



MODERN METHODS OF CONSTRUCTION

And the Important Role of Australia's
Timber Frame & Truss Sector

2024

FTMA Australia



MODERN METHODS OF CONSTRUCTION THE IMPORTANT ROLE OF AUSTRALIA'S TIMBER FRAME & TRUSS SECTOR

This document serves to inform decision makers, and advocates for the crucial contribution of the timber frame and truss sector to Modern Methods of Construction (MMC) in Australia. Its goal is to present a succinct overview that emphasises the urgent needs of the Australian building industry to find efficient, productive and low emission construction solutions and highlights the importance of timber building systems in achieving this outcome.



FTMA and Australia's Mature & Extensive F&T Sector

The Frame & Truss Manufacturer's Association of Australia Ltd (FTMA) stands as the premier national association representing the manufacturers and suppliers within Australia's timber frame and truss sector. It acts as the authoritative voice for timber frame and truss manufacturers, fostering connections across the extensive supply chain.

Timber frame and truss manufacturers supply the structural components for approximately 85% of new homes across Australia. The sector employs thousands and continually drives innovation through substantial investments in modern construction methodologies, particularly in elemental offsite prefabrication. These advancements enhance onsite productivity for builders, allowing for more streamlined and cost-effective home construction across the nation.

FTMA aims to foster a thriving industry focused on frame and truss manufacturing, providing high-quality, cost-effective timber construction solutions. These systems support Australia's green building goals by promoting energy efficiency and reducing embodied emissions, making them a practical choice for builders and homeowners alike.

Carbon Warrior Initiative

As part of its commitment to environmental sustainability, FTMA has launched **Carbon Warrior**, an initiative aimed at combating climate change.

Building operations and construction contribute nearly 40% of global energy-related CO₂ emissions. Research indicates that employing renewable materials can significantly mitigate these emissions, slowing the adverse effects of climate change.

Carbon Warrior strives to Create a Greener Future by minimising the environmental footprint of the construction sector and enhancing awareness within the industry and among consumers.

One of the most impactful ways to contribute to this effort is through our choice of building materials, with timber emerging as the leading and most adaptable option that offers a constructive solution to the climate crisis.



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The National Housing Accord is the biggest housing initiative of our generation, it could also have the biggest environmental benefit as well - with the right policy directions.

It's not just about 'More Housing' - it's about doing this and getting a better environmental outcome!

INTRODUCTION & CONTEXT

The Australian Federal and State governments have set aspirational targets around two important policy areas:

- Climate Change and Emissions Reduction - Net-Zero by 2050, and
- National Housing Delivery – 1.2 million new, well-located homes over 5 years from 2024 – National Housing Accord 2022.

These objectives are interlinked, as increased construction inherently leads to higher emissions unless we adopt innovative building practices aligned with agreed net-zero targets. Emphasising the impact of embodied carbon and increasing the utilisation of low carbon emission materials and construction techniques represents a transformative shift from traditional practices, offering substantial carbon reduction benefits that resonate on local, state, national, and global scales.

Federal and state governments recognise **Modern Methods of Construction** as vital to achieving these goals. The communiqué from the March 2024 Building Ministers meeting highlighted the significant potential to address Australia's housing supply crisis by fostering the growth of prefabricated and modular housing, while also addressing the need for decarbonisation in the construction sector, focusing on reducing embodied emissions in construction materials.

The carbon emissions generated during the construction process are the second largest contributor to overall embodied carbon, particularly for materials requiring substantial onsite assembly. As a result, low emission offsite construction and prefabrication practices are being strongly advocated by many governments and voluntary rating schemes throughout Australia. It is recognised that these practices will yield benefits such as construction time savings, enhanced construction productivity, project cost savings and lower overall lifecycle costs, improved build quality, and reduced environmental impact in the key areas of both carbon emissions and waste.

“Embodied Carbon in residential building stock can be reduced by implementing strategies such as using lightweight materials and wood products... and adopting offsite manufacturing methods.”¹

Timber provides a unique low emission building material and construction solution, widely available through existing national supply chains.

