

Timber and Architecture (Part III — The Future)**Guram Svanadze***Georgian Technical University, M.Kostava st 77, Tbilisi 0159, Georgia.*guramsvanadze@gmail.comDOI: <https://doi.org/10.52340/building.2025.72.02.08>

Abstract Until the late twentieth century, engineers believed that constructing timber buildings taller than six stories was structurally impossible. Traditional sawn timber offered sufficient strength when forces acted parallel to its grain, yet it remained vulnerable to loads applied perpendicularly. As a result, wood lacked both the tensile capacity of steel and the compressive strength of reinforced concrete—qualities essential for building tall structures and resisting lateral forces such as wind.

Today, however, timber architecture has undergone a radical transformation. Buildings exceeding 80 meters in height have been completed or are currently under construction in Europe, North America, and Australia. Entire “timber districts” are emerging in several cities, and architects are now designing large-scale facilities—airports, railway stations, pedestrian bridges, schools, hospitals, and even stadiums—using engineered mass timber. Research increasingly confirms the positive psychological and physiological benefits of biophilic materials within educational and healthcare spaces. Notably, in 2024 the world’s first fully timber stadium opened,



Fig. 1. W350 Project, Tokyo.

signaling a paradigm shift in large-scale structural design.



Fig. 2. Eco Park Stadium, Stroud, UK. Zaha Hadid Architects.

This article examines how engineered timber technologies such as CLT, LVL, and Glulam are reshaping contemporary construction, and it analyzes their potential impact on the global building industry in the coming decades.

Introduction

Historically, preparing raw timber for construction required labor-intensive manual work. In contrast, the modern timber industry operates through automated manufacturing systems that process wood with extraordinary speed and precision. Today, engineered components can be fabricated in almost any size or geometric configuration. Large building sections—entire wall panels, floor plates, and even multi-bay structural modules—are assembled in controlled factory environments before being transported to site.



Fig. 3. Illustration showing the process of manufacturing architectural parts in a factory.

This shift has fundamentally changed the nature of construction. Off-site fabrication reduces noise, dust, and on-site labor risks; it accelerates project timelines; and it minimizes weather-related delays. Contemporary engineered wood products—most notably cross-laminated timber (CLT), laminated veneer lumber (LVL), and glued laminated timber (Glulam)—allow entire buildings to be constructed from wood, from primary load-bearing columns to structural walls and diaphragms.

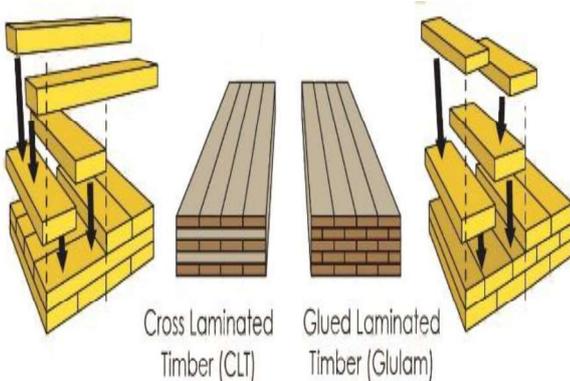


Fig. 5. The illustration depicts the process of transporting an architectural detail made in a factory.



Fig. 6. The illustration shows a plan for making cross-laminated and glued laminated timber.

Moreover, mass timber's favorable strength-to-weight ratio enables the creation of components that, relative to their weight, are stronger than steel. CLT, in particular, exhibits remarkable seismic resilience due to its ability to undergo controlled deformation without catastrophic failure. These Fig. 4. The illustration depicts the installation process of a factory-made architectural detail.

innovations challenge long-held assumptions about the limitations of wood, opening new possibilities for tall, large-span, and complex architectural forms.

