Feasibility of Point-Supported Mass Timber

Tall wood buildings offer tremendous potential for low-carbon, high-performance construction, but they also introduce a distinct set of challenges not typically encountered in conventional approaches. Design teams new to this form of construction may be unfamiliar with the systematic approach needed to enhance affordability and efficiency in these buildings.

Within the spectrum of structural solutions for mass timber, point-supported CLT is a compelling option for tall building applications. Teams must understand how to harness its unique benefits and navigate its limitations to unlock its full potential. When applied effectively, point-supported approaches can improve efficiency, reduce material usage, and unlock new pathways to cost-competitive tall timber construction.

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Photo Courtesy naturallywood.com

Efficiency of Point-Supported Systems

Recent changes in Canadian Building Codes have allowed for timber buildings taller than ever before. Residential buildings up to 18 storeys are now code permitted in BC & Ontario. Wood construction has gained interest for its affordability, sustainability, and high performance. Point-supported CLT stands out as one of the most effective systems for residential buildings using Encapsulated Mass Timber Construction (EMTC) in the 7–18 storey range. Recent examples include Brock Commons (18 storeys), BCIT Tall Timber (11 storeys), and Tallwood 1 (12 storeys).

Point-supported systems differ from more traditional post and beam systems in that they do not use beams to support the floor/roof panels.

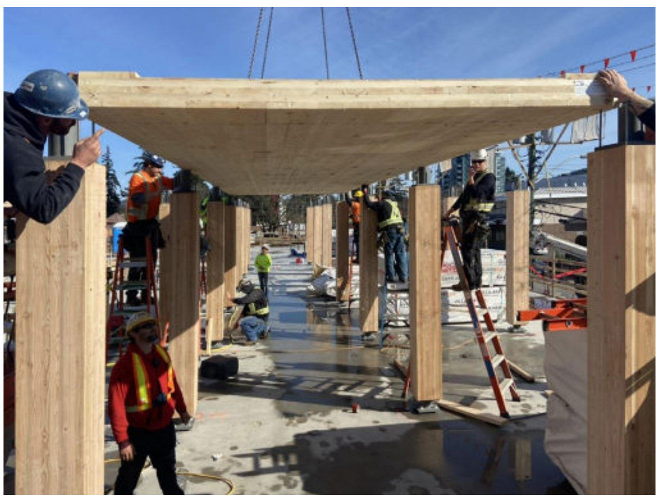
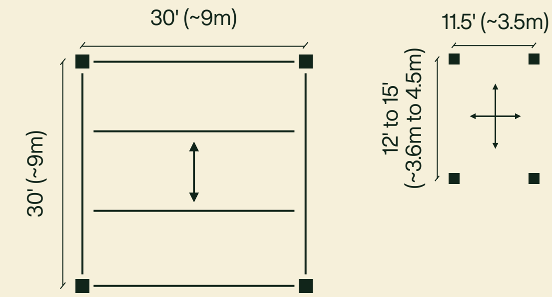


Figure 1. Tallwood 1 – installation of first CLT panel, March 2021

Panels span between posts directly, generally positioned at the corners of panels and use the two-way bending capability present in panels with alternating grain direction (CLT and MPP are the most common examples).

EMTC tends to be optimized for material cost, by minimizing structural fibre volume. This approach can lead to many structural pieces. For taller buildings, this can lead to longer construction times adding cost. Figure 2 compares fibre volumes and structural pieces for a fictitious 12-storey building with a 185' x 45' floor plate.

Framing	Purlin + Girder (Optimized for fibre volume)	Point-Supported (Optimized for erection)



Structural Pieces	924	732 (-25%)
Panels	192	192
Columns	180	540
Purlins	408	–
Girders	144	–
Fibre	28,700 ft³ (812 m³)	33,100 ft³ (+15%) (937 m³)

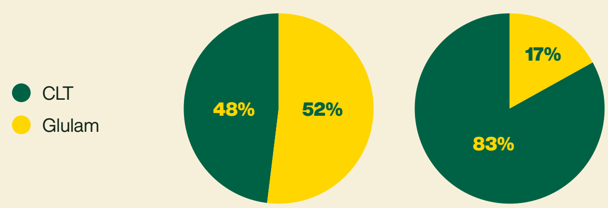


Figure 2. Comparison between structural schemes for a 12-storey EMTC building

Point-supported systems have significantly fewer pieces at the cost of increased fibre volume (e.g., thicker panels). However, CLT can typically be manufactured more efficiently than Glulam due to the large variation in lumber grades used in CLT. Thus, material costs for point-supported systems can be comparable, with the advantage of accelerated erection times.

