki ahşap üretiminin fazla olması, yapının konumu itibarıyla şantiye olarak yeterli alan sunamamış olması ve sürdürülebilirlik alanında sağladığı avantajlar da göz önüne alındığında Brock Commons binasında ahşap-beton kompozit yapım sistemi tercih edilmiştir. Sonuç olarak on yedi katlı yurt binası; iki adet betonarme çekirdekle birlikte lamine ahşap kolon ve döşeme sistemi kullanılarak yetmiş gün içerisinde ekonomik, sürdürülebilir, çevre dostu, hafif, deprem yüküne dayanıklı, içerdiği prefabrike elemanlar nedeniyle şantiye içi trafiği en aza indiren kompozit bir yapı olarak tamamlanmıştır.

Anahtar kelimeler: *Kompozit malzeme, Ahşap – beton kompozit yapım sistemi, Metal bağlantı elemanları, Lamine ahşap yapı elemanı.*

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1. Introduction

A composite structure refers to a building that employs a combination of structural materials—including reinforced concrete, steel, and timber—within a single supporting system. These materials can be used together on the same load-bearing elements or to form different elements within the same system. Mechanical interaction between hardened concrete and timber is achieved either through keyed recesses formed in the timber or by installing mechanical fasteners prior to casting the concrete (Ceccotti, 2002). The development of timber–concrete composite (TCC) systems began shortly after the First World War as a response to shortages of steel, prompting the search for alternatives to conventional reinforced concrete and steel construction (Auclair et al., 2023). Since the 1970s, interest in timber-concrete composite systems has increased, and it is evident that this system is used not only to reinforce existing wooden flooring but also in the construction of flooring for new buildings and bridges (Turrini & Piazza, 1983; Natterer et al., 1996).

Timber-concrete composite systems are a construction technique. The structural performance of the timber and concrete elements in this system largely depends on the composite behaviour characteristics. This type of composite system is particularly popular in the United States, Australia and Europe. Timber-concrete composite systems are used in the renovation of old timber-frame and masonry buildings, as well as in new constructions, such as buildings and bridges. It is formed by timber beams and concrete slabs and is used in the construction of structural elements such as walls, floors and roofs. Timber-concrete composite systems are not yet widely used in Turkey. This study demonstrates the potential applicability of this little-known system in Turkey, and forms the basis for adapting the timber-concrete composite construction system to local conditions.

1.1. The Combined Use of Timber and Concrete in Construction

Since early construction practices, the cross-sectional dimensions of structural timber have been increased through laminating techniques that rely on mechanical joints to form all-wood composite members. However, because these joints deform under load, full composite action cannot be achieved. The use of concrete and timber within a single composite cross-section can be viewed as a natural progression of this traditional approach. Unlike all-timber laminations, full composite action is attainable with the use of non-slip connectors, allowing both materials to contribute their strength and stiffness most effectively. Composite timber–concrete systems exhibit several notable characteristics:

- They are lighter than equivalent reinforced-concrete systems, as timber has a substantially lower density than concrete (Figure 1.a).
- When the two materials are effectively connected, their load-bearing capacity can be up to three times greater—and their flexural rigidity up to six times higher—than conventional timber floor systems (Figure 1. a-b).
- They achieve greater structural efficiency, measured as load carried per unit self-weight, compared with all-concrete systems. Although they may be less efficient than pure timber systems, they are typically more economical (Figure 1. a, b, c).
- They also perform well as shear walls, with the concrete layer contributing racking resistance and the timber ribs providing stiffness against out-of-plane buckling (Figure 1).

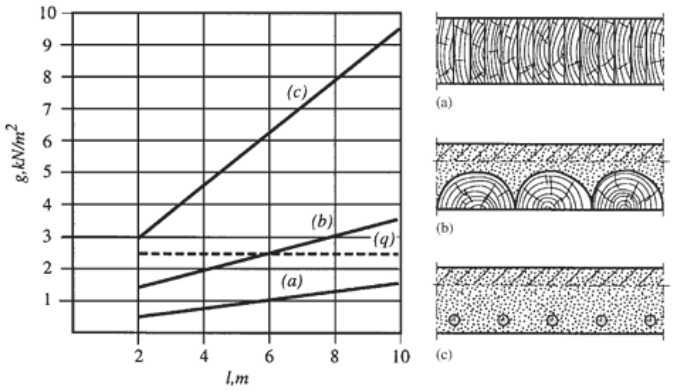


Figure 1. Relationship between floor self-weight g and span l for a service load of q=2,5 kN/m^2, comparing: (a) an all-timber section; (b) a concrete–timber composite section; and (c) an all-concrete section (Natterer et al., 1996)

Timber and concrete are used together in three different ways: as a building material, a building element, and a construction system.