For the residential and low-rise construction markets, Australia has over 280 Frame & Truss manufacturers, distributed nationally, supplying a range of high-quality, factory built, lightweight prefabricated timber elements that serve to provide for their customers (builders), improved onsite productivity, speed of construction, and output.

For larger buildings including mid-rise apartments, and offices, a range of lightweight and mass timber systems are also available.

“In Australia, embodied carbon emissions are expected to increase by 65 percent by 2050.”

¹ Illankoon, C.; Vithanage, S.C.; Pilanawithana, N.M. Embodied Carbon in Australian Residential Houses: A Preliminary Study. Buildings 2023, 13, 2559.

² KPMG (2023), Tackling embodied carbon within Australia's construction and infrastructure sector.

MODERN METHODS OF CONSTRUCTION – WHAT IS IT?

Modern Methods of Construction (MMC) refers to a broad range of construction techniques that incorporate a degree of pre-manufacturing or site-based process enhancements. While many think of MMC as synonymous with fully volumetric or modular construction - essentially pre-constructed homes delivered to the site - it is crucial to clarify that this is not how all of the homes in Australia will be built. Instead, MMC encompasses a range of offsite prefabrication solutions that can improve the efficiency, effectiveness and productivity of building projects.

What is Prefabrication?

.... prefabrication is simply production of parts of a building structure offsite and away from where the building will eventually be. These components and modules brought on to site late in the process for assembly into a complete building.

*prefabAUS Prefabrication Industry Roadmap
2023-2033*

MMC in Australia includes several types of offsite prefabrication solutions including:

2-dimensional or elemental panelised structural systems. These systems are fabricated offsite for components such as walls, roofs, and floors;

- a) **Open structural frames** - This includes timber frame prefabricated wall frames and roof trusses, pre-designed and coordinated before manufacturing, which are then delivered ready to be lifted into position on site.
- b) **Semi-closed panels** - could potentially include adding elements such as: building wrap/vapour barrier, pre-installed windows, insulation, external battens, one covered layer either single external cladding, or internal linings. They can also encompass floor cassettes or roof cassette systems.
- c) **Fully closed panels** – These involve dual layers of cladding or lining to encase the structural elements and may include pre-installed windows and doors, along with essential services.

3-dimensional buildings, or parts of buildings (Volumetric / Modular). These vary in complexity and size, ranging from 3D structural frames to pre-clad boxes, to fully lined modules complete with finishes and services installed, fabricated off-site, before transporting and lifting these into position on site to form complete houses.



Recent insights outline that constructing efficiently, through the application of offsite and modular methods, can yield numerous advantages, including:

- **Time Savings:** Achieving delivery timelines that are 20% to 50% faster than traditional methods.
- **Cost Savings:** Reducing costs by an average of 20%, attributable to lower labour expenses, efficient materials procurement, minimised on-site rework, and enhanced quality control.
- **Waste Reduction:** Reporting reductions in waste of over 40% compared to conventional onsite construction methods.
- **Productivity Gains:** Streamlined material procurement and coordinated supply, delivery, and installation processes.
- **Carbon Savings:** A UK study¹ indicated that carbon emissions could be decreased by 45% relative to onsite construction, achieved through reduced reliance on concrete and steel and optimised logistics.

Additional benefits of MMC include - diminished downtime due to weather, enhanced quality control from factory settings, and support in addressing the labour shortages in the construction industry by attracting a diverse workforce reflecting various ages, genders, and abilities.



¹ Infrastructure Victoria (2023), Opportunities to reduce greenhouse gas emissions of infrastructure.