The benefits of construction speed cannot be understated. When approached systematically, schedule savings could outweigh the material cost difference of a point-supported system. A recent example is 1510 Webster, with 16 storeys of timber erected in just three months[1]. The superstructure was completed one month ahead of schedule, with a net savings of $30 million USD compared to a concrete option[1].

Hybrid Construction Schemes

As building codes limit the use of wood lateral systems, a hybrid building that maximizes the inherent benefits of each material will likely be the most cost effective. Concrete and steel are commonly used in the lateral systems of tall buildings.

Point-supported systems share many similarities with current tall concrete buildings in Canada, allowing for seamless integration in current construction practices.

Figure 3. Brock Commons Tallwood House
Photo Courtesy naturallywood.com

The flat slab system with a concrete core is a common residential tower structural system. A point-supported wood system replaces the concrete slabs with a lighter material, providing potential savings in the core and foundation due to lower gravity and seismic loads. The benefits of a flat slab for mechanical systems are retained with this system and pre-drilled penetrations allow fast mechanical install with minimal field cutting for openings.

Mass Timber can also be combined with steel elements such as columns and braced frames. This creates an opportunity to maximize benefits from offsite construction, allowing for potential time-savings in site installation.

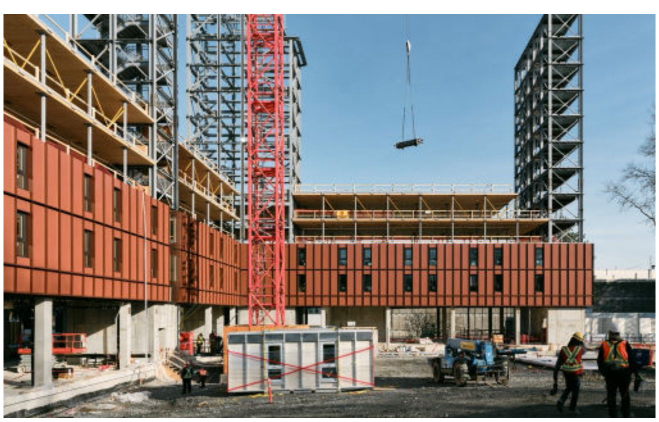


Figure 4. BCIT Tall Timber
Photo Credit © Andrew Latreille

Steel columns can be simpler to fabricate and erect due to reduced weight. Their smaller profile allows them to be concealed in fire-rated partition walls more efficiently than larger timber columns. There are potential synergies from consolidating trades for steel and timber, as they require similar practices. Reduced embodied carbon compared to concrete alternatives is also a significant benefit.

Architectural Considerations

Point-supported timber systems are ideal for occupancy types that benefit from small or easily divisible unit sizes. As the panels are supported along each side of the panel the panel width will determine the column grid. As manufacturers have different maximum panel widths, it is critical to check if your column grid is feasible with potential suppliers.

Early collaboration will set up the project for success. Schematic panel layout should occur at the same time as supplier review for a cost-effective and optimized design.

Figure 5. Brock Commons Tallwood House
Photo Courtesy naturallywood.com

Occupancies that have the same size units as dorms or hotels are ideal for a point-supported layout. Generally, two- and three-bedroom residential can be more difficult as column layouts need to remain consistent. Similar to all other material types, column layout should not vary over different storeys, so a floor layout that is consistent over all residential levels will be more cost-effective.

Structural Considerations

Point-supported systems rely on biaxial capabilities of mass timber panels. Designers must account for orthotropic properties that affect load distribution between major and minor panel directions.