1.1.1. Composite building material; Holzbeton

At first, Holzbeton was just an experimental product, and it was made from cement and wood shavings. It is then formed into blocks using a wooden frame and can be used in masonry structures (Figure 2). It is made from wood industry waste products. These are mixed with water and cement to create a concrete mixture, which is then shaped into blocks using chipboard moulds. The hollow blocks are filled with mortar on site prior to use. Thus, combining the ecological nature of wood and its heat-saving properties with the durability of concrete offers a new alternative building material. It has heat- and sound-absorbing properties. It is lightweight. It is also resistant to fire and weather conditions. Compared to traditional concrete blocks, it is a more sustainable building element. As it is a prefabricated element, it also speeds up the construction process (Şahin Diri, 2022).



Figure 2. As a building material; Holzbeton (Baustoffwissen, n.d.)

1.1.2. Composite structural element; Reinforced concrete–timber composite flooring

This composite system is used to construct structural elements such as walls, floors and roofs. It is formed using timber beams and concrete slabs (Figure 3. a). This makes use of the tensile strength of wood and the compressive strength of concrete, taking advantage of the best properties of both materials. The connection ensures complete composite behaviour between the wood and concrete. This mechanical connection can be achieved using nails, screws, or metal plates that are either embedded or notched in the wood (Halıcıoğlu & Yürekli, 2016) (Figure 3. b). Wood-concrete composite flooring is the most widely used structural element produced by this system. It is favoured over traditional timber-framed flooring due to its greater rigidity and reduced weight compared to reinforced concrete flooring (Şahin Diri, 2022). In timber–concrete composite systems, the concrete layer is generally a reinforced concrete slab, and the timber component can be composed of solid wood, glued laminated timber (glulam), structural composite lumber, cross-laminated timber (CLT), nail-laminated timber (NLT), or other engineered wood products (Auclair et al., 2023).

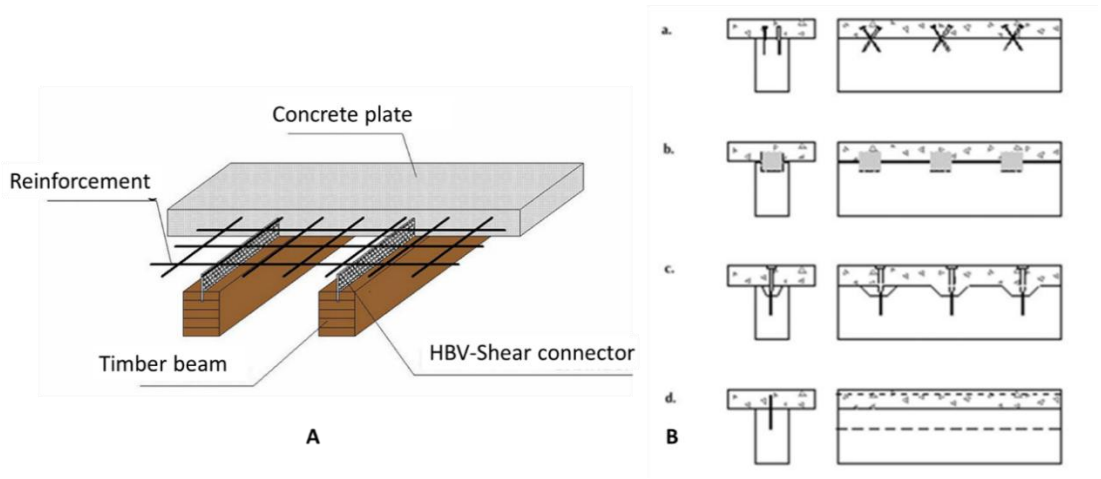


Figure 3. a) As a structural element; reinforced concrete slab with timber beams (Ticomtec, n.d.), **b)** Detailed connections for timber-beamed reinforced concrete slabs; a. Nail connection, b. Sheet metal connection, c. Chemical anchor connection, d. Bonded metal plate connection (Ceccotti, 2002)

1.1.3. Composite structure system: Timber-reinforced concrete composite structure

Timber-concrete composite building systems combine wood and concrete elements using various joint solutions. This composite behaviour improves the performance of the building's structure or facade. This method of building is used to make timber floors stronger and stiffer in existing buildings and in new constructions, especially in tall buildings and long structures. Upon achieving optimal interconnection between the two materials, the load-bearing capacity and bending rigidity of the composite structure are shown to exhibit a marked enhancement in comparison to that of a conventional timber floor system (Ceccotti, 2002). Timber-concrete composite systems can be a cost-effective solution for the construction of buildings with floors that have longer spans, since the mechanical properties of the two materials would be used efficiently (Auclair et al., 2023). Additionally, the extra mass of the concrete can enhance the acoustic performance when compared to that of a timber floor system alone. (Figure 4).

