Inquiry: Inquiry into Climate Resilience

Hearing Date: 6 November 2024

Question[s] taken on notice

Directed to: Victorian Forest Products Association

Received Date: 28 November 2024

1. **The CHAIR, page 4**

Question Asked:
On that, what is your understanding of the difference from a livability, thermal efficiency and environmental comfort point of view of a building that is thick slabs of concrete versus one that has got more timber throughout?
Andrew WHITE: Yes, sure. On the thermal heating question, I would have to take that specifically on notice; I do not have data to hand on the question of thermal heating.
What I do have information on is in terms of human wellbeing. There has been quite a lot of research done around – and this may sound strange – the impact of having timber buildings and how integrating wood into buildings creates a warm and natural environment. So there is some research I can provide –

Response:

A 2015 study explored the relationship between office workers' psychological wellbeing, work environments and employee expectations. For many workers, the design of an office was important in their decision to work at a company. The presence of plants and other natural elements were also identified as important. The report also showed national and cultural differences were apparent, *with Australians identifying the use of wood in office design and furnishings as contributing to greater productivity*. The authors identified that there is a high cost to Australian business from a loss in productivity from the impact of stress on the health of workers.

Similarly, a Japanese study compared the initial physiological response of 14 people sitting in rooms with either wooden or steel wall panelling. The pulse and heart rate of each subject was measured every second for 20 seconds whilst facing the panelled wall covered by a curtain, followed by 90 seconds with the curtain removed and the wooden or steel panel visible. The study found that exposure to wooden panels significantly decreased the blood pressure of subjects, whilst exposure to steel panels

significantly increased it.

There are countless other studies which show similar result. Please see link below for full report.

Source: Planet Ark – Wood – Nature Inspired Design
doc-1501-wood-nature-inspired-design-report-final.pdf

2. **David ETTERSHANK, page 5**

Question Asked:
Given the obvious pressures on construction costs at the moment, what is your understanding of the relative cost comparisons of using timber vis-a-vis steel and concrete? There are two factors there: one is the cost of construction and the other one is time of construction. Do you have views on that?
Andrew WHITE: Yes, I do have some data on the cost of construction, and I can provide this as well separately to the committee.

Response:

Mass timber is superior to concrete and steel when taking into consideration all key performance factors, including cost and reduced carbon emissions.

Measuring embodied carbon is key to evaluating the highest-impact and most cost-effective solutions to reducing embodied carbon on a building project, which is why VFPA is recommending that the Victorian Parliament adopt a methodology for measuring embodied carbon in all new houses and buildings, making this mandatory and setting targets.

Embodied emissions reduction

It is now broadly accepted that decarbonising the building sector will help to reduce the effects of climate change. Embodied carbon emissions in Australia's built environment were estimated to be 16% in 2019 (GBCA & thinkstep-anz, 2021) but are expected to climb to 85% by 2050 if nothing changes.

The Clean Energy Finance Corporation has reported that on average, sustainability-rated infrastructure projects achieve a reduction of up to 33% in embodied carbon compared to similar designs with no such measures

A 2021 international study identified embodied carbon reductions of up to 50 percent when replacing concrete and steel with mass timber construction in functionally equivalent 8, 12 and 18 storey buildings in three US regions (Puettmann, et al., 2021).

The T3 Building in Collingwood is Melbourne's tallest timber building. Due to its unique timber design, it has seen a 34% reduction in carbon (Source: T3 Building).

A study by Jayalath, A. et al. (2020) looks at *Life cycle performance of Cross Laminated Timber mid-rise residential buildings in Australia.*

The study found that a cross laminated timber building was found to have 30% less life cycle GHG emissions (LCGHCE) compared with the reinforced concrete (RC) building over a life span of 50 years in Melbourne, and 34% and 29% reduction in LCGHCE in Sydney and Brisbane, respectively.

The cost analysis results showed that costs for the CLT building were 1.3% lower than conventional RC in Melbourne, and 0.9% lower in Sydney and Brisbane.

Cost

In relation to the cost, cost savings are one of the most important aspects of any build and can be broken down into a number of areas, from actual price to reduced labour, to time and operational-related savings.

The Wood Solutions table below outlines the general cost savings of timber vs conventional materials (i.e. comparing cost of materials). The table shows a 7-storey office structure made of timber solutions, offers the largest cost-effective option with a saving of $1,141,485.

