



Mass Timber Construction in Builders Risks

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Executive Summary

Mass timber construction is becoming more common place and accepted on larger structures throughout the United States. Its benefits including efficiency, stability, sustainability, and aesthetics have contractors, designers and project managers enthusiastic about the direction of construction. While this construction type may have many positive factors, there's still risk that comes with it.

While it's said that mass timber may not necessarily be as much of a fire hazard as traditional wood frame construction, research and testing are still being completed to evaluate how this construction type performs in a fire. For builders risk coverage, it has many of the same exposures that exist in a traditional wood frame constructed building and should be underwritten and assessed with these exposures in mind.

What is Mass Timber?

Mass timber is a new category of wood products comprised of multiple solid wood panels that are typically glued together. Common types of mass timber are identified as Cross-Laminated Timber (CLT), Laminated Veneer Lumber (LVL), or Glued-Laminated Timber (Glulam). The laminated wood panels provide additional strength and stiffness than traditional wood products, and allow for the construction of larger and taller buildings. Mass timber is becoming a strong, low-carbon alternative to concrete and steel.¹

Types of Mass Timber:

- **Cross-Laminated Timber (CLT)**²- consists of layers of dimension lumber (typically three, five or seven) oriented at right angles to one another and glued to form structural panels for maximum strength and stability.
- **Glued-Laminated Timber (Glulam)**²- is composed of individual wood laminations (dimension lumber), selected and positioned based on their performance characteristics, and then bonded together with durable, moisture-resistant adhesives.
 - GLT needs to be manufactured to industry specifications and the glue used in GLT must be specific for GLT construction.²
- **Laminated Veneer Lumber (LVL)**³- is made of dried and graded wood veneer³ which is coated with a waterproof phenol-formaldehyde resin adhesive, assembled in an arranged pattern, and formed into billets by curing in a heated press.

Common Uses:

With mass timber's benefits to being a sturdy, aesthetically pleasing and environmental-friendly option, it's clear why this type of construction is a solid solution. As a complement to other wood framing options, it can be used on its own, in conjunction with other wood systems such as wood frame, or in hybrid structures with steel or concrete. As mass timber construction increases in popularity, the following types of property may see this type of construction:

- Office buildings
- Public and institutional buildings
- Schools, colleges, universities
- Hotels²

History and Background

Cross-laminated timber (CLT) was first developed in the early 1990s in Austria, where softwood forestry is extremely common. It was championed by researcher Gerhard Schickhofer, who is still active and who won a prestigious forestry prize for his work to standardize and secure popular support for the new material.³

In Austria and in Europe, CLT was developed for use in residential construction and its popularity spread in the 2000s. In Europe, wood frame construction for homes is less common than in the U.S.; they prefer more solid materials like concrete or brick. CLT was meant to make residential construction more sustainable.³

But in the U.S., CLT can't (yet) compete with wood frame construction, which is cheap and ubiquitous. It wasn't until North American architects got the idea of using CLT in bigger buildings, as a substitute for concrete and steel, that it began popping up in North America in the 2010s.³

In 2015, CLT was incorporated into the International Building Code (IBC), which jurisdictions across the US adopt as their default. A set of new changes that will enable mass timber structures up to 18 stories tall have been accepted and are expected to be formalized into the newest IBC code in 2021.³

Why Mass Timber?

The overall costs of a building constructed of mass timber is less than a traditional concrete and steel building. While mass timber is generally more expensive per unit than steel or concrete, the savings is recognized in reduced labor costs where the number of construction workers required on-site may be reduced as much as 50%. In addition, projects can be constructed 25% faster. A building constructed of mass timber can be built quicker than a traditional concrete and steel building.² Both factors impact the bottom line of the contractor and building owner. It's easy to point out the positive aspects of this construction type, but oftentimes its challenges are overlooked.



Challenges to Consider with Mass Timber

Mass timber construction presents many challenges compared to traditional noncombustible construction. When classifying building construction, mass timber should be viewed as combustible as a wood frame project due to the exposure of the wood in the exterior and interior of the structure.

This type of construction takes an experienced contractor who not only understands how to build with mass timber but understands the fire exposures. Mass timber construction introduces new techniques and requires skills which differ from today's standard building construction. That said, special skilled trades are required for handling such projects. Additionally, the timing of timber arriving on site is critical – it needs to be installed quickly with limited time in a lay-down yard to prevent damages.

