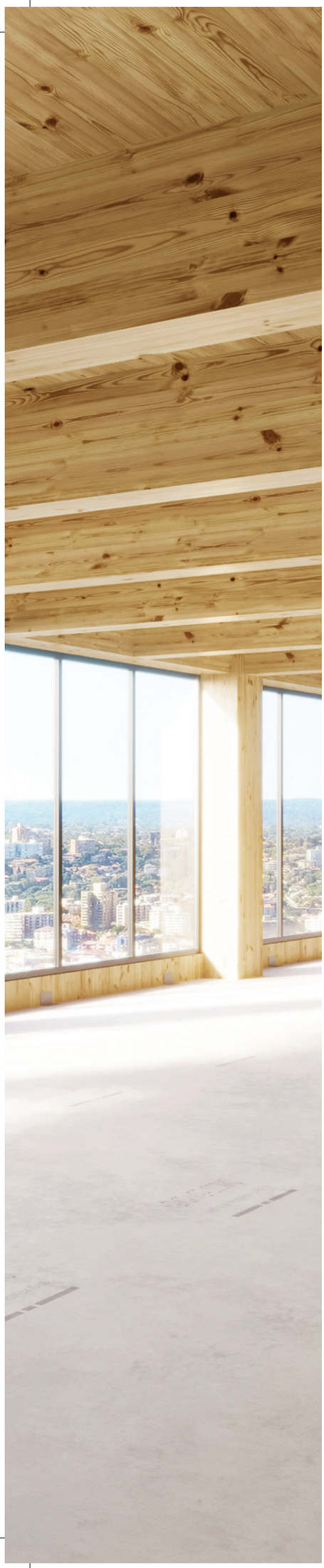
Sustainable Structures

Why Mass Timber is the Future of Construction

NexTimber
by Timberlink

IT'S WHAT BETTER TOMORROWS ARE BUILT ON


“The strength and light weight of mass timber enables its use as solid walls, floors, elevator shafts, and columns to construct entire buildings.”



Introduction

The construction industry accounts for 38% of global CO_2 emissions.[1] In order to reach global net-zero emissions, the International Energy Agency has estimated that direct building CO_2 emissions need to fall by 50% by 2030 – a reduction of around 6% per year.[2] To reach this goal, it is imperative that we move the building and construction sector onto a low-carbon pathway.

Architects, designers and specifiers can play their part by implementing materials strategies that reduce the lifecycle environmental impact of construction. The sector's attention now turns to new, innovative materials that slash waste, reduce pollution and help create a healthier built environment. Ironically, a potential solution has emerged from one of the oldest building materials in the world – wood.

Advancements in materials technology have given rise to mass timber, a new category of wood product that is set to revolutionise the building sector. Due to its unique composition, mass timber enables efficient, safe, lightweight, cost-effective and structurally-sound construction for taller structures.

As this new material gains popularity around the world, architects and designers are recognising its architectural benefits, and its potential to help decarbonise the building sector.

What is mass timber?

Mass timber, sometimes referred to as engineered wood, is a range of composite wood products that utilise state-of-the-art technology to bind or fix the strands, particles, fibres, veneers or boards of wood together with adhesives, fasteners or other methods of fixation. This method of construction results in large structural panels, posts, and beams that are exceptionally strong and versatile. Products in this category are engineered to carry higher loads in tall structures like concrete and steel, but are significantly lighter in weight.

Mass timber building systems are often manufactured off-site for load-bearing wall, floor, and roof construction. These products are engineered to precise design specifications to ensure uniformity and predictability in structural performance. Leading brands use high-grade feedstock, structurally graded with the latest technology, and tested for fire performance.

The mass timber family includes glue-laminated timber (glulam or GLT), laminated veneer lumber (LVL), nail-laminated timber (NLT), dowel-laminated timber (DLT), and cross-laminated timber (CLT). Of these products, CLT and GLT are among the most well-known.

CLT is made from kiln-dried timber, such as radiata pine, which is finger jointed, dressed and arranged to form a solid timber panel. Alternating layers are laid perpendicular to each other, with adhesive applied along the faces and edges of each piece of timber before being cured under pressure to form one solid rectangular billet. Individual building elements are then digitally machined from the billet. The cross direction layup of the panels, combined with digital fabrication, offer a strong, rigid, dimensionally stable and precision cut building product.