Main Discussion — How Timber Will Shape the Construction Sector in the Coming Years

Cross-laminated timber represents one of the most transformative developments in architectural materials. Produced by bonding layers of solid-sawn boards in alternating grain orientations, CLT forms robust, dimensionally stable panels that resist loads in multiple directions. Because of this multi-axial strength, CLT performs differently from traditional materials such as reinforced concrete, which tends to crack and fail more abruptly. Timber's elastic behavior allows significant deformation before structural failure, providing inherent resilience.



Fig. 7. Forte Tower, Melbourne, Australia. 2012

Although first developed in Europe during the early 1990s, CLT entered the International Building Code only in 2015, enabling mass-timber structures up to 18 stories. Since then, the global expansion of tall-timber construction has accelerated dramatically. LVL—created by laminating thin veneers under high pressure—and Glulam—constructed from bonded dimensional timber—further expand design

flexibility, allowing architects to create long-span beams, curved elements, and expressive structural forms that would be difficult or inefficient to produce in steel or concrete.

One of the most compelling advancements is the emergence of mass-timber high-rises. Over the last decade, timber buildings have progressively climbed higher: from Melbourne's 32-meter, ten-story Forté Tower in 2012 to the current record-holder, the 25-story, 88-meter **Ascent MKE** mixed-use tower in Milwaukee, USA. Built with Glulam columns and massive CLT floor plates, Ascent demonstrates the viability of timber skyscrapers. Despite its height, the building weighs only one-fifth as much as a comparable reinforced concrete structure.



Fig. 8. Ascent MKE, Milwaukee, USA. 2022.

Even more ambitious proposals are advancing:

- a 21-story residential tower in Amsterdam,

- a 40-story timber skyscraper in Stockholm,
- an 80-story conceptual mass-timber tower at London's Barbican,
- and a 70-story project envisioned in Japan.

These proposals underscore the architectural community's willingness to redefine material hierarchies and challenge the steel-and-concrete paradigm that has dominated since the early twentieth century.



Fig. 9. Ascent MKE, Milwaukee, USA. 2022.

Conclusions

Mass timber—and engineered wood more broadly—constitutes one of the most significant innovations in recent construction history. These materials enable architects to build taller, lighter, and more sustainably than ever before. Global timber consumption continues to rise, surpassing even cement—the closest competitor in volume—whose production currently exceeds 1.3 billion cubic meters per year. Yet this rapid

growth also brings new pressures. Only about 40% of the world's harvested wood is used for non-fuel purposes, raising concerns about long-term forestry management and ecological balance.

Here, scientific research and technological innovation play a crucial role. Engineered wood products have the potential to replace energy-intensive materials such as steel and concrete. Glulam and CLT structures are up to five times lighter than reinforced concrete buildings, reducing foundation requirements and minimizing embodied energy. Considering that concrete accounts for roughly 5% of global carbon emissions and steel for approximately 3%, the transition to timber-based construction represents a meaningful pathway toward climate-neutral development.

Recent laboratory breakthroughs further expand wood's relevance in future material science. At the University of Maryland, Professor Liangbing Hu demonstrated that wood's inherent mechanical limitations can be overcome by partial lignin removal followed by high-temperature densification. The resulting material is not only twelve times stronger than natural wood but also three times more durable, positioning it as a viable substitute for metals such as aluminum and steel.

Researchers at the Wallenberg Wood Science Center have even developed transparent wood by removing lignin entirely and infusing the cellular structure with a resin that matches its refractive index—creating a material that could one day replace glass. Meanwhile, Finnish laboratories are advancing methods for producing biodegradable plastics from wood fibers, introducing new possibilities for carbon-neutral consumer products. Together, these developments point toward a future in which timber is not merely a traditional building material but a foundation for a **post-carbon architectural economy**. Engineered wood could transform everything from

skyscrapers to everyday objects, offering a renewable alternative to some of the most environmentally costly materials of the industrial age. The path ahead suggests not only the rise of taller timber buildings but the emergence of a new material culture—one in which wood, reimagined through science and technology, becomes central to sustainable architectural practice.

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