Building type	Cost of structural solution		Cost savings of timber compared to conventional
	Timber	Conventional	
7-storey office building	$7,237,259	$8,379,104	-$1,141,485
8-storey lightweight timber frame apartment building	$4,073,727	$4,698,581	-$624,854
8-storey CLT apartment building	$4,406,714	$4,698,581	-$291,867
2-storey aged care facility	$697,020	$809,620	-$112,600
Single-storey industrial shed	$216,342	$238,861	-$22,519

Derived from the Wood Solutions guide developed by FWPA, we have listed ways in which timber-based options can save on both time and budget.

Source: Wood Solutions

[Cost Engineering: Mass Timber vs. Concrete & Steel | ASH]

[Cost Comparisons Design Guides | WoodSolutions]

MBM Analysis

A comparative cost analysis was also conducted by MBM, between timber frame and traditional concrete construction for an entire 6-story affordable, model apartment building. The analysis aimed to identify any cost disparities between the two methodologies.

The report attempts to establish a like-for-like comparison across all trade elements taking into consideration how the methodologies impact each trade. Please see below a high-level comparison of the proposed development.

See below a high-level comparison of the proposed development.

Description	Traditional Construction Total	Timber Construction Total	Variance	%
Substructure	$ 534,240	$ 457,920	-$ 76,320	-14%
Superstructure	$ 13,988,540	$ 12,880,679	-$ 1,107,861	-8%
Finishes	$ 3,014,640	$ 2,556,720	-$ 457,920	-15%
Fittings	$ 1,144,800	$ 1,144,800	$ -	0%
Services	$ 8,128,080	$ 8,013,600	-$ 114,480	-1%
External Works/Services	$ 648,720	$ 534,240	-$ 114,480	-18%
Subtotal Construction Cost	**$ 25,665,500**	**$ 23,908,919**	**-$ 1,756,581**	**-7%**
Preliminaries	$ 4,619,790	$ 3,825,427	-$ 794,363	-17%
Margin	$ 1,211,412	$ 1,109,374	-$ 102,038	-8%
Subtotal Construction Cost	**$ 31,496,702**	**$ 28,843,720**	**-$ 2,652,982**	**-8%**
Contingency -10%	$ 3,149,670	$ 2,884,372	-$ 265,298	-8%
Subtotal Construction Cost	**$ 34,646,372**	**$ 31,728,092**	**-$ 2,918,280**	**-8%**

As depicted above, the timber construction method was approximately 8% more cost efficient than traditional construction.

Due to the conceptual nature of the documentation, MBM have made several assumptions, allowances, and exclusions in the preparation of the estimate and as such should be considered as indicative pricing only. MBM notes that no specifications or schedules are available at this stage and as such, the rates applied are based on projects similar in size and type. Where no design is available MBM have applied benchmarked elemental rates. More detailed costs can be prepared as design evolves.

As depicted above, the timber construction method in this modelling was approximately 8% more cost efficient than traditional construction.

Construction time

MASSLAM GLT projects consistently deliver construction timelines up to 30% faster than traditional methods. This accelerated pace is driven by the

efficiency of MASSLAM's bearing connections, which require an average of only 3-4 minutes per member to install.

Subsequently, rapid assembly translates to reduced time-related expenses, including crane and equipment rental, labour wages, insurance premiums, and permitting fees. Accelerated construction timelines can lead to substantial savings in these areas and earlier occupancy times.

Source: ASH-Affordable-Housing-Report-MBM-240828.pdf

3. **Sarah MANSFIELD, page 9**

Question Asked:
Just some of the figures, some of the calculations. So you are talking about, for example, the carbon footprint of a building potentially taking into account the embodied carbon. How does that compare then? Do you factor in the impact on the forest where that tree was removed from, whether it is a plantation or a native forest, the carbon that was stored in plants, the trees and other plants that are affected, soil? You know, that broader –
Andrew WHITE: Holistic view? **Sarah MANSFIELD**: Yes, life cycle.
Andrew WHITE: Look, the short answer is I am not 100 per cent sure on the answer to that with these particular calculations I have provided, but I am more than happy to come back and provide information on what is included and what is not included so that you have got clarity around where that is sitting.

Response:

The carbon footprint of timber production has been mapped (i.e. a lifecycle approach) and it shows that wood fibre performs incredibly well, sequestering substantially more carbon than it emits during its their production.

Plantations require energy to establish and maintain them for wood production, as well as for the actual harvest process. The energy used is partly in the form of fossil fuels such as diesel and petrol for establishment, fire protection, roading maintenance as well as for harvest and haulage of logs. Electricity, typically sourced from the grid, may also be used in plantation nurseries.