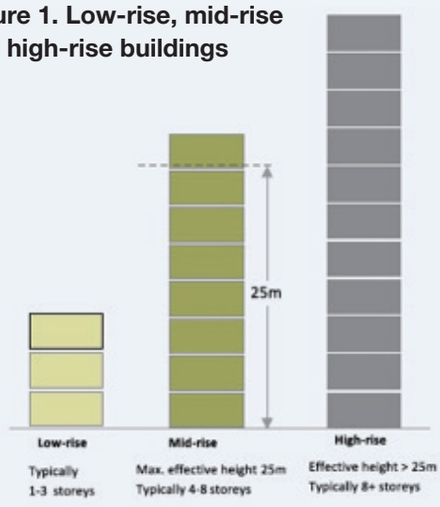
GLT is composed of finger-jointed and laminated layers of machine graded kiln-dried dressed timber which are pressed together with an adhesive under pressure. This creates a high performing structural member which unlike CLT, only has the grain running in the primary direction of the element, making it well suited for use as beams and columns.

What is mass timber used for?

The strength and light weight of mass timber enables its use as solid walls, floors, elevator shafts, and columns to construct entire buildings. There are several types of mass timber framing systems, including: post-and-beam systems consisting of skeletal frameworks of decking, beams, and posts supported on a foundation; mass timber floor and wall systems constructed to form a honeycomb structure designed to handle both vertical and lateral loads; and hybrid systems that utilise steel, concrete, and other construction materials.

Initially, timber building systems were only used for low-rise construction, but the enhanced properties of mass timber mean it can be used as the structure for taller wood buildings. Under the 2016 version of the National Construction Code (NCC), timber construction systems (which encompasses lightweight timber framing, but also newer mass timber options) were permitted for use in low to mid-rise construction, specifically Class 2, Class 3 and Class 5 buildings up to 25 metres in effective height.[3] In 2019, this was extended to include all classes of building, enabling the use of timber building systems in aged accommodation, schools, retail and hospitals.[4]

Figure 1. Low-rise, mid-rise and high-rise buildings



Low-rise timber buildings are buildings of:

- Type C construction (1 or 2 storey) or
- Class 2 and 3 buildings up to 3 storeys; 4 storeys if the ground level is a concrete or masonry garage. (Timber concession)

Mid-rise timber buildings have an effective height of not more than 25 metres

Typically, they are 4-8 storeys high (the maximum number of storeys depends on the floor-to-floor height)

High-rise timber buildings have an effective height greater than 25m.

Source: https://www.woodsolutions.com.au/mid-rise-timber-buildings-design-guides

A path to sustainable construction

Sustainability is a multi-dimensional concept that encompasses the environmental impact and lifecycle emissions of a product, as well as its economic, social and health impacts. How does mass timber stack up under these criteria?

Carbon emissions and sequestration

In addition to being a natural and renewable material, the great advantage of wood is its high carbon sequestration value. As trees grow, they absorb carbon from the atmosphere. Forest landscapes globally store more than one trillion tonnes of carbon – twice as much carbon as there is in the atmosphere.[5] This carbon storage potential extends to wooden buildings. A timber-framed home stores 7.5 tonnes of carbon, while a steel-framed house emits 2.9 tonnes of carbon.[6]

Due to different manufacturing processes and a reduced reliance on fossil fuels, wood manufacturing results in far less carbon emissions than either steel or concrete.[7] This factor, combined with the material's carbon storage potential, means that the use of timber products can offset the lifecycle emissions associated with timber production, distribution and use.

There may be concern that increasing construction demand for timber may lead to other negative environmental impacts, such as deforestation. Meeting timber demand through sustainable forestry is an effective method of mitigating such impacts. Accordingly, it is important to choose manufacturers who only use third-party certified Australian wood, and who ensure every tree used is replanted.

The advent of mass timber construction has made it possible for the building sector to move onto a low-carbon pathway. An article published in the Nature Sustainability journal estimates that using mass timber for 90% of new urban buildings globally could prevent nearly eight billion tonnes of CO_2 emissions by 2050.[8] Other studies have noted that scaling-up low-carbon construction with mass timber in place of conventional building materials in half of expected new urban construction, could provide as much as 9% of global emissions reduction needed to meet 2030 targets for keeping global warming below 1.5°C.[9]

Faster construction, less waste

Mass timber construction offers additional carbon and energy savings through faster construction, less waste and improved logistics. Research into mass timber construction indicates that, through good planning, it is possible to see the superstructure of a mass timber building completed 30% to 50% faster than a steel, concrete, or light wood frame counterpart.[10] Moreover, timber buildings can be erected faster with smaller crews and less equipment – all of which can reduce energy consumption, emissions and other environmental impacts of construction.

