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SUSTAINABLE TIMBER USE IN THE AUSTRALIAN HOUSING MARKET: ARE CONSUMERS WILLING TO PAY THE PRICE?

Douglas Thomas, Grace Ding and Keith Crews
Department of the Built Environment,
University of Technology Sydney (UTS), Australia
e-mail: Douglas.Thomas@uts.edu.au

ABSTRACT

A large proportion of traditional Australian homes contained timber floors and timber exterior cladding until the advent of the standard concrete slab/brick veneer house. Up to 95% of new homes are built by project home companies and the majority of these contain an external envelope consisting of concrete flooring, clay brick walls and concrete tile or steel sheet roofing. This design is currently driven by consumer's expectation of low cost, durable homes that are completed within restricted time limits. There is now a price premium on bespoke housing projects that differ materially or otherwise from a limited set of designs offered by project home firms. The adoption of concrete and brick homes originated from a perceived advantage of longevity, low maintenance and thermal comfort. Innovation in wood treatments, wood protection and insulation has provided solutions to these issues so that timber is now a viable option with added benefits such as environmental sustainability and erection speed. Australian consumers have a growing awareness and desire to live in a way that is sustainable and are making choices that reflect this attitude. This has been demonstrated through the high adoption rate of recent government-supported schemes such as subsidized insulation and solar panel installation. This paper aims at investigating homeowner's perception of timber as a sustainable building product, the desire of homeowners to use sustainable building products, and the willingness of homeowners to pay a premium to live sustainably. This paper highlights Australian homeowners reluctance to use the most sustainable building materials even when they are willing to pay for a more environmentally sustainable home. This paper presents the results of a questionnaire survey to homeowners in the city of Sydney, New South

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Wales, Australia and some strategies on how to increase the use of timber in new housing projects in Australia.

Key words: Sustainable Building, Timber, Australian Houses, Consumer Perceptions.

Introduction

The Australian residential construction industry makes up close to 7% of the Gross Domestic Product (GDP)[1] and the construction sector causes approximately 23% of national carbon emissions [2]. This sector has the capability of improving sustainability through improving operating energy efficiency and reducing embodied energy in buildings through material choice used in construction. Homeowners have an awareness of the operating energy issues through the rising cost of electrical/gas and building codes that regulate the types of new homes that can be built. Consumers have less understanding of the contributions that embodied energy has to the carbon footprint of their homes. The purpose of this paper is to examine Sydney homeowner's perception of environmental sustainability as applied to material usage in new homes, their preference for different building materials and willingness to pay a premium to reduce the environmental impact of their home. The paper presents the process of data collection and analysis of an online survey. The results of the survey reveal that most of the homeowners prefer heavy construction materials even though they believe timber is a more environmentally friendly material. The paper finally presents strategies for increasing the use of the timber as the most sustainable building material.

Traditional housing construction

Project home construction makes up a high percentage of new and knock down/rebuild home projects in suburban areas surrounding Australian cities. Large developers also provide house and land packages consisting of limited design option project homes on allocated lots. The majority of brick veneer project homes are constructed with concrete ground floors, brick external walls with an inner leaf of plaster covered timber frames and roofs manufactured from prefabricated timber trusses covered in tiles or metal sheeting. The increase use of heavy materials such as brick are due to its perceived low cost and low maintenance attributes [3]. This has resulted in a trend away from homes more materially based on timber which historically was used for structural floors, flooring and external wall cladding in the typical Australian home. The move away from the use of timber in residential construction may be reversed with gradual implementation of government climate initiatives to reduce carbon emissions produced by the construction industry [4].
The Australian Building Code (Now known as the National Construction Code) currently legislates the minimum requirements for new home energy efficiency with every state having slight variations in the application of the legislation [5]. The state

of NSW uses an environmental assessment tool called BASIX (Building Sustainability Index) to reduce the operating energy and water usage of all new homes and renovations; [6]. The BASIX scheme has been in operation for seven years and recent evaluations have established its success by the reduction of water and energy use in these homes of 40% and 20% respectively[7, 8]. Reducing operational energy in homes has been the focus of government policy not just locally but internationally as seen in countries in Europe [9, 10]. Legislative requirements have seen the energy efficiency of new homes increase through design features including greater insulation in the building envelope, improved solar orientation, reduced air infiltration and higher quality glazing specification. Continuing reductions in operational energy requirements of new homes will place more importance on the embodied carbon proportion of dwellings and consequently on the materials chosen for buildings [11].