1.2. Timber- Reinforced Concrete Composite Construction

Advances in modern timber construction technologies have led to timber structures being widely used in public buildings, such as apartments, office buildings, schools, stadiums and conference centres (Figure 4). The structural elements of a building include its foundations, columns, beams and floors. We can list the combinations of load-bearing elements in timber and concrete composite buildings as follows:

- A timber-framed system resting on a reinforced concrete foundation.
- The use of timber floors within a reinforced concrete column-beam system or reinforced concrete floors in conjunction with a timber column-beam system.
- The use of a timber roof or façade system in a reinforced concrete structure.
- The construction of a timber-framed extension to a reinforced concrete structure is another example of how these systems can be used together.



Figure 4. Examples of timber-reinforced concrete composite construction systems: **a)** Eric Tweedale Stadium, Sydney, Dwp architects, 2021 (Dwp, n.d.), **b)** Ascent, Wisconsin, Korb & Associates Architects, 2022 (Thorntontomasetti, n.d.), **c)** Okanagan College Jim Pattison Centre of Excellence, Penticton-Canada, HDR /CEI Architect, 2010 (Fastepp, n.d.)

As the architects of Eric Tweedale Stadium (Figure 4. a); "Timber construction was fundamental to the project's sustainability objectives, illustrating that large buildings can be developed with low carbon output, low waste, and high energy efficiency. An eight-meter glulam roof cantilever provides a clean, expressive form recalling the site's historic forest. Alongside its low-carbon timber structure, the stadium employs east–west orientation, passive shading, rainwater harvesting, and photovoltaic and metering provisions to reduce energy and water demand." The stadium provides an active contribution to climate protection of around 109t CO2 emission (Archdaily, n.d.).

The Ascent project features nineteen mass-timber residential levels resting on a six-story cast-in-place, post-tensioned concrete podium that accommodates parking and retail spaces (Figure 4. b). The structural framework comprises glulam beams and columns supporting one-way CLT floor panels topped with gypcrete, with two reinforced-concrete cores providing lateral stability (Thorntontomasetti, n.d.). Post-tensioned transfer beams, designed in coordination with the pool and mechanical area depths, integrate the timber superstructure with the concrete garage below. This post-tensioned podium allows for reduced floor-to-floor heights while satisfying the structural and environmental requirements of a Midwestern parking facility.

The Okanagan College project exemplifies the implementation of Composite Concrete–Timber systems in the construction of gymnasium wall panels, integrating thermal insulation, embedded radiant heating conduits, and MEP rough-in components (Structurecraft, n.d.). The roofing system employs hybrid wood–steel truss assemblies. In alignment with the client's performance objectives, Fast + Epp engineered a series of innovative structural solutions (Figure 4.c). These advancements include the development of timber–concrete hybrid composite wall panels incorporating heating and cooling networks, the design of steel–timber hybrid trusses, and the extensive utilization of FSC-certified materials as well as lumber sourced from pine beetle–affected forests.

1.2.1. Advantages of using timber-concrete composite construction systems

- Structures made from reinforced timber composites are significantly lighter than concrete structures.
- Timber is a natural building material. Using timber instead of reinforced concrete in construction reduces the carbon footprint.
- Timber-Concrete Composite Construction Systems are more rigid and resistant to earthquakes and fire than traditional timber construction systems.

1.2.2. Disadvantages of the timber-concrete composite construction system

- High labour costs.
- Requiring excessive labour.
- Connectors increase the total construction cost.
- The necessity for special detail solutions.
- Structural behaviour differences offered by different materials, such as thermal resistance, thermal conductivity, seismic resistance and expansion coefficients.
- Special production requirements.

2. Material and Method

The wood-concrete composite system is widely used in the construction of buildings and bridges in many countries, but it is neither produced nor used in our country. The aim of this study is therefore to introduce the wood-concrete composite system, which is not yet in use in our country, and to present its potential applications in construction. To this end, the wood-concrete composite materials, elements and systems used in buildings were first described through a review of relevant literature and internet searches, followed by an examination of the example building's construction method.

- For this purpose, the structural design of Brock Commons in Canada, set to become the world's tallest wood-concrete composite structure upon completion, was analysed, and research was conducted into the design of the hybrid system by examining the functional sharing of the load-bearing system, as well as its cost, construction time, prefabrication advantages, weight, foundation dimensions, seismic behaviour and interface details between wood and concrete.
- Based on the results obtained, the advantages and disadvantages of using the wood-concrete composite system for multi-storey hybrid structures in general were identified, as were the reasons for preference related to these. An assessment was also made regarding what lessons could be learned for a possible 'concrete core + wooden floors' concept in Turkey.

3. Findings and Discussion

3.1. Brock Commons Student Residence Building

The advantages of the reinforced concrete-timber composite construction system in the design, implementation and usage stages are explained in this section using the example of Brock Commons Student Residence (Figure 5).