ELEMENTAL PREFABRICATION

Elemental prefabrication focuses on the offsite production and delivery of high-quality value-added elements, products, and systems, all manufactured under controlled factory conditions. This approach enhances construction productivity, speeds up project timelines, and improves overall quality, fulfilling client expectations and providing a compelling value proposition that they are willing to pay for. Strategies for elemental prefabrication include adopting a 'Start Simple and Add Value' philosophy, where standardisation maximises cost efficiencies through repetition. Building towards a 'Kit of Parts' model encourages the development, refinement, and promotion of standardised elements that can be integrated into various home designs, facilitating flexibility and efficiency in construction.

Walls

Prefabricated timber framed wall systems make up the large majority of timber framed construction delivered in Australia. There are many components which make up a finished in-situ wall in a building and these elements can often be added by frame and truss manufacturers if clients recognise the potential productivity gains and are willing to invest in these value-added services.

Typical timber framed wall panel components could include installation of:

- Moisture/air control barriers
- Insulation
- Sheathing/panel bracing
- Windows
- Doors – external and internal
- Battens for external claddings
- External cladding
- Internal plasterboard
- Fire-protection or acoustic elements (if needed)
- Services



Roof Trusses & Cassettes

Roof cassettes have demonstrated efficiency and cost-effectiveness on various projects. The swift installation of these components allows for quick building closure, keeping the structure watertight and protecting lower levels. This expedites work for subsequent trades.

Typical roof cassette components include:

- Trusses/rafters
- Bracing elements
- Sheathing
- Battens
- Roofing



Cassette Floors

Prefabricated solutions are commonplace in mid-storey floor construction, often using fabricated open-webbed floor joists or I-beams. Offsite prefabricated floor cassette applications are particularly efficient, economical and beneficial where repetitive building situations occur such as townhouses, apartments, and office floor construction applications.

Prefabricated cassettes have also proven to be very effective for raised ground floor applications on constrained sites, such as those with sloping ground, flood-prone areas and reactive clay sites.

Typical floor cassette components include:

- Joists/Open web beams, I- beams
- Flooring – Particleboard/plywood/FC sheets/Magnesium Oxide
- Bracing/Strongbacks/Rim Boards
- Services
- Ceiling



MMC & REDUCING EMISSIONS IN THE BUILT ENVIRONMENT

The dwellings we all live in, are often overlooked in the drive for sustainability improvements, but residential construction sector can deliver more climate-responsible, embodied carbon emission reducing building practices.

The biggest financial investment the average Aussie makes is their home, but did you know - the biggest environmental impact the average Aussie has can also be the home - if they choose renewable building materials, like timber, and low embodied construction practices.

With the growing interest by building professionals, regulators, and governments at all levels in embodied emissions impacts there continues to be misunderstanding, and lack of recognition, around biogenic carbon, and its benefits, particularly in the built environment. Biogenic carbon is the carbon that is absorbed and stored (sequestration) by plants and trees through the process of photosynthesis.

All wood products contain biogenic carbon that has been sequestered through the growth of the trees. Each cubic metre of Australian sawn softwood and hardwood timber stores 0.9 and 1.22 tonnes respectively, of CO₂-eq sequestered from the atmosphere – or a simple easy to remember average figure is there is one tonne of CO₂-eq stored in one cubic meter of wood. Biogenic carbon also remains stored in timber products for the life of the product. This is particularly valuable with buildings constructed from timber as they effectively become carbon storage units.

An even greater carbon gain comes from the substitution effect of using wood in place of other, more fossil fuel-intensive materials. Data differs according to material, as well as to country, however all agree that considerable CO₂ savings can be made by using wood where appropriate, instead of other carbon intensive materials.

Timber can be, and is, used in a wide range of construction applications, and markets, and this use reduces overall global embodied carbon emission effects.

Timber roof and wall framing is by far the predominant material traditionally used in residential home construction. The weighted average home in Australia uses 14.6m³ of sawn softwood, assuming an average nationally yearly build of 100,000 detached homes from timber, and a total cradle to gate net GWP emission value of -718 KgCO₂eq/m³, (allowing for a net biogenic sequestration of -875kg CO₂-eq GWP-biogenic, and 157kgCO₂-eq GWP fossil emissions), this equates to around 1.05million net tonnes of CO₂ stored in these homes – a massive amount.