Timber construction in Australia

Concrete floors in new homes in Australia dominate over traditional timber bearer and joist structural systems for the reason of perceived durability and thermal benefits. Thermal mass benefits of exposed concrete are well documented to reduce the operating energy requirements of buildings [12] however most Australian homes have floor coverings and fail to realise these benefits [3]. A recent thermal floor performance study in Tasmania has discovered minimal difference between the internal thermal ratings of identical villas comparing concrete slab on ground to elevated timber structural flooring [13]. Under floor insulation applied to timber floor homes can provide a greater thermal resistance than concrete floors in addition to maintaining the benefits of lower embodied energy, greater speed of construction and light- weight material handling advantages. Previous issues of durability and insect resistance issue associated with timber floor systems and cladding have been overcome with the reliable and cost efficient supply of natural and engineered treated softwood products in Australia. Sustainable plantations in Australia supply the majority of this timber and these may also derive financial benefits through generating carbon credits through the recently introduced carbon tax related carbon farming initiative [14, 15]. This may give timber products a price advantage over alternate home building materials such as concrete, steel and bricks. Cost is a barrier to the provision of more environmental sustainability dwellings produced by large volume project homebuilders due to the relatively small profits margins in their product [16].

The cost of new housing is important to Australian consumers particular in a time in which literature suggests that housing affordability is extremely low for bottom to middle income earners [17]. This is also reported to be an issue in the UK where housing affordability decreased in the last decade [18]. Swedish homebuyers indicated that higher costs of environmentally sustainable products discouraged property investment and a majority of Germans surveyed that highly rated timber for its environmental attributes still indicated that economic value was an important

factor in their house buying decisions [19, 20]. To overcome consumers reluctance to spend more money on environmentally sustainable housing it has been suggested that economic incentives be introduced through government policy initiatives [21]. This has been a success in Australia in recent years with a number of government-subsidized initiatives. These include solar panels for hot water and electrical supply; roof cavity insulation and water tanks for garden water and grey water recycling.
The large scale uptake of the schemes indicate the willingness of Australian home owners to implement sustainable building options yet no incentives exist to increase the use of materials with lower embodied carbon for new homes or renovation work. Some authors suggest that increased personal cost by current consumers should be accepted to avert a greater cost for future generations [22]. This may be the appropriate response in the stewardship of resources however apart from legislation many Australians are choosing to materially enrich their lives at the expense of ecological sustainability. This is demonstrated through increased energy consumption from larger homes (greater m2/occupant), grander entertainment systems, and the expectation of consistent thermal comfort leading to higher uses of air conditioning [6]. The willingness of Australian homeowners to participate in schemes that aim to reduce the energy use in dwellings contradicts the decisions of consumers in purchasing large new homes that have high-energy demands. This could indicate a lack of understanding of ecological sustainability or the disconnection between homeowner's economic choices and the desire for reducing the human impact on the environment.

Research Method

The purpose of the research was to obtain data that reflected homeowner's perception of sustainability in home building, their understanding of timber as an environmentally beneficial material, their inclination to use timber in a new home build and willingness to pay a premium to increase the eco-sustainability of their home. Questionnaire surveys were used to allow for quick distribution, wider coverage and to increase the efficiency of data collation and analysis. The sample group was chosen for their propensity to understand basic building terms, environmental sustainability, and own a single dwelling outright or carry a mortgage. The survey was distributed via a link embedded in an email sent to friends, family and work colleagues to enable participants to answer and submit surveys at their own convenience and to maintain their anonymity. The potential participants were then reminded 2 weeks after initial distribution by email, phone and personal contact to complete the survey. Final response rate was 60%. The questionnaire contained five main sections that included family demographics, existing home envelope materials, material preferences, and homeowner attitudes to sustainable construction and their willingness to pay a premium for sustainable building materials.