The prefabricated nature of mass timber construction is the driving factor in improving construction speed and efficiency. Prefabrication allows elements to be manufactured offsite using digital technology, and delivered just-in-time for onsite assembly. Through good planning, digital models are coordinated with other disciplines prior to fabrication, allowing for openings and service penetrations to be incorporated into the process. Connections and components can be pre-installed, making them favourable for efficient assembly. These aspects are only a few benefits that enable efficient onsite workflows including the expedition of follow-on trades, reduced labor onsite, fewer trucks delivering materials, and more.

Mass timber building systems are produced in controlled factory environments to the exact dimensions. The accuracy of timber structures means that other fixtures such as glazing, facade systems and joinery can also be prefabricated. The increased precision in design and modelling, results in very little onsite waste during construction. Any waste made on the site can be fed back and recycled for other purposes, for example as a carbon neutral energy source. With less waste to manage, there will be a reduction in labour hours, less disruption to the surrounding community and it will be easier to maintain a safe construction site.

Locally manufactured

With Australia's own mass timber industry on the rise, architects and builders can reap the economic and environmental benefits of choosing local supply over imported products. Buying 'local' mass timber avoids hidden costs such as tariffs, insurance, importing fees, and minimises warehouse overheads. It also avoids the risks of fluctuating exchange rates, or blown out lead times due to transport delays. Customers also have the benefit of local technical support.

Not only does it provide greater speed, certainty and reliability in supply, buying local mass timber also supports Australian businesses, which has flow-on benefits to the local community in terms of job generation and economic growth. Moreover, it is easier to verify the environmental credentials of local timber products with certification schemes, such as Programme for the Endorsement of Forest Certification (PEFC), to ensure they are harvested from well-managed forests that are continuously replenished.

Health and wellbeing

Promoting health and wellbeing is a key facet of sustainable design hence the move towards the use of healthy materials that minimise health risks in building construction. Numerous studies link the use of wood in the built environment to physical and mental health benefits, such as lowered blood pressure and heart rates, reduced stress and positive social interactions.[11] The use of timber within an office environment has been shown to make workers happier and more productive.[12] In the learning context, the use of timber in a classroom setting was demonstrated to improve academic performance and reduce levels of stress in children.[13]

Mass timber has broader potential health benefits, not just to occupants but for all stakeholders. For example, cleaner and less-congested construction sites provide for safer work environments and fewer workplace accidents. There is also the value of knowing that your building has a low-carbon footprint, which is a motivating factor for owners and tenants during a time of growing environmental awareness.

Timber buildings: The future is now!

A series of policy changes and initiatives has helped mass timber gain acceptance internationally. In various jurisdictions, building regulations have permitted the use of timber for multi-storey applications. For example, a set of changes to the International Building Code in 2021 permits the construction of mass timber structures up to 18 storeys tall.[14] In Canada, height restrictions on timber buildings were recently loosened in British Columbia and Oregon.[15] In the United States, there are nearly 600 built or planned wooden commercial buildings, with projections indicating that the market for mass timber products could double every two years.[16]

In Australia, mass timber construction has become a bona fide alternative to conventional construction methods. Design professionals are quickly gaining expertise with every new mass timber project they complete. Some Australian projects of note include La Trobe University's new student accommodation project at its Bundoora campus, Victoria's largest mass timber project with almost the entire structure utilising CLT and GLT beams and columns, and Monash University's Passivhaus-certified Gillies Hall, a six-storey timber structure with five levels of mass timber over a first-floor concrete podium.