For a functionally equivalent 90x45mm kiln-dried softwood stud the GWP_{fossil} = 0.64 kgCO₂-e/m, five times less than a 90x40mm 0.75mm BMT steel¹ framed stud at 18.3kgCO₂-e/m² or 3.11 kgCO₂-e/m

Data source EPD Australasia: FWPA Softwood Timber and BlueScope – TRUECORE® Steel

Apartment blocks in Australia are traditionally built out of high emitting concrete, if more 'low-rise' apartment blocks are built using 'lightweight timber systems, and 'mid-rise apartments' using either 'lightweight or mass-timber systems', then more carbon can be stored, and significantly more carbon emissions saved recognising the material 'substitution effect'.

We need to grow and use more low embodied emission bio-based materials such as wood and also more low embodied construction practices such as prefabricated offsite construction.

WHAT IS NEEDED FOR SUCCESS & HOW GOVERNMENT CAN ASSIST

The unfortunate failure in recent times of many modular and volumetric MMC companies, both in Australian and internationally, can be attributed to several critical factors that hinder their ability to operate efficiently and sustainably.

By analysing these failures alongside the benefits of an elemental approach to MMC, and identifying how government support can facilitate success, we can better outline a roadmap for future business models in the offsite construction industry.

Why Volumetric Companies Sometimes Struggle or Fail	Benefits of an Elemental Prefabrication Approach	How Government Can Assist
<p>Capital intensity Many volumetric focused businesses which have failed have been set up from scratch, which requires an enormous capital expenditure, and there can be a large lag before there is a return. Establishing an automated production line including specification, purchase and commissioning, can take several years, and generating efficiency through that line can also take a long time as the process is developed and refined.</p>	<p>An existing, well established and mature national Australian frame & truss sector already exists – many fabricators are already offering a range of elemental prefabrication value added options. Elemental prefabrication can also be far less capital intensive as many activities do not actually require costly specialised equipment – automation though may be a choice if high throughput volume is needed and justified.</p>	<p>The government should invest in stimulating larger and more innovative modern methods of construction solutions. This assistance though, needs to be fairly distributed right across the full offsite prefabrication solutions supply chain, including the frame and truss sector, not just focused on one solution area.</p>
<p>Project pipeline Factories operate best when there is a consistent flow of work, and a narrow range of products produced. Demand for modular can be variable and without a baseline of demand it is difficult to generate efficiency and make savings in cost promised. Many failed businesses have struggled to find consistent project pipelines to keep the factory flowing and are reliant on smaller contracts or work with low repetition, which require significant design resource and make finding efficiency on the factory floor far more challenging.</p>	<p>Australia's existing frame & truss sector already provides the structural components for -approx 85% of all Australian homes. Many are also keen to further innovate and invest in elemental offsite prefabrication. Consistent project pipelines are obviously key to any business particularly when they specialise in specific offerings, but as the frame & truss sector offers elements there is flexibility to shift focus if market conditions vary.</p>	<p>Large institutional clients like government have the best opportunity to standardise designs and deliver consistent pipelines of work to allow all MMC businesses right across the offsite prefabrication supply chain to establish and flourish. The Government needs to actively support all offsite prefabrication solutions, with focus on reduced emissions.</p>
<p>Cashflow Off-site construction, particularly volumetric, is very dependent on up-front expenditure, with many materials having long-lead times and requiring payment long before the final products are delivered to site. Typical contracts in use for construction projects in Australia are based on payment after materials are delivered on site, which could result in a lag of six months or more between paying for materials and being able to claim for them. Many businesses do not have the capacity to fund these gaps.</p>	<p>All off-site construction is dependent to differing degrees on up-front expenditure. Elemental prefabrication offers a range of solutions of different complexity and cost. Contracts for supply of these different elements can be more easily structured around logical and fair staged payment timings.</p>	<p>The government needs to take the lead in establishing and standardising the use of more equitable contract terms which allow for up-front payments and/or earlier release of cash for off-site construction. To stimulate and grow the MMC industry this needs to be a high priority for Govt.</p>
<p>Design MMC businesses have a vast number of design demands to balance, and as the overall complexity of the systems they offer increases, so does their need for design expertise, documentation coordination. Volumetric construction requires the highest level of upfront design. This can be problematic and highly time intensive when customers want high levels of variety and home offering differences rather than standardisation (quite typical for Australia where consumers often desire a unique home look).</p>	<p>Elemental prefabrication is focused on improving the onsite speed and productivity of construction components. Less full-building upfront design is required - the elemental design focus here is more on ensuring discrete elements can be transported, assembled and constructed quickly and efficiently onsite.</p>	<p>Current design regulatory and compliance practices that follow traditional building standards are not appropriate for modular construction. The government can assist by encouraging and recognising industry design guidelines for offsite prefabrication and or modular buildings.</p>

