MASS TIMBER

Achieving *Net Zero Carbon Footprint* in Construction

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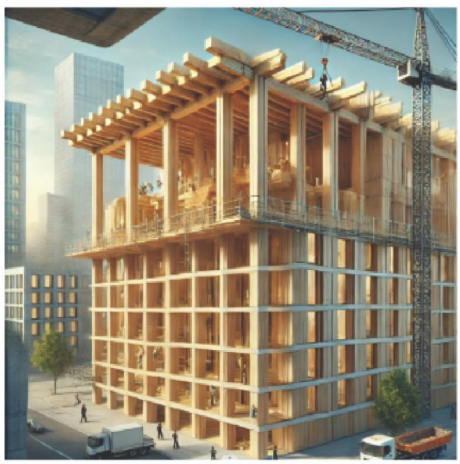
As the construction industry faces its significant carbon footprint, new solutions are being explored to address climate change. One of the most promising materials in this area is mass timber.



By utilizing the natural characteristics of wood, mass timber construction provides a way to greatly lower carbon emissions while producing sustainable and visually attractive buildings.

This article examines the role of mass timber in reaching net zero carbon footprints in construction, along with two case studies that demonstrate its effectiveness through calculations and analyses.

Understanding Mass Timber

Mass timber refers to large wood products that can be engineered for structural applications. Common types include Cross-Laminated Timber (CLT), Glulam (Glued Laminated Timber), and Nail-Laminated Timber (NLT). These products are created by layering and bonding multiple pieces of wood, resulting in high-strength panels suitable for beams, walls, and floors.

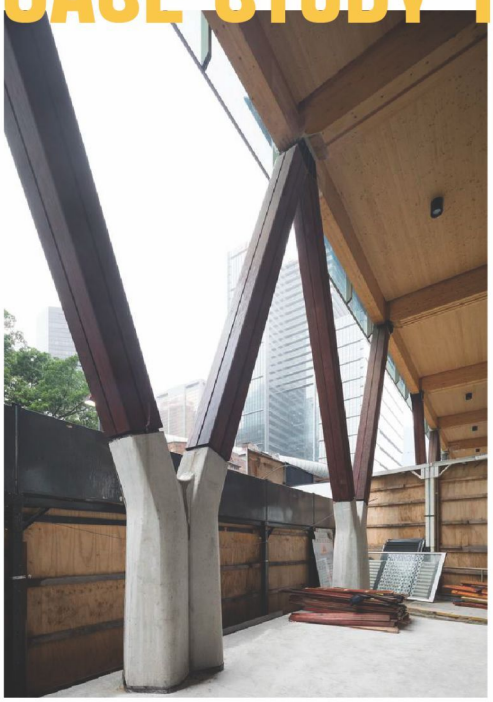
Benefits of Mass Timber

1. Carbon Sequestration: Trees take in carbon dioxide as they grow, storing carbon within their biomass. When used in construction, mass timber keeps this carbon locked away, effectively stopping it from re-entering the atmosphere.
2. Reduced Embodied Carbon: Mass timber has a smaller embodied carbon footprint compared to traditional materials like concrete and steel. The production of concrete releases large amounts of CO2, while timber's life cycle emissions are significantly lower.
3. Energy Efficiency: Wood naturally insulates, which can help lower energy use for heating and cooling in buildings.
4. Renewability: When harvested sustainably, mass timber is a renewable resource, aligning with the principles of a circular economy.

Achieving Net Zero Carbon Footprint

To achieve a net zero carbon footprint in construction, it's crucial to take into account both operational and embodied carbon. Operational carbon pertains to the emissions produced from energy consumption throughout a building's life, whereas embodied carbon includes emissions associated with the materials, such as those from extraction, manufacturing, and transportation.

CASE STUDY 1



International House Sydney, created by TZANNES, consists of six stories made from sustainable cross-laminated timber. This design not only lowers carbon emissions but also contributes to a healthier indoor atmosphere. The visible timber framework showcases the material's natural beauty and durability, proving that mass timber is a practical choice for commercial buildings. Additionally, it enhances public areas and supports eco-friendly urban growth.

Calculations

Materials Used: 2,800 m3 of CLT and 1,500 m3 of glulam.