Project Location: Vancouver, B.C. **Project Type:** Dormitory Building **Size:** 15,115 m^2 **Completion:** 2017 **Structure Height:** 53 m **Structural System:** Mass Timber Hybrid, Point-Supported Mass Timber, Post-and-Beam **Project Materials:** Cross-Laminated Timber (CLT), Glue-Laminated Timber, Parallel Strand Lumber (PSL) **Design Team:** Acton Ostry Architects Inc. **Structural Engineer:** Fast + Epp **Tall Wood Advisor:** Architekten Hermann Kaufmann **Field Science:** GHL Consultants Ltd.	

Figure 5. Brock Commons Building, general information and outside view (Naturallywood, n.d.) Image (Brudder Productions, n.d.)

Brock Commons, a student residence in Vancouver, Canada, accommodates 400 students and, at 53 meters in height, was the world's tallest mass-timber building at the time of its completion. It

represents the university's eighth major timber project and serves as a significant driver of innovation for the regional timber industry (Hkarchitekten, n.d.). The site plan (Figure 6), typical floor plan and section (Figure 7) of the building are shown in the following figures. During the construction planning process, there was no available storage space, and a programme was implemented due to the site's physical constraints. Key advantages of the adopted structural system include the elimination of beams, the relatively low weight of the CLT panels, and the rapid erection facilitated by prefabrication. The primary drawback is the limited supply of CLT, as only one local manufacturer produces the panels; importing them from Europe was explored but deemed too costly due to shipping (Naturallywood, n.d.). The manufacture of the elements was therefore organised to coincide with the construction programme. Firstly, the reinforced concrete works were completely separated from the building. This enabled the assembly of the timber superstructure and installation of the building facade to begin once construction of the 18-storey reinforced concrete core was complete. The concrete works were scheduled for the winter months and the assembly of the timber superstructure was postponed until spring due to weather-related issues. To minimise water absorption on site, water-resistant coatings were applied to the timber elements at the production facilities. The roof structure was constructed from steel.



Figure 6. Building site plan (Naturallywood, n.d.)

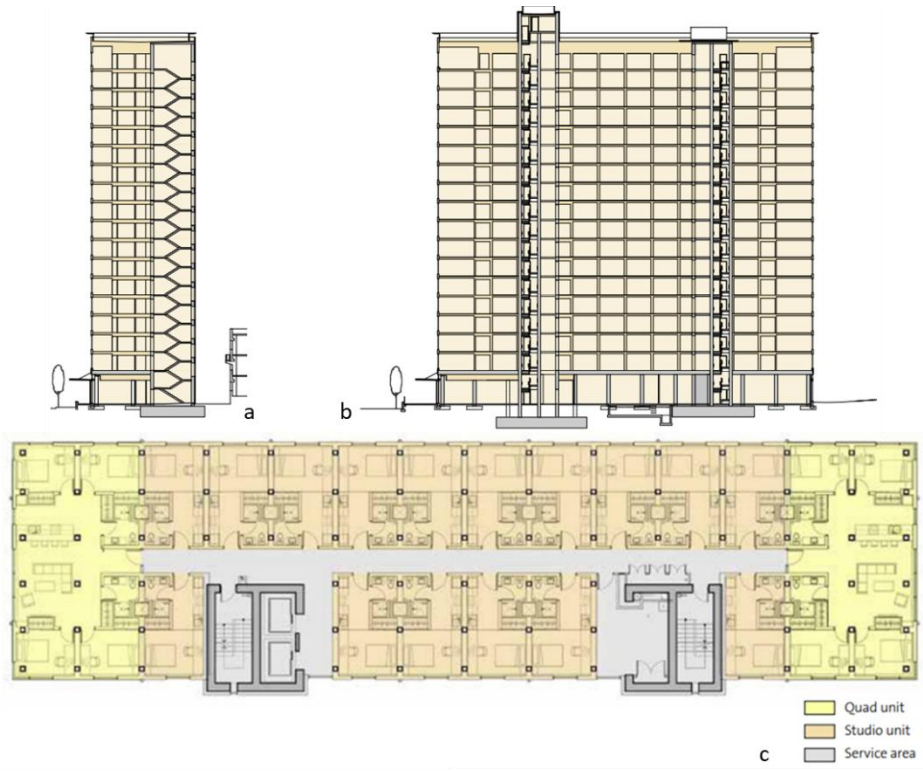


Figure 7. Brock Commons Building, typical floor plan and sections (Naturallywood, n.d.; Actonostry, n.d.)