Increasingly, however, wood fibre businesses across the supply chain are moving to using significant renewable energy sources within their operations, often utilising the waste products from their operations to create energy.

Carbon emissions are typically split into two groups

- **Biogenic** – emissions or removals associated with biomass (living organisms) e.g., carbon captured/sequestered in trees or emitted when burning wood waste or at end of life – part of the natural carbon cycle.
- **Non-biogenic** – emissions created from fossil fuels (non-living organisms) such as gas and coal.

In sawmills, a large proportion of the energy used to convert logs into wood products may be from biogenic sources such as sawmill residues. For example, any kilns used to dry timber rely on wood biomass for energy – the release of the biomass carbon does not result in net GHG emissions if this wood is from sustainably managed forests.

Because biogenic carbon does not contribute more carbon to the atmosphere than it sequesters, it has advantages over fossil-based carbon which can persist in the atmosphere for many thousands of years.

Wood fibre production lifecycle (carbon footprint)

In terms of the overall carbon lifecycle of timber production (i.e. its carbon footprint), detailed information on the emissions footprint for the key types of wood products used in Australia is contained in Environmental Product Declarations (EPDs).

Timber performs incredibly well, resulting in a negative net carbon footprint. In other words, there is far more carbon sequestered and captured than is emitted during timber production processes.

For example (as illustrated in *Figure 5* below), the production of 1m3 of kiln-dried dressed softwood results in 157kg CO2 -eq of fossil-fuel derived emissions and 25kg CO2 -eq of biogenic GHG emissions other than CO2. The biogenic CO2 emissions from production do not count towards the emission footprint of the product as the CO2 is re-absorbed by the growing trees in sustainable forest systems.

At the mill gate, this results in a net carbon footprint of -718 kg CO2 /m3 of dry and dressed softwood. In other words, when both carbon stored in the timber and cradle to gate fossil GHG emission and biogenic GHG emissions other than CO2 are accounted for, the net impact is the retention of 718 kg CO2 in each cubic meter of timber produced. This is a very positive result.

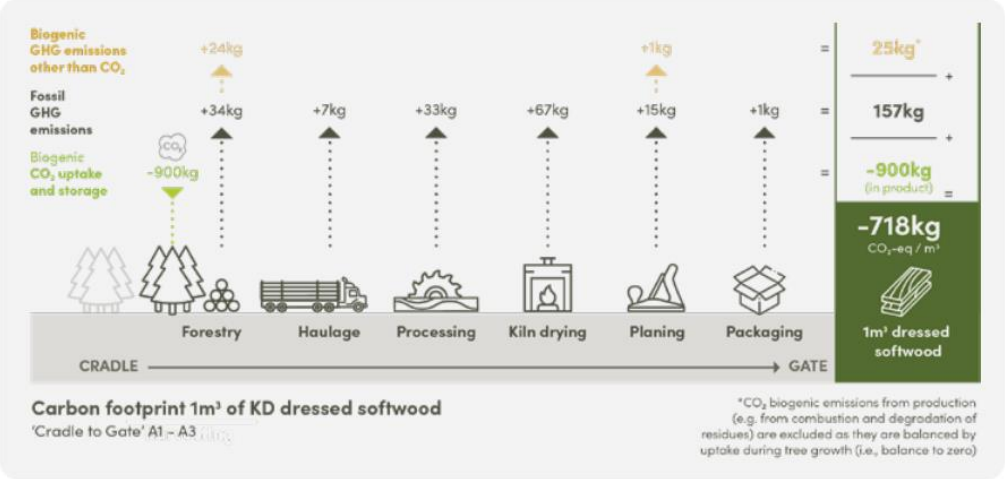

Figure 5 - Carbon footprint of 1m³ of kiln-dried dressed softwood (FWPA, Australian Sawn Softwood EPD S-P-00560 v2.0, 2022)

Similarly, the production of 1m3 of kiln-dried dressed hardwood results in 327 kg CO2 -eq of fossil-fuel derived emissions and 162 kg CO2 -eq of biogenic GHG emissions; with a net carbon footprint of -731 kg CO2 /m3.

Further examples are contained in the link below.

To continue to maximise the climate benefit of timber even further, industry is working hard to reduce and eventually eliminate fossil fuel emissions and other biogenic emissions, as much as possible.