Building better tomorrows

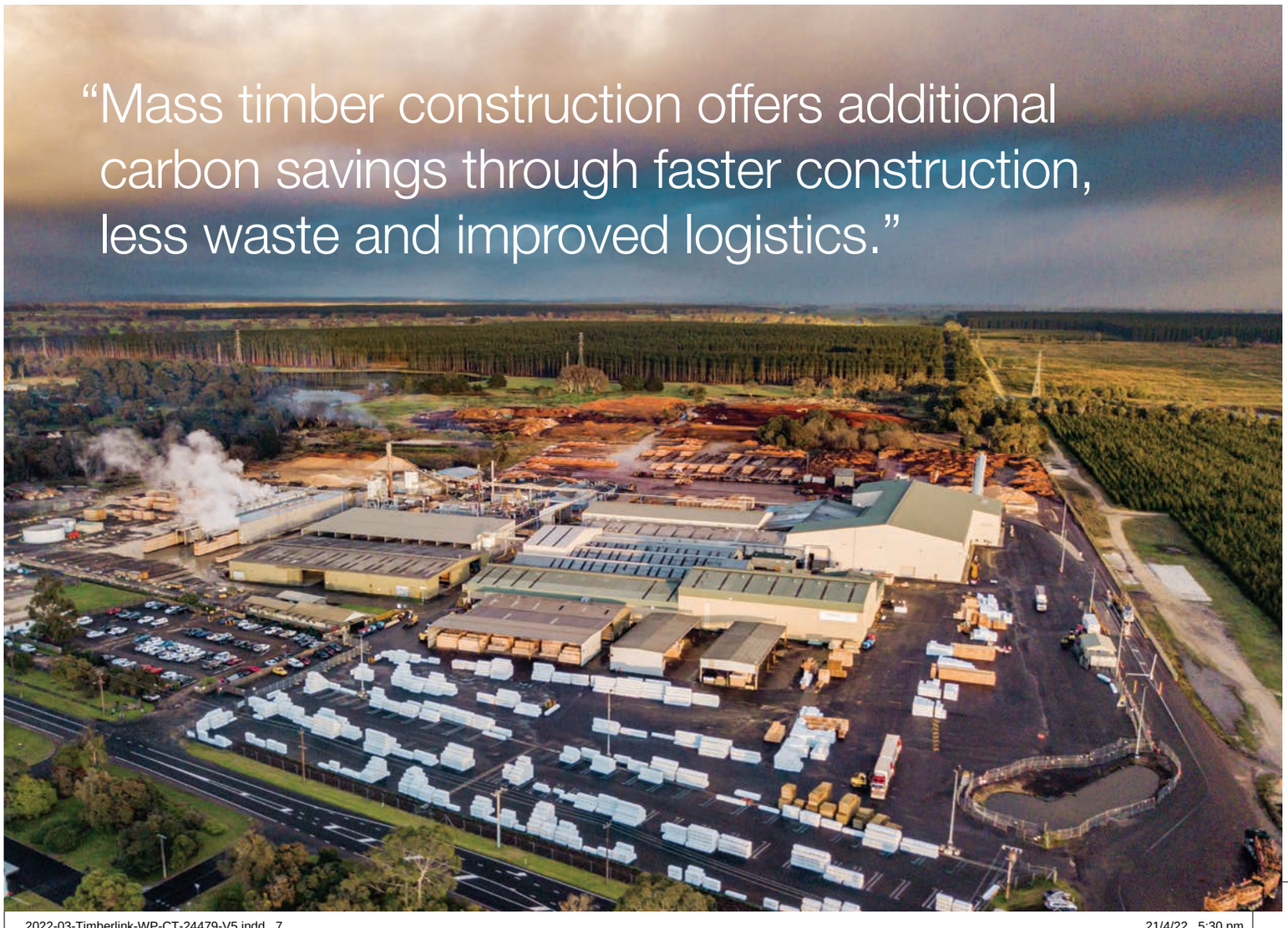
NeXTimber® by Timberlink

NeXTimber by Timberlink is a range of Australian-made Cross Laminated Timber (CLT) panels and Glue Laminated Timber (GLT) manufactured from certified plantation radiata pine, offering a renewable, sustainable and low-carbon solution for commercial, residential, and public projects. With their range of engineered wood products, Timberlink offers complete building structure solutions that work on their own or in conjunction with traditional steel and concrete materials, to balance and reduce net embodied carbon.

With production scheduled to commence in 2023, NeXTimber will be manufactured on Timberlink's Tarpeena site from Timberlink timber, sourced from local certified pine plantations, the NeXTimber range is at the forefront of integrated forestry and softwood processing in Australia. The majority of these plantations, like Timberlink, are under the ownership of funds managed by New Forests. This connection from seed to structure will give NeXTimber customers a unique level of supply certainty, and one supply point for both CLT and GLT with options for associated fixings.

Locally grown, manufactured and supplied, the NeXTimber range provides more flexibility in lead times to give design and build teams more opportunities for optimisation. Timberlink has invested heavily in local, regionally-based manufacturing to improve customers' supply reliability. NeXTimber also provides a foundation for the sustainable buildings of tomorrow, providing a prime opportunity to reduce the embodied carbon of a project without compromising on performance.

Timberlink is looking forward to growing the NeXTimber brand and supporting more specifiers and builders in using renewable Australian-made mass timber that stores carbon. Timberlink has committed to SBTi targets that are aligned to the Paris agreement targets to limit global warming to 1.5c, creating a reductions pathway to reduce their emissions in scope 1 and 2 targets by 53% by 2030. In the last three years, the company has reduced emissions by 27%, with a lot more in progress to deliver on their sustainability promise.



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Note This whitepaper may contain references to third-party research, data and industry publications. No guarantee is given as to the accuracy and completeness of third-party information. This whitepaper was written and produced by Architecture & Design.

NeXTimber by Timberlink

All information provided correct as of March 2022

CLT and GLT images used throughout are an artist’s impression of NeXTimber products.

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