With a typical inter-storey height of 2,8 m, the 18-storey building measures a total of 58,5 m to the top of the elevator parapet. Its floor area spans 840 m^2 (measuring 15 m × 56 m) across its 18 floors, housing 404 beds in single-bed studios and four-bedroom units. The building employs a hybrid structural system supported by 2,8 × 2,8 × 0,7 m reinforced-concrete spread footings (Figure 7 sections). Each core bears on a 1,5 m raft slab with soil anchors, and a 250 mm perimeter wall on a strip footing completes the foundation system. A concrete second floor functions as a transfer slab. The superstructure consists of a concrete podium and cores, mass-timber columns and floors, and a steel roof. The foundation system consists of 2,8 × 2,8 × 0,7 m reinforced concrete spread footings, supplemented by a 250 mm–thick perimeter wall supported on a 600 × 300 mm strip footing. Each core is founded on a 1,5 m–thick raft slab equipped with soil anchors capable of resisting 1,250 kN of tension (Naturallywood, n.d.). The concrete podium accommodates ground-floor amenities and provides the large spans and clear heights required for public areas at the first floor. The second-floor transfer slab carries gravity loads from the 17 stories above, decoupling the ground-floor structural grid from that of the timber structure. The 450 mm cast-in-place concrete cores (Figure 7 plan) ensure lateral stiffness and integrate vertical circulation, including stairwells and elevator shafts.

The primary framing system comprises mass-timber columns—Parallam in the highest-loaded regions and glulam elsewhere—together with a perimeter beam supporting the building envelope. Typical column dimensions are 265 × 265 mm and 265 × 215 mm on the upper levels, arranged within a 4 × 2,85 m structural bay (Connolly, Loss, Iqbal and Tannert, 2018). The main prefabricated elements include CLT floor panels, glulam columns, steel connectors, and the facade (Figure 8). These components are assembled atop a concrete base and stair cores. Cross-laminated timber (CLT) floor slabs rest on these columns; the five-layer panels provide a total thickness of 16,6 cm. The staggered two- and three-span CLT panels act biaxially, enabling a joist-free ceiling and facilitating rapid installation as well as straightforward integration of building services. Shear transfer between adjacent CLT panels is achieved using recessed three-layer plates, creating a continuous structural diaphragm (Hkarchitekten, n.d.). Horizontal loads from wind and seismic action are carried via steel straps from this diaphragm to the concrete core, while the timber columns transmit vertical loads to the reinforced-concrete ground-floor structure.

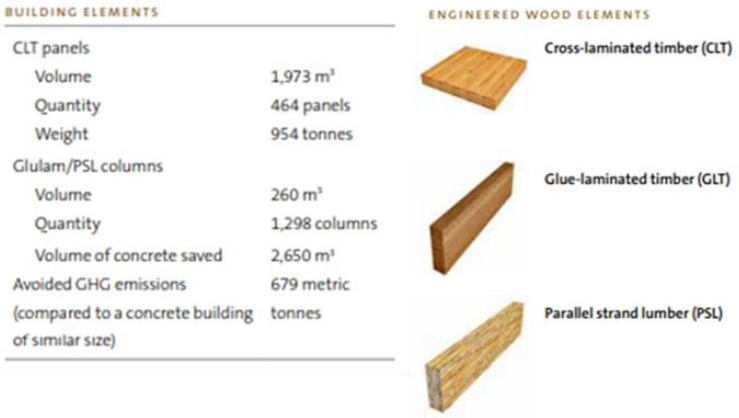


Figure 8. Materials used in the building (Naturallywood, n.d.)

The interior design prioritizes fire protection and acoustic separation. Encasing the timber columns and floor panels provides a two-hour fire-resistance rating (Figure 9). Internal demising walls are rated for two hours between suites and one hour between units and corridors.

