



## Building the Future in Wood: Harnessing Mass Timber to Store Carbon and Deliver Net-Zero Infrastructure

The buildings we construct today will shape the climate we inherit tomorrow. Across Ireland and globally, the built environment is responsible for a substantial share of greenhouse gas emissions, driven largely by carbon-intensive construction materials. As nations commit to net-zero targets and climate-resilient development, attention is turning to alternative construction methods that reduce emissions while delivering long-lasting infrastructure. Mass timber, an engineered wood product comprising multiple layers of structural grade timber, is capable of achieving significant structural performance and storing carbon for decades. It is emerging as a practical and scalable solution at a time when rapid decarbonisation of the construction sector is urgently required.

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### Research Overview

This research, published in the *Cleaner Environmental Systems Journal* in 2025, and building on initial findings presented in the *Construction and Building Materials Journal* in 2024 and the *Buildings Journal* in 2018, investigates how mass timber can be integrated into buildings and infrastructure systems to reduce whole-life carbon emissions while enhancing structural performance and sustainability outcomes. Recent focus on operational carbon emissions (heating, lighting, etc.) has shifted towards embodied carbon (the emissions associated with materials), highlighting the need for innovation across the built environment. Using a combination of laboratory testing, life cycle assessment, and case studies, the research evaluates how timber structures perform across their lifespan, from material sourcing to end-of-life reuse. The overall approach emphasises practical, evidence-based solutions that support the transition towards a circular and low-carbon built environment.

### Key Insights / Findings

The research demonstrates that mass timber buildings can function as long-term carbon stores, locking away carbon absorbed during tree growth for the duration of the building's life. This creates a dual benefit: reducing emissions associated with traditional materials while actively removing carbon from the atmosphere. Evidence also shows that prefabricated timber systems can improve construction efficiency, reduce on-site waste, and support safer and more predictable project delivery. These outcomes benefit a wide range of stakeholders, including policymakers seeking credible decarbonisation pathways, industry professionals aiming to meet sustainability targets, and communities seeking healthier, lower-impact buildings.



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## Further Reading:

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## Smart Specialisation Strategy (S3) Theme:

Renewable Energy, Climate Change  
& Sustainability

## Sustainable Development Goal (SDG):

SDG 11: Sustainable Cities &  
Communities

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## Why it Matters

The significance of this research lies in its contribution to real-world climate action within the construction sector, one of the most significant industries requiring decarbonisation. By providing robust performance data and practical design guidance, the work helps reduce uncertainty around the use of timber in larger and more complex structures. This supports informed decision-making by engineers, developers, and public authorities responsible for delivering sustainable infrastructure. In practice, this enables more confident adoption of low-carbon construction methods at scale. The societal benefits extend beyond emissions reduction, including improved indoor environmental quality, faster construction timelines, and stronger connections between forestry, manufacturing, and regional economies. Ultimately, the research supports progress towards several SDGs, particularly responsible consumption and production, climate action, and sustainable cities and communities.

## What's Next?

Looking ahead, the research focus of the TRIBE Lab (Transformative Research & Innovation in the Built Environment) leading this work will strive to address environmental challenges through applied research through experimental and demonstration projects, updated building standards, and expanded use of digital tools for measuring whole-life carbon performance. Scaling the use of mass timber will require coordinated action across multiple supply chains, from sustainable forest management to advanced manufacturing and design for disassembly. Future research will focus on long-term structural health monitoring of timber buildings and integration of modular construction methods that allow buildings to be adapted or reused over time. There is also growing potential to apply these solutions to public infrastructure such as schools, transport facilities, and community buildings. By translating research findings into policy and practice, mass timber can become a mainstream component of climate-positive construction systems.



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