Mass Timber

Mass timber construction uses engineered wood products, such as cross-laminated timber (CLT), glulam, and nail-laminated timber (NLT), which are formed by bonding layers of wood with adhesives or fasteners. Panels and beams are manufactured off-site for strength and speed, then assembled on location for tall buildings and other structures. This method offers significant environmental benefits, strong structural performance, and efficient construction. However, like other lumber products, mass timber is vulnerable to moisture damage and pest infestation.

Hazard Resilience

Fire resistant, as surface char forms a protective layer. Fire rating of 3+ hours.

Moisture management is needed. Risk of swelling or decay without protective detailing.

Strong wind resistance as engineered connections provide stability.

High thermal efficiency and moderate insulation.

Flexibility and engineered joints help withstand earthquakes.

Cost estimates for mass timber construction can vary by region, design, and supply factors. In British Columbia, current quoted costs for mass timber systems are in the range of $400–$450 per square foot, influenced by demand, manufacturing capacity, and regulatory support. Prefabrication reduces construction time and labor, while local sourcing supports regional economies. Upfront costs can be higher than conventional concrete but may be offset by speed and sustainability incentives. Depending on the extent and degree of fire damage, post-fire repair may be intensive and expensive.

North Vancouver city hall. Photo Credit: KK Law, courtesy naturallywood.com

Climate Resilience

Component	Mass Timber
Fire	✅ Fire resilient, with asterisks. Extensive fire testing shows mass timber can achieve and exceed code-required fire ratings even when exposed. Panels char on the surface, forming a protective layer beneath, which preserves structural strength—often lasting 3+ hours in standard fire tests. The BC 2024 Building Code requires mass timber be encapsulated with a noncombustible material. The National Building Code 2020 requires the same. Additionally, sprinkler installations are required during construction process of mass timber buildings. Depending on the extent and degree of fire damage, post-fire repair may be intensive and expensive.
Floods	⚠️ Flood resilience is moderate. Water exposure can cause swelling or degrade timber over time. Well-detailed construction (protective coatings, ventilation, elevated foundations) can reduce risk, but mass timber, like all wood, requires moisture management to prevent decay and mold.
Moisture	⚠️ Moisture-sensitive, but manageable. Engineered wood (CLT, glulam) is less sensitive than solid lumber but still requires proper detailing. Vapor-permeable membranes, seals, and rain screens are used. Prolonged wetting can cause decay or structural weakening.
Extreme Temperatures	✅ Good thermal performance. Mass timber has significant thermal mass. Temperature swings are controlled via layered construction, air sealing, and panel thickness. With correct detailing, panels perform well in both heat and cold; freeze–thaw durability is good. ⚠️ Moderate insulation properties
Wind	✅ Strong wind resistance. Mass timber structures can withstand substantial wind loads. Tall timber buildings use engineered connections (steel anchor rods, lateral trusses) and composite/substrate systems to provide redundancy and stability, with demonstrated robustness in Canadian testing.
Seismic	✅ High seismic resilience. Mass timber is lightweight and flexible; walls and frames absorb and dissipate earthquake forces, with good ductility. Connections and panel systems are engineered to allow the structure to bend and return to normal after an earthquake, supporting resilience.

Benefits & Risks

Aspect	Benefit of Mass Timber	Risk of Mass Timber
Environmental	Renewable resource that stores carbon, with lower embodied emissions than concrete/steel. Biodegradable. Mass timber can reduce construction emissions by 25–45%.	Sourcing depends on sustainable forestry. Manufacturing energy and adhesives still contribute to emissions.
Durability	Durable, with proper detailing against moisture. Fire and pest-resistant engineered wood products (CLT, glulam) have strong performance.	Prolonged moisture or flooding can cause decay. Connections and coatings need regular inspection. Risk of pest infestation. Repairs or retrofits, especially post-fire, may be complex and costly.
Energy Efficiency	Moderate thermal insulation combined with thermal mass lowers energy use. Prefab panels reduce construction waste. Air sealing and layered assemblies enhance comfort and efficiency.	Insulation value (R-value) is lower than others, so layered wall systems or additional insulation may be needed.
Economic	Faster on-site assembly, reduced labor, and lower foundation costs. Materials are generally locally sourced, as forestry is a significant B.C. economic sector.	Cost volatility due to major supply/demand fluctuations, with current upfront cost estimates currently high ($400 – 450/ft2). Production volume may be limited by manufacturing capacity.
Regulation & Codes	B.C. building code was updated and mass timber buildings up to 18 storeys permitted	Navigating approvals remains complex. Insurance may be more expensive or difficult to secure for very tall or new mass timber buildings.

Technical Feasibility & Cost

Materials:
Mass timber refers to engineered wood products such as cross-laminated timber (CLT), glue-laminated beams (glulam), nail-laminated timber (NLT), or dowel-laminated timber (DLT). These are made by layering wood planks with adhesives (or mechanical fasteners), forming large panels/beams with high strength for structural use. Timber is typically manufactured off-site for precision and quality, then assembled on location.

Maintenance and Lifespan: Well-built mass timber structures can last for generations if protected from moisture and pests. Routine monitoring for leaks and connection wear is important. Repairs and retrofits may require expert oversight and specialty trades, but wood is generally easier to adapt than concrete.

Building Codes: BC's building code allows mass timber buildings up to 18 storeys. It may still be considered innovative or 'alternative' in certain applications; insurance and permitting can be more complex for very tall projects.

Cost Estimate: *The cost of mass timber construction in Canada in 2025 typically ranges from $400 to $450 per square foot, with a 10–20% premium over concrete due to higher material and insurance costs, and external factors like lumber market fluctuations and tariffs adding further volatility.*

Bioenergy Research & Demonstration Facility at UBC.
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Construction

Construction

- Tall buildings use mass timber columns, beams, and floor/roof panels for the core and shell.
- Wall/floor systems connect via steel anchor rods, engineered connectors, and, in some cases, combined concrete/mass timber hybrid approaches.
- Prefabricated panels can enable faster assembly and less waste.

Method	Details
Prefabricated mass timber panels	CLT/glulam/NLT panels are made off-site, then delivered and assembled.
Hybrid timber-concrete systems	Mass timber is used for vertical/horizontal framing. Concrete is used for core or floors when needed.
Composite/substrate connection	Steel rods, engineered connectors used for lateral and vertical reinforcement.
Traditional frame with timber infill	Less common for high-rise but used for smaller buildings and residential applications.

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