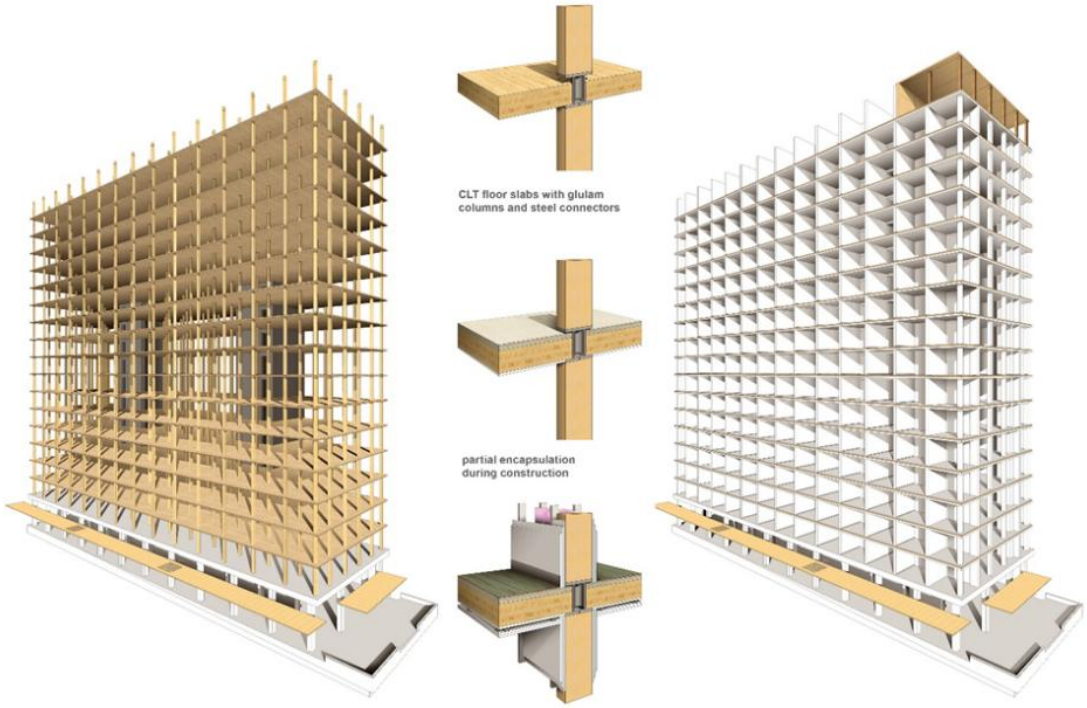


Figure 9. Brock Commons Building drawings and flooring details; most of the mass timber elements were wrapped in gypsum board, mainly to protect them from fire (Naturallywood, n.d.; Livinglabs, n.d.)

The Brock Commons structural system utilizes a hybrid configuration (Figure 10. a). The foundations, ground floor, and cores are constructed from cast-in-place, reinforced concrete, while a concrete second-floor slab serves as a transfer level between the concrete and timber elements, allowing the ground-floor structural grid to differ from that of the wood superstructure. Acoustical performance targets 52–54 STC (Sound Transmission Class) for floor assemblies and 50–62 STC for walls (Naturallywood, n.d.). To enhance sound absorption and minimize vibrations, a 40 mm concrete topping is added to the CLT panels to increase mass and stiffness, provide fire protection during construction, and an air cavity is incorporated within the ceiling assembly. Additionally, carpet tiles and resilient flooring are used to reduce impact noise (Figure 10. b). From the third to the eighteenth floor, gravity loads are supported by glulam (GLT) columns and CLT panels, with PSL columns employed in higher-load zones between floors 2 and 5 (Naturallywood, n.d.). Point connections between columns and floor slabs are realized using hollow structural steel assemblies.

Although the project utilizes only four standard panel sizes, most panels on a single floor are unique due to the arrangement of mechanical, plumbing, and electrical openings. The CLT panels are 169 mm thick and consist of five layers of dimensional lumber. Each floor's 29 panels are connected using a 140×25 mm plywood spline, fastened with nails or screws to adjoining panels (Naturallywood, n.d.). The panels were manufactured in four lengths: two 6 m panels and two 10 m panels at the cores, nineteen 8 m panels, and six 12 m panels (Figure 10. c–d). PSL columns are incorporated on floors 2 through 5 at the building's center to provide additional compressive strength.