Bending

The most accurate approach to capturing biaxial bending behaviour is with a Finite Element model. Layered surfaces or equivalent effective stiffness properties in each direction are common approaches to account for this orthotropic behaviour.

Along the strong axis, panels tend to behave as continuous flexural elements. Columns act as pinned supports, causing maximum hogging moments at these locations. The bending resistance is the highest in this direction as most laminations are parallel to the load.

In the short direction, panels will behave as simply supported between columns in the weak axis. These design moments often govern panel behaviour because of the weaker bending resistance. For instance, a 5-ply panel has two laminations relatively close to the neutral axis that resist bending stresses.

Shear

Like two-way concrete slabs, punching shear is a common governing failure mode for point-supported CLT. This is largely due to the relatively weak Rolling Shear Capacity of the intermediate layers. Although reinforcing with self-tapping screws is possible, there could be significant cost implications with this approach. It is advisable to limit spans and panel thickness to avoid having to reinforce at numerous locations.

Designing for punching shear is not currently part of CSA O86:26. As a result, designers need to rely on methodology outlined in testing reports. This tends to involve intricate Finite Element Models and a thorough understanding of wood mechanics for an an accurate assessment.

Cost Efficiency

A team consisting of design and construction experts was assembled by BC Housing to assess the feasibility of tall EMTC buildings. Their findings were published in the report titled "A Comparative Feasibility Study for Encapsulated Mass Timber Construction: BC Energy Step Code Compliant 7 to 12 Storey Buildings".

Three archetypes were developed based on trends and climatic zone needs in three different locations in BC. A three-level concrete podium structure was introduced for all archetypes as it allows for larger grids for commercial and amenity spaces at lower floors, in addition to more efficient parking layouts.

Construction Costs

A comprehensive comparison was developed for both concrete and EMTC options for each archetype. Cost and schedule variances from a baseline concrete building are summarized in the table below.

Scheme	Unit Cost Variance ($/sq.ft)	Schedule Variance
Point Tower (Vancouver)	−1.9%	−122 days (−19%)
Slab Tower (Kamloops)	−1.9%	−128 days (−20.9%)
L Tower (Coquitlam)	−0.6%	−150 days (−18.2%)
Average	**−1.5%**	**−133 days (−19.4%)**

Table 1. Cost and schedule comparison between concrete and EMTC schemes[2]

EMTC is installed faster than concrete construction in all scenarios considered. When accounting for the accelerated schedule, total construction costs were similar between concrete and EMTC schemes. This is due to the shortened erection times mentioned previously, and a 20% reduction in concrete volume for foundations[2]. Minimal variance was found in all other construction activities.

Sustainability

Sustainability targets have historically focused on operational carbon, which can be reduced with increased insulation and high-efficiency envelope construction. This approach often overlooks a considerable portion of greenhouse gas (GHG) emissions from manufacturing and construction processes. Municipalities have started introducing requirements for Life Cycle Assessments (LCAs) to reduce carbon emissions from all construction activities. When accounting for embodied carbon, EMTC shows significant advantages over steel and concrete buildings. According to a report from BC Housing, EMTC can result in up to a 70% reduction in Global Warming Potential compared to traditional construction[2].

Closing Remarks

Mass Timber requires a more collaborative and systematic approach than is typical under current construction methods. Pre-fabrication, service integration, and layouts consistent with manufacturing constraints are critical. With these systems in place, mass timber can provide a high-performance and cost-effective solution for tall buildings.

The point-supported timber system is just one way to build timber structures, but it can be a very effective system for tall residential construction and should be an option that every design team considers.

References

1. **Morrison Hershfield.** *A Comparative Feasibility Study for Encapsulated Mass Timber Construction: BC Energy Step Code Compliant 7 to 12 Storey Buildings.* BC Housing, 2023. BC Housing Research Centre, research-library.bchousing.org/Home/ResearchItemDetails/8722. Accessed 31 Mar. 2025.
2. **WoodWorks.** *1510 Webster Case Study.* WoodWorks – Wood Products Council, Jan. 2024, woodworks.org/resources/1510-webster/. Accessed 31 Mar. 2025.

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