LIFE CYCLE CONSIDERATIONS

Energy efficiency, greenhouse gas emissions, cost and durability

When comparing wood to other building materials, key aspects such as energy use and greenhouse gas emissions, cost and durability should be considered over the lifetime of the structure.

Energy efficiency and greenhouse gas emissions

Compared to other building materials, wood has one of the lowest environmental impacts. Wood is a renewable resource, and using wood can contribute to minimising greenhouse gas (GHG) emissions.

Overall, wood products and structures perform better in terms of energy use during the production of materials (embodied energy) and in terms of heating and cooling during the use of a building. As wood products have a lower global warming potential than non-renewable construction materials, the use of wood can contribute to minimising GHG emissions.[1]

The building sector is responsible for 40 percent of primary energy demand and 36 percent of energy related CO^2 emissions in industrialised countries.[2] By using timber in construction, it is possible to turn buildings into stores for atmospheric carbons.

Cost effectiveness

Studies show that wood structures may be cheaper over their lifetime.

Timber buildings can be prefabricated off-site, which generally reduces total building time and therefore cost. Another benefit of off-site prefabrication is less on-site disruption.

Research has shown that estimated life cycle costs of wood-frame barracks is about 40 percent lower than those of masonry and steel on a per square foot basis.[3] The analysis covered initial capital costs and salvage values as well as maintenance, preventive maintenance, and capital improvements over 40 years.

Energy for heating and cooling is a major operating expense for buildings. When comparing the total life cycle energy use of wood, steel and concrete commercial buildings over a 50-year building life, it was found that wood buildings have lower energy use in construction, and in maintenance and repair.[4]

Wood has been used to great effect in the City of Perth Library. Photo credit: City of Perth.

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Strength and durability

Wooden structures' strength and durability is comparable to or better than structures made of other building materials.

New wood products such as structural composite lumber, glued laminated timber (glulam), pre-fabricated panelling and cross-laminated timber now have increased dimensional stability, higher strength-to-weight ratios and greater long-span capabilities.[5]

In a study that examined building structures at the time of demolition, it was found that wooden structures were far older before being demolished than concrete and steel buildings. The age of buildings at the time of demolition per structural material were:

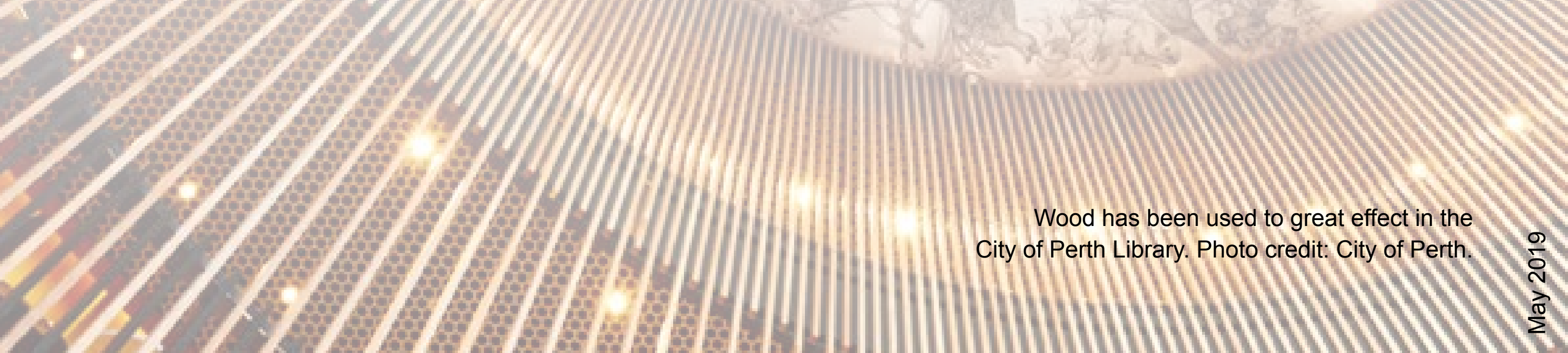
- Wood - 85 percent were more than 51 years old, 49 percent were 76 to 100 years old and 18 percent were more than 100 years old;
- Structural concrete - 63 percent were less than 50 years old; and
- Structural steel - 80 percent were less than 50 years old.[6]

Durability of wooden structures and products can be assured through good design and appropriate construction and maintenance practices.

Several resources are freely available to guide building and construction professionals:

- WoodSolutions has Technical Design Guides for durability, and for building and product specific concerns. *Timber Service Life Design Guide 5* provides guidance on life design and durability and can be found at www.woodsolutions.com.au/articles/technical-design-guides.
- reTHINK WOOD has an infographic on steps to achieve durability and longevity, which includes a list of resources on building with wood. This is available at www.slideshare.net/rethinkwood/wood-in-buildings-steps-to-durability-and-longevity.

[1]. Bowyer, et. al (2013), Life cycle cost analysis of non-residential buildings; Hill and Zimmer (2018), The environmental impacts of wood compared to other building materials, Dovetail Partners Inc.; Eriksson (2004), Comparative LCAs for wood and other construction methods. In Proceedings of the World Conference on Timber Engineering, Lahti, Finland (Vol. 1417); Gustavson and Joelsson (2010), Life cycle primary energy analysis of residential buildings, Energy and Buildings, 42(2), 210-220.
[2]. Energy Technology Perspectives (2017) as cited by International Energy Agency, https://www.iea.org/buildings/
[3]. NAHB Research Center (2004) as cited by Bowyer, et. al (2013)
[4]. Cole and Kernan (1996) as cited by Bowyer, et. al (2013)
[5]. reTHINK WOOD (2012), Wood in Buildings: Steps to Durability and Longevity, https://www.slideshare.net/rethinkwood/wood-in-buildings-steps-to-durability-and-longevity
[6]. Athena Institute (2004), Minnesota Demolition Survey, Phase II Report.



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