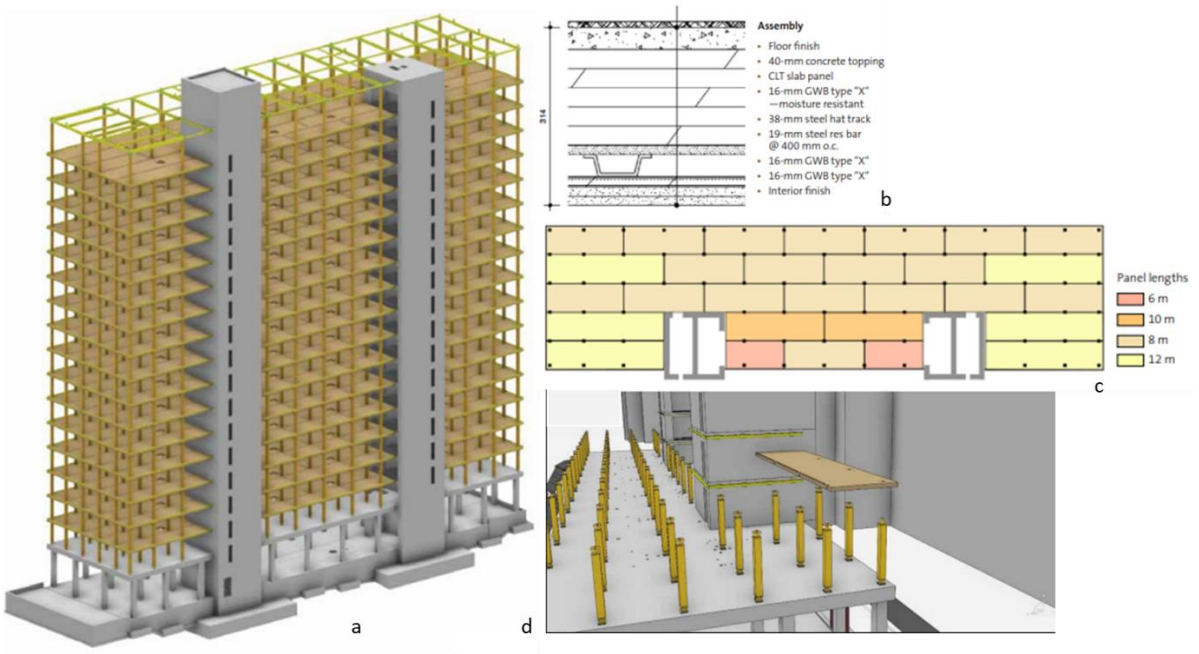


Figure 10. a) Hybrid structural system (Naturallywood, n.d.), **b)** Typical floor section detail (Naturallywood, n.d.), **c)** CLT panel plan (Naturallywood, n.d.), **d)** The connection of GLT columns-CLT floor panels and reinforced concrete core drawing (Naturallywood, n.d.)

Figure 11. a illustrates the connections between the reinforced concrete slab and the timber columns. Equally important is the interface between the CLT floor panels and the concrete core, which must transfer vertical shear while accommodating the differential settlement between the timber and concrete systems, estimated at approximately 50 mm. This was achieved using a steel ledger angle (203 × 152 × 13 LLH) welded to a 300 mm embedded plate cast into the core at 1,500 mm intervals, then fastened to the CLT panels (Naturallywood, n.d.). Adjacent CLT panels were connected along their edges using 140 × 25 mm plywood splines. A round hollow structural section is welded to steel plates embedded at both the top and bottom of each column and secured with threaded rods epoxied into the column. At the column bases, a smaller-diameter hollow section nests within the one above. The CLT panels rest atop the lower columns and are anchored to the steel plates with four threaded rods (Figure 11. b). Figure 11. c shows a cross-section of the rooms in the dormitory building. The building's prefabricated façade consists of 8 m–long steel-stud sections with integrated Windows (Figure 11. d). The cladding was replaced with high-pressure laminate panels made of 70% wood-based fibers, displaying a striped pattern of light and dark shades. Corner glazing softens the building's edges, while a metal cornice caps the structure (Naturallywood, n.d).

The building was erected extremely quickly, with two floors added each week; the superstructure was completed in only nine and a half weeks, ahead of schedule. The mass-timber superstructure is approximately 7,648 tons lighter than an equivalent concrete building, allowing for smaller and more economical foundations (Fast et al., 2016). However, in a high-seismic context like Vancouver, the reduced mass also lowers the structure's overturning resistance compared to concrete.

Wood is a sustainable and versatile building material. It stores carbon dioxide rather than emitting it, and continues to do so for the life of the structure and beyond when wood fibre is recycled or reclaimed. Using wood products instead of other materials in the building avoids the emission of more than 2,432 metric tons of carbon dioxide equivalent. The building was designed to achieve LEED Gold certification (Thinkwood, n.d.).