This structured approach highlights the current pitfalls of volumetric companies while showcasing the potential advantages of adopting an elemental prefabrication model and the vital role that government intervention can play in fostering a thriving industry.

GOVERNMENT AND INDUSTRY – WORKING TOGETHER FOR MMC SUCCESS

For the future of MMC to thrive, collaboration between the offsite prefabrication industry and government is essential. This partnership is crucial for maximising efficiencies and accelerating the adoption of practices that deliver immediate advantages by enhancing builder productivity and facilitating the rapid construction of homes across the nation.

By leveraging appropriate support and investments across the entire offsite prefabrication supply chain, significant advancements can be realised. The government can play a pivotal role in this evolution through various means as outlined below.

FTMA Endorses the Following Recommendations in the *PrefabAus Prefabrication Industry Roadmap 2023 - 2033* where *'Prefabrication plus Digitisation equals Smart Building'*:

- Recognise the importance of Smart Building in Government Industrial Policies
- Build scale: Apply strategic public procurement principles
- Position Smart Building within the NHA (1.2 million new homes) and other major projects
- Embed Design for Manufacture and Assembly (DfMA) in projects
- Improve access to capital: Finance
- Build consistent nationwide standards and better regulation
- Build the future workforce
- Build the ecosystem: Industry awareness, market information and Smart Building industry clusters
- Create Flagships, Baselines and Benchmarks

Furthermore, FTMA Advocates that Government Should:

- Implement a National/State framework to measure embodied carbon, including the creation of a national embodied carbon database for building materials and products.
- Support the integration of embodied carbon targets into the National Construction Code (NCC) and set corresponding state-specific targets.
- Mandate lifecycle carbon emission calculations and reporting.
- Enforce requirements for embodied carbon reduction in government-related buildings and projects.
- Recognise and incentivise the uptake and use of low embodied carbon materials and sustainable construction practices.
- Promote the development and accessibility of cost-effective, low-emissions Australian building materials.
- Establish requirements and incentives that encourage the increased use of bio-based materials.

Through this collaborative effort, the offsite prefabrication industry can realise its full potential, contributing to the urgent need for housing solutions while aligning with contemporary sustainability goals.

CONCLUSION

In conclusion, the synergy between government and the offsite prefabrication industry is pivotal for the success of Modern Methods of Construction (MMC).

By embracing collaborative strategies that prioritise efficiency, sustainability, and innovation, both sectors can address the pressing need for housing while minimizing environmental impacts. The recommendations outlined in this document provide a clear pathway for government intervention and industry support. Through targeted policies, investment in technology, and the promotion of best practices, we can cultivate a robust construction ecosystem that not only meets the urgent demands of housing but also contributes to a greener, more sustainable future – assisting the government with both its aspirational National Housing Accord and Net-Zero by 2050 policies. As we move forward, it is imperative that all stakeholders work hand-in-hand to realise the immense potential of offsite prefabrication and its role in shaping the future of the construction industry.



PARTNERS

This report is only made possible due to the support by our valued partners.





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