Source: FWPA Research- Carbon-Primer-and-Glossary-Final.pdf

4. **Sarah MANSFIELD, page 9**

Question Asked:
I think the other thing I am just seeking clarity on is that obviously a living tree will continue to draw down carbon throughout its life cycle whereas obviously once that tree is cut down whatever carbon it has got in it stays in it, but it is not drawing down or absorbing any more carbon once that is in a building.
Andrew WHITE: That is true, and that is why our approach with the plantations is to have a phased approach where we are continuously planting more and more trees so that we are sequestering more and more carbon. My understanding – and I am happy to provide some information on this as well – is that as the tree is actually growing it is sequestering more carbon than it otherwise would be if it had reached maturity. So

there is actually a benefit from a plantation perspective in regrowing the trees over and over again, because you are sucking more carbon out as the tree is growing than, say, a mature tree. I do not have that information in front of me, but I am happy to provide some information. There have been some scientific studies that have shown there are benefits to obviously regrowing the tree.

Response:

Commercial timber plantations have significant carbon benefits, as outlined.

For example, a recent UK study comparing the relative climate change mitigation potential of commercial plantations to that of environmental plantings (Forster, Healey, Dymond, & Styles, 2021), concluded that the mitigation potential of commercial plantings far exceeded that of environmental plantings.

In a recent study conducted for Forest and Wood Products Australia (Perry, Pechey, & Binney, 2021), it was estimated that a 20% increase in the total commercial plantation area in Australia would offset the equivalent of 10% of the greenhouse gas emissions from the top 50 ASX companies for the next 25 years.

The rate of carbon capture is highest early on. The rate carbon is captured/sequestered into woody biomass is highest when the tree is first planted to its mid-growth phase. The timber plantation life cycle of harvest and replanting every 15-30 years, therefore maximises the carbon sequestration of a given area.

5. **Wendy LOVELL, page 10**

Question Asked:
I was really interested in you saying that in France it is mandated that they must have at least 50 per cent wood or natural products in their homes. Can you give us just a little bit of background as to the rationale behind that, please?
Andrew WHITE: It is a very good question. I might have to take that one on notice and provide some more information. I do not actually have that information to hand in terms of the specifics of that policy, but I am happy to provide that to you on notice, if that is okay, in terms of the reasons. I can assume the reasons are pretty clear from what I have outlined in terms of the benefits and where the trends are going globally. There are really a number of countries now that are looking to come to the forefront of this,

and obviously with the Olympics being quite a notable event, I am assuming that they thought this would be a good opportunity to promote positive practices around environmentally sustainable buildings and so on and so forth. But the exact detail on that I would have to provide on notice, if that is okay.

Response:

France's new RE2020 regulation mandates analysis of embodied emissions over the entire life cycle of a building, from the facility's creation to its deconstruction/demolition. This applied as of 1 January 2022 for residential buildings and into 2023 it expanded to cover other building types.

What is notable about RE2020 is that it requires dynamic life cycle analysis (LCA), which weighs future emissions less than current emissions (the former of which are expected to cause less climate harm, given the decarbonization targets of countries worldwide.) Thus, RE2020 favours materials – such as wood – that have low emissions during their manufacture and/or that store carbon. France is believed to be the first country to apply a dynamic LCA approach to the building sector.

RE2020 includes embodied carbon limit values that over subsequent years will progressively lower to reduce emissions. The roll-out of limit values also took effect at the beginning of 2022. These limit values will be tightened in 2025, 2028 and 2031, with every step further pressurizing the building sector to decarbonise.

In France, all new public buildings must be made from at least 50% wood or other sustainable materials to help achieve sustainable urban development.

Source: Timberbiz » Pioneering regs for Sweden and France mandate more wood

6. **John BERGER, page 11**

Question Asked:
My question is more around the cost to the environment, because I am thinking that once you are putting a laminated beam together there are glues, resins, all sorts of things – you know, heat temperatures that need to be achieved to put these timbers together – and it is the same with producing RSJ or RHS for structural stability or for the costs associated with putting both products together. Has there been a comparison of one against the other?
Andrew WHITE: I would have to come back to you on that.

Response:

Detailed cost comparison information between timber and steel is included in the answers to previous questions on notice above, as well as the lifecycle (i.e. carbon footprint) of timber production overall.

The latter includes information on emissions from the production of wood fibre for different wood types, compared to the carbon sequestered overall. The carbon footprint is negative overall, meaning in the production of timber there is significantly more carbon being sequestered and then stored, than is being emitted throughout the production and harvesting process.