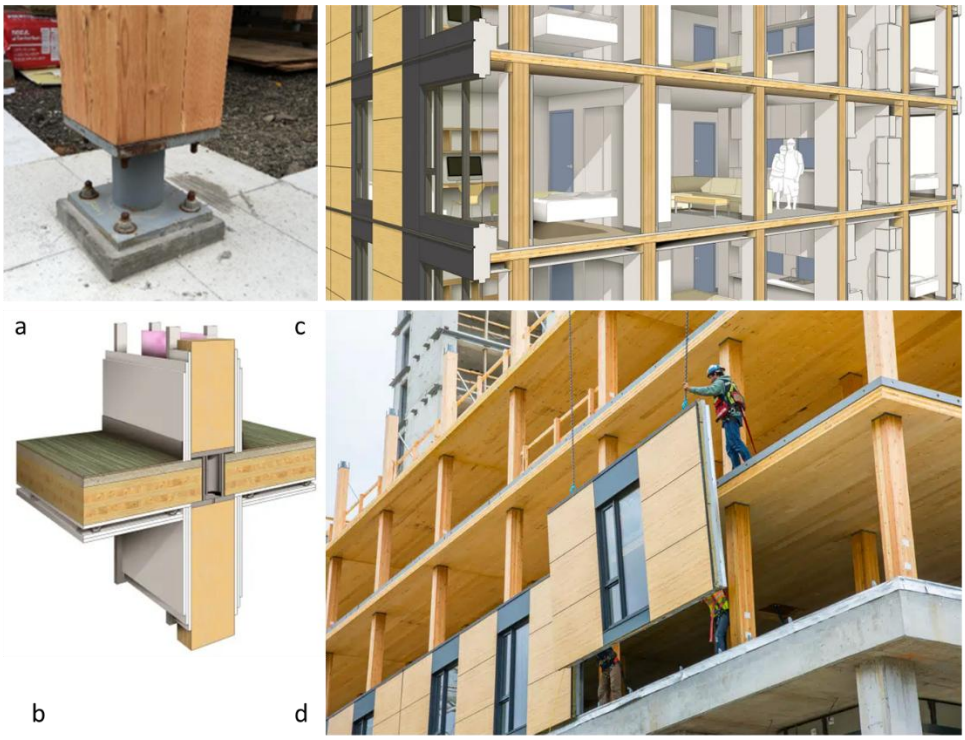


Figure 11. a) Column-to-slab connection (Connolly, et al., 2018), **b)** Steel connector detail at CLT panel floor-and-GLT column intersection (Architectmagazine, n.d.), **c)** Encapsulated mass timber structure (Actonostry, n.d.), **d)** Facade panel installation (Naturallywood, n.d.) Image (Law, K.K., n.d.)

3.2. The Advantages of Using Timber-Concrete Composite Systems in Construction

- The CLT panels used for the flooring are load-bearing in two directions and therefore do not require supporting beams.
- The reinforced concrete cores of the building provide lateral stability by moving in unison with the CLT floor panels. This also reduces seismic loads.
- Due to the adjustment of the panel size according to the maximum span that can be crossed in the plan, together with the timber column system and the design of the architectural project, the span has increased and the structural efficiency of the system has improved, while the total number of panels per floor has decreased.
- The reinforced concrete timber composite structure is lighter than a reinforced concrete structure.
- The use of timber in the flooring has improved the structure's acoustic properties.

3.3. The Disadvantages of Using Wood-Concrete Composite Systems in Construction

- The water absorption of timber materials in the structure must be taken into account, and installation must be carried out according to weather conditions. For this reason, timber manufacturing at the construction site took place during the spring months.
- As current standards in the western Canadian market could not meet the moment and deflection values in the two-way spread CLT panels, the panels were specially manufactured.

4. Conclusion and Suggestions

This study examined the Brock Commons Student Residence project, in which processed timber structural elements were favoured alongside reinforced concrete. The results obtained in the material comparison table (Table 1) lend support to the use of these elements.

Table 1. Evaluation table of construction materials according to selection criteria

	in-situ reinforced concrete	prefabricated reinforced concrete	natural wood	engineered wood	welded steel	bolted steel connection
accessibility to materials	6	5	2	3	5	5
ecology and sustainability	3	3	6	5	4	4
load applied to the structure	3	4	6	6	5	5
cost	6	5	2	3	4	4
construction period	2	5	3	4	3	4
effect on human health	3	3	6	5	4	4
construction site waste generation	3	6	6	6	5	6
sound transmission	4	4	6	6	2	2
thermal conductivity	5	5	6	6	1	1
fire resistance	6	6	1	1	3	3
seismic resistance	4	4	5	5	6	6
opening passed through	4	5	3	5	6	6
energy consumption during production	4	3	6	5	1	2
the service life of the material in the structure	3	3	5	5	6	6
Total	**56**	**61**	**63**	**65**	**55**	**58**

Note: This table compares material types according to the criteria that determine material selection. The most advantageous material is given a value of 6, and the most disadvantageous material is given a value of 1 (The data was obtained from a survey conducted among faculty members and construction industry workers).

Compared to traditional timber systems, timber-concrete composite systems offer greater advantages in terms of rigidity, acoustic performance, fire resistance and earthquake resistance. Wood is a natural building material. Using wood instead of reinforced concrete in construction reduces the amount of harmful gases released during concrete production and use, consequently reducing the carbon footprint. Compared to reinforced concrete systems, the reduced weight decreases the load on the foundation, thereby increasing earthquake resistance. Furthermore, wood's aesthetic appearance makes wood-concrete composite building systems more appealing from an architectural perspective.

This composite system, which combines timber and concrete, provides structural and environmental benefits compared to structures made of either wood or reinforced concrete alone. The Brock Commons building has also gained a lighter and stronger structure. Using wood has enabled a more ecological design. Furthermore, factory production of the timber elements meant that construction could be completed in just seven months. The timber-concrete composite system's versatility, as demonstrated by its use in both new buildings like Brock Commons and the reinforcement of old structures, enhances its appeal.

This study highlights the advantages of using reinforced concrete-timber composite systems in buildings. However, it also reveals that these applications require special detail solutions and detailed work plans. Efforts should be made to facilitate easier solutions and promote the use of these construction systems. Taking into account the native wood species in Turkey and earthquake regulations, a future study is proposed that will involve the design and numerical analysis of a similar hybrid system.

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The article was written by a single author. There is no conflict of interest.

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