1. Embodied Carbon:

Total Sequestration:
CLT: 2,800 m3 x 1.1 tonnes/m3 = 3,080 tonnes CO2.
Glulam: 1,500 m3 x 1.2 tonnes/m3 = 1,800 tonnes CO2.

Total Carbon Sequestration:
3,080 + 1,800 = 4,880 tonnes CO2.

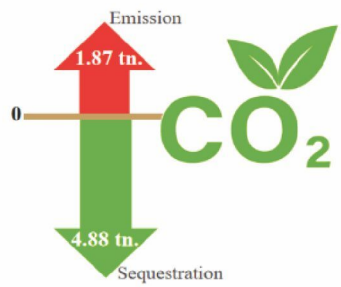
2. Embodied Carbon Emissions:

Total Emissions:
- CLT: 2,800 m3 x 0.4 tonnes/m3 = 1,120 tonnes CO2.
- Glulam: 1,500 m3 x 0.5 tonnes/m3 = 750 tonnes CO2.

Total Embodied Carbon Emissions: 1,120 + 750 = 1,870 tonnes CO2.

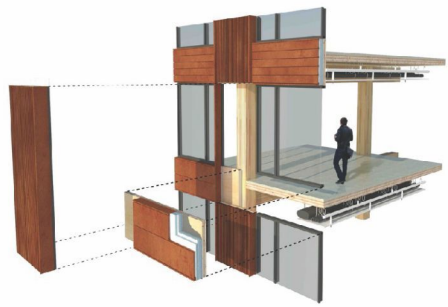
3. Net Carbon Impact:

Net Carbon Sequestration:
4,880 - 1,870 = 3,010 tonnes CO2.



CASE STUDY 2:

T3 (Timber, Technology, Transit) is a six-story office building that opened in 2016. Designed by Michael Green Architecture, the T3 (Timber, Technology, Transit) office building in Minneapolis exemplifies the application of mass timber in commercial construction. Completed in 2016, T3 is a seven-story structure constructed primarily with CLT panels and glulam beams. The building showcases the aesthetic and structural benefits of mass timber while achieving LEED Gold certification for its sustainable design. T3 has become a landmark project that demonstrates the feasibility and advantages of using wood in mid-rise urban developments.



Calculations

Materials Used: 1,000 m3 of CLT and 500 m3 of glulam.

1. Embodied Carbon Squestration:

Carbon Sequestration:
CLT: 1,000 m3 x 1.1 tonnes/m3 = 1,100 tonnes CO2.
Glulam: 500 m3 x 1.2 tonnes/m3 = 600 tonnes CO2.

Total Sequestration: 1,100 + 600 = 1,700 tonnes CO2.

2. Embodied Carbon Emissions:

Total Emissions:
- CLT: 1,000 m3 x 0.4 tonnes/m3 = 400 tonnes CO2.
- Glulam: 500 m3 x 0.5 tonnes/m3 = 250 tonnes CO2.

Total Embodied Carbon Emissions: 400 + 250 = 650 Tonnes CO2.

3. Net Carbon Impact:

Net Carbon Sequestration: 1,700 - 650 = 1,050 tonnes CO2.

Conclusion

Mass timber offers a promising approach for the construction industry aiming for net zero carbon emissions. By capturing carbon, lowering embodied carbon emissions, and encouraging the use of renewable materials, mass timber structures such as the International House Sydney and T3 in Minneapolis showcase the possibilities for a more sustainable built environment. As technology and techniques for working with mass timber advance, its increased use could be vital in addressing climate change challenges and promoting a sustainable future in construction.

Further Considerations

While the advantages are considerable, it is essential to focus on sustainable sourcing, life cycle assessments, and the integration of mass timber with other building technologies to truly unlock its potential for achieving net zero carbon construction. As industry stakeholders place greater emphasis on sustainability, mass timber emerges as a strong alternative that supports global initiatives to address climate change.

REFERENCES

International House Sydney
Official Project Page: TZANNES – International House Sydney Case Study
Document: WoodWorks – International House Sydney Case Study

T3 Building, Minneapolis
Official Project Page: Michael Green Architecture – T3 Minneapolis
Case Study Document: Woodworks – T3 Minneapolis Case Study

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