Most mass timber products arrive on the job pre-constructed, and only need to be assembled onsite. While in transportation, it's crucial to prevent damages to the products while in route to the job site. Other attributing key factors include ensuring the project site components will be protected from weather-related elements, and the glue-laminated timber (GLT) needs to be manufactured to industry specifications.

Probable Maximum Losses (PML):

- The larger the combustible structure, the harder it may be to extinguish a fire.
 - This potentially could result in damage to other adjacent properties.
 - Hot burning embers from combustible wood constructed buildings have spread fires to other properties as far away as a half mile if high winds are present at the time of the fire.
- Mass timber construction will burn and char on the exterior. The stability of charred wood varies by the intensity of the fire, and damage will need to be evaluated by a structural engineer to assess its integrity.

- Charred wood from an insurance perspective, although still intact, will present an aesthetics issue. It will most likely need to be replaced which could be extremely costly.
- Burning wood produces heavy smoke resulting in extensive smoke damage that may be costly to clean and/or replace from the building structure and HVAC components.
- Research continues on the effects of wood delamination when glues are exposed to high heat during a fire.
 - This can lead to replacement of members only partially damaged from a fire or heat.⁴
- Timber is more susceptible to water damage than buildings constructed of concrete and steel. In addition, moist timbers if encapsulated can lead to mold.
- The material lay down yard has the potential to be exposed to fire loss and malicious mischief if not properly protected.

Fire Prevention and Mitigation Actions to Consider:

- Fire prevention management and policies need to be strictly enforced.
- A mandatory hot work program should be implemented and enforced on site.
 - Hot work includes cutting, welding or any spark producing work. Depending on the phase of construction in a non-combustible project, a fire initiated by hot work, while dangerous, will generally result in an isolated fire loss.
 - By comparison, a hot work fire ignited in a combustible mass timber project will likely result in significant loss and delay in project completion.
- Building fire protection systems should be activated as soon as possible especially for those with increased size and value.
- Site surveillance including watchman services, fire and intrusion detection alarm systems, and/or monitored cameras are much more important throughout all stages of construction than with projects that have non-combustible construction.



Long Term Impacts:

- Compared to concrete, steel or any type of non-combustible construction, insurance costs may be significantly higher during construction and upon completion for the life of the building.
- The building owner's and general contractor's reputation and public image can be extremely damaged from a large fire which could result in a negative impact to both the owner and general contractor.

Conclusion

It is imperative for new building owners and general contractors to understand both the many advantages and disadvantages of mass timber construction. It's easy for them to be swayed by the cost, speed, aesthetic, and sustainability of this type of construction. However, there's still research that needs to be done on the long-term effects of risk exposures before the industry chooses to go all in on mass timber. For the insurance industry, the potential damage to mass timber constructed buildings from smoke, fire and water must not be underestimated.

Contact us

To learn more about how Intact Inland Marine can help you manage your mass timber construction related exposures, please contact Stephen Lavallee, Risk Control Manager for Intact Inland Marine at SLavallee@intactinsurance.com or 781-332-7915.

Resources

¹Building Systems - Woodworks. (n.d.). Retrieved March 19, 2021, from <https://www.woodworks.org/design-and-tools/building-systems/#tabs-1-2>

²reThink Wood. (n.d.) Mass Timber in North America: Expanding the possibilities of wood building design. Retrieved from <https://www.awc.org/pdf/education/des/ReThinkMag-DES610A-MassTimberinNorthAmerica-161031.pdf>

³Laminate Veneer Lumber - The Canadian Wood Council. CWC. (2019, April 9). <https://cwc.ca/how-to-build-with-wood/wood-products/structural-composite/laminate-veneer-lumber/>.

⁴Roberts, D. (2020, January 15). The hottest new thing in sustainable building is, uh, wood. Retrieved from <https://www.vox.com/energy-and-environment/2020/1/15/21058051/climate-change-building-materials-mass-timber-cross-laminated-clt>

⁵Brandon, D. (2018, March). *Fire Safety Challenges of Tall Wood Buildings - Phase 2: Task 4 - Engineering Methods. Phase 2: Task 5 - Experimental Study of Delamination of Cross Laminated Timber (CLT) in Fire*. Fire Protection Research Foundation.

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