Observation and Analysis

Participants for the questionnaire were homeowners from suburban areas surrounding the city of Sydney. Participants were presumed to have a general understanding of the meaning 'environmentally sustainable' and were familiar with building terms used in the survey. The average household surveyed contained 4.2 people compared to Australia's average of 2.4 and 95% received household incomes above the national average of $53,000 annually. They live in homes just below the size of the average Australian homeowner (240m2)[23], have lower mortgages (76% had less than the national average of $300,000) and 67% have annual savings greater than $5000 [24]. The demographics of the sample group indicate that in terms of affordability they would be most capable of choosing to spend on the most sustainable building option when purchasing a new home.

Material preference

Participants were asked to describe the materials that were found in the wall cladding and floors in their current place of residence and nominate the materials they would use if they were building/purchasing a new home giving reasons for their choice. The external wall cladding, structural floor and floor coverings were used in the survey as these elements provide the most options for building envelope choice. Figures 1 to 3 show the comparison between the materials that exist in the survey participant's homes and the materials that would be chosen in the case of owners building a new home. With regards to materials used for external wall cladding approximately 70% of owners lived in brick veneer or double brick homes and 16% in timber-clad dwellings. When survey participants had the option of building a new home with brick or timber cladding 77% nominated brick and only 10% timber. The reasons given for brick were durability and thermal comfort whereas the preference for timber was aesthetics.

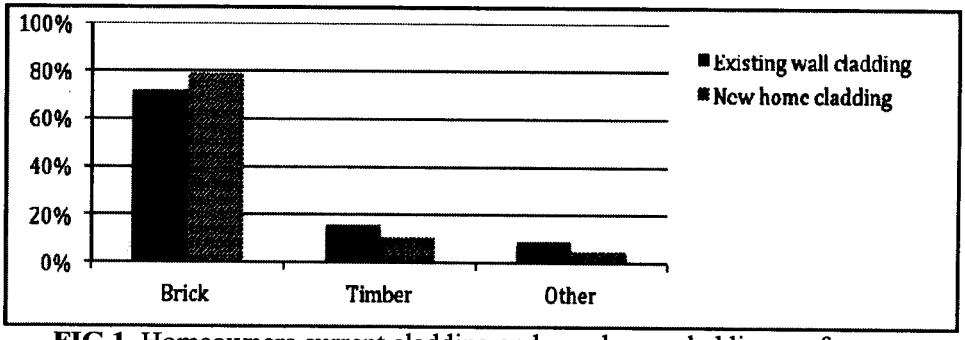

FIG 1. Homeowners current cladding and new home cladding preference.

The existing structural floors were mainly concrete slab and timber bearers and joists with timber's prevalence almost 40% greater than concrete flooring. The material of choice for new construction strongly favoured concrete for structural flooring at a ratio of 2:1. The preference for concrete was due to perceived durability, acoustic and thermal features as well as previous negative experiences with insect attack on timber. Timber was the structural system of preference for those who were concerned with constructability/ alterability as well as low cost.

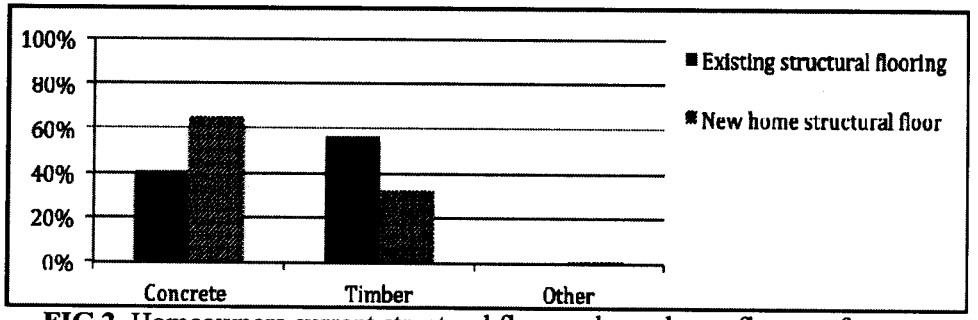

FIG 2. Homeowners current structural floor and new home floor preference.

