

**The increase of timber use in
residential construction in Australia:
Towards a sustainable residential
development model**

Douglas N Thomas

**A thesis submitted in fulfillment of the requirement for the
degree of Doctor of Philosophy**

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Certificate of authorship/originality

I certify that the work in this thesis has not previously been submitted for a degree nor has it been submitted as part of requirements for a degree except as fully acknowledged within the text.

I also certify that the thesis has been written by me. Any help that I have received in my research work and the preparation of the thesis itself has been acknowledged. In addition, I certify that all information sources and literature used are indicated in the thesis.

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List of peer reviewed publications during candidature

'Sustainable timber use in Australian residential construction: Perception versus reality'

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'Sustainable timber use in the Australian housing market: Are consumers willing to pay the price'.

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'Medium rise structural timber apartments: Luxury or long-term carbon storage solution?'

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'Multi-storey residential timber buildings in Australia: Where is the education?'

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Abstract

There is currently a limited use of timber products in residential development in Australia due to the dominance of heavy materials such as concrete, steel and brick. This dominant use of heavy materials is a reversal of the traditional material choice that was based predominantly on timber products. Technological advances and efficiencies drove the change to heavy materials in these particular industries. The emerging issue with this reliance on heavy materials is the impact of their use on the environment. The carbon impact and problem of finite resource depletion associated with concrete, steel and bricks need to be addressed due to the increasing pressure from national and international requirements and legislation. The construction industry needs to reduce its negative impact on the environment and sustainable timber presents a material solution to the problem. Timber from sustainably managed forests and plantations can be utilised as lumber or manufactured into engineered products for residential development use in both detached and multi-residential projects. Whilst there is research on carbon reduction through timber use in residential construction there is a gap in the research into how timber can achieve adequate performance in the key indicators in the Australian construction industry. These indicators are cost, time, quality and sustainability. There is also historic prejudice and misperception toward timber use in construction from both the supply and demand side of residential development. This study aims to discover the current perception towards timber in residential development and produce a sustainable timber use model that addresses the key performance indicators of the Australian construction sector. The performance of timber when compared to the current heavy material use in residential development will be compared through the use of the model.

A survey was conducted to gauge the perception of the demand side of residential development of the current use of timber in the structural envelope and cladding of housing projects. Interviews were then undertaken with construction practitioners to gain a supply perspective of some of the issues with timber use from a technical perspective and to review if survey results were

based on real timber performance problems or misperceptions. The data collected from the survey and interviews in addition to current literature on timber use in construction was used to develop a sustainable timber strategic building model. This strategic model provides an alternative model to the current heavy material use in residential construction. The model is tested and the results validated through ten building case studies by comparing the key performance factors when timber is substituted for non-renewable construction materials. When timber is used in the sustainable residential development model it is found to out perform traditional materials in aspects of time, cost, quality and sustainability.