Timber floor coverings were present in 58% of existing homes surveyed compared to carpet 33% and tiles 6%. 70% of households stated they would install timber flooring in a new home if they had the option. Ease of maintenance/cleaning and aesthetics were the primary justifications for householder's preferring timber flooring with only one owner stating environmental factors as the reason of choice. Carpets were nominated for comfort and tiles for aesthetics and cleaning.

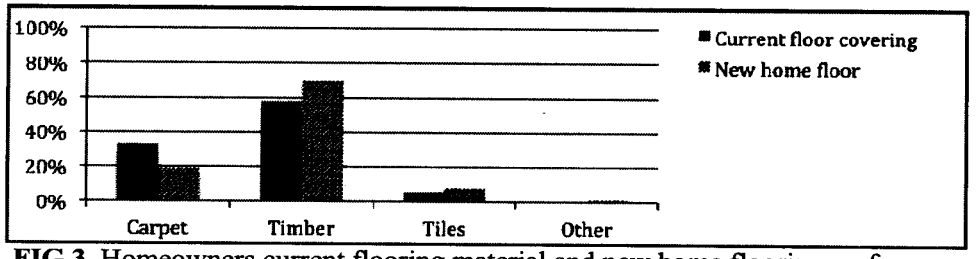

FIG 3. Homeowners current flooring material and new home flooring preference.

Homeowner's attitudes towards environmentally sustainable building materials

Three questions were asked of the homeowners regarding their attitude towards living sustainably and using sustainable building materials for houses and their perception of commonly used building materials in residential construction (concrete and bricks). The first two questions used a 5-point standard Likert scale where respondents were

asked to rate each question from strongly disagree to strongly agree. In response to whether the society should spend more effort on preserving the environment 87% replied in favour of greater action and 89% which of homeowners believed that environmentally sustainable materials should be used to build new homes. The perception of owners towards the most environmentally sustainable building material revealed that timber was viewed by 62% as the most sustainable material followed by bricks (19%), reinforced concrete (12%) and other materials (5%).

Homeowners affirm their willingness to pay additional costs for sustainable building solutions in a new home purchase. They will pay a premium for sustainable wall cladding in the order of 5-10% and 5-10% for the structural floor system. Seventy nine percent (79%) of survey participants also confirmed that they would contribute extra funding for a more environmentally sustainable house. This contribution ranged from $5000-$100,000 (up to 15% of the homes value) with a mean of $30,000 which represents 4% of the average properties' value for the areas surveyed. The majority of homeowners also indicated that government subsidies would increase the chance of their selection of sustainable building materials.

When given the option between a timber and brick new house purchase 69% of respondents chose a brick home. The remaining 31% preferred a timber home. Figure 4 and 5 gives a break up of the reasons for participant's selections of dwelling type. The main reasons the brick selection is low maintenance, thermal comfort, structural integrity and durability. Soft factors were the dominant driver for timber home choice lead by aesthetics and natural characteristics. Only 7.5% of those willing to buy a timber dwelling picked environmental factors as an influential feature.

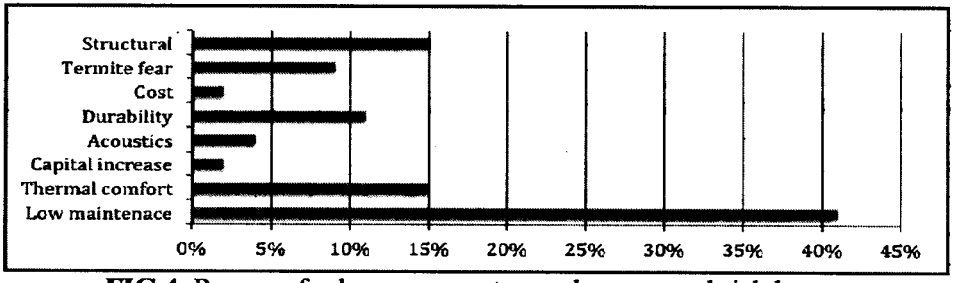

FIG 4. Reasons for homeowners to purchase a new brick house.

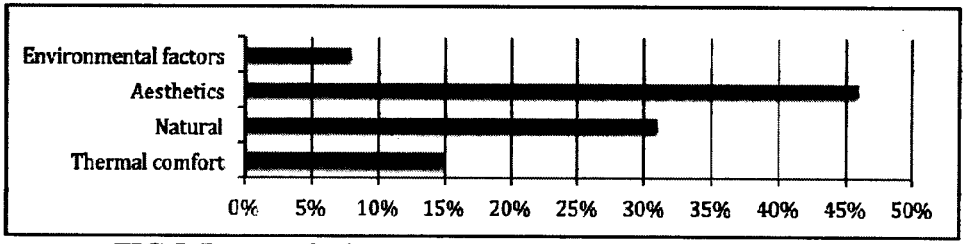

FIG 5. Reasons for homeowners to purchase new timber house.

When choosing a house to live there are a number of considerations that consumers evaluate. The top three out of ten factors ranked by homeowners were price, house size and house appearance. The next most important considerations are proximity to work, environmental features and proximity to extended families/schools and the lower ranking qualities included the distance of the home to shops and health care.

Conclusion

A section of Sydney homeowners have expressed an awareness that it is appropriate to live and build homes in a more sustainable fashion and would be willing to pay a premium to build a new home with increased use of environmentally sustainable materials. The majority are convinced that timber is the most sustainable building material however they have indicated that they would chose a new home built of concrete structural floor and brick veneer. This demonstrates a disconnect between their expressed intentions and actions which may be related to one or more of the issues below:

- Persisting negative perceptions that timber is likely to be damaged through moisture, insect attack and exterior weathering.
- Inadequate understanding of the thermal comfort advantages of timber flooring and external wall systems when designed appropriately.
- Ongoing misunderstanding that heavy floor and wall envelopes provide the most durable, cost and time efficient option for new home builds.
- Large homebuilders have marketed and supplied concrete and brick veneer homes as their main product for a long period therefore limiting timber design choices for consumers.

Another crucial factor that needs to be addressed to see an increased timber use in new homes is ensuring equivalent or increasing profit margins for builders whilst providing a cost competitive product for consumers. A number of strategies are suggested below to address the fore mentioned barriers to increased timber usage:

- Increase marketing to re-educate consumers regarding the durability (insect and rot resistance), thermal performance and reduced maintenance of timber. This would compliment the recent media campaign that promotes the aesthetic and environmental benefits of timber.
- Introduce subsidies for the increase use of timber in new home builds as part of the government's environment policy. This may assist in keeping timber home prices competitive and help achieve Australia's carbon reduction targets.
- Allow Australian timber producers to receive carbon credits for not just new timber plantations but for the sequestered carbon in the wood products they supply to the building industry. This would assist the large project home

companies maintain a low material cost base when using timber compared to brick and concrete products.
- Include embodied carbon credits for materials as part of the national building code and state environmental legislation.

All these strategies aim to increase the use of timber in house construction by building on Australia's need to reduce carbon emissions nationally, maintain housing affordability and working with consumers existing desire to live in a sustainable way without compromising their current standard of living.

Limitations

This study included a small sample of house owners (Sixty households surveyed) and mainly reflected the preferences and views of the economically advantaged so it is recommended that an extensive survey be conducted to include the whole range of Sydney's socio-economic groups in the position of home ownership.

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