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Attitudes to the use of Wood as a Structural Material in Non-residential Building Applications: Opportunities for Growth

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Attitudes to the use of Wood as a Structural Material in Non-residential Building Applications: Opportunities for Growth

Prepared for the

Forest & Wood Products
Research & Development Corporation

by

K. Bayne and S. Taylor

EXECUTIVE SUMMARY

Recent international studies on the use of timber in non-residential buildings – in Canada, the US, Australia, and New Zealand – observe the notable absence of timber in this application, point out the significant room for improvement, and suggest strategies the timber industry could implement to improve market share. Most of these studies suggest that designers are not comfortable in designing with wood, and that steel and concrete are more appealing materials for non--residential building design.

Previous research has suggested that the major barriers to increasing market share of wood products in non-residential building applications in Australia are fire performance and overall designer confidence in commercial and industrial timber-based construction. While the issue of fire performance is being addressed both through design solutions and amendments to building codes and standards, the issue of overall confidence in the use of wood as a structural material in non-residential applications requires further exploration.

With the objective of determining the key reasons driving specifier confidence, focus groups and Interviews were held with 34 designers/specifiers during March and April 2005. The issues deemed to be significant were similar to those found in previous studies. These issues were:

- a lack of available information and assistance with timber design;
- timber marketing that is targeted towards the residential sector and not segmented for specific building applications;
- lack of tertiary level training;
- lead times and cost;
- commercial risk;
- and the lack of connection detailing and timber fabricators to erect non-residential buildings

A range of strengths and weaknesses relating to the structural application of timber for non-residential purposes were highlighted, confirming that specifiers have reservations about its use as a viable product for certain high-performance applications. The more positive aspects related to:

- aesthetics,
- easy construction and adaptability of design;
- character;
- fire performance; and
- energy.

Negative structural aspects concerned:

- performance,
- cost, and
- speed of erection.

Specifiers indicated that timber would work better in buildings where there was a link to human growth and development, or community spirit, so that timber could be enjoyed. These building types included:

- residential care facilities;
- educational buildings;
- community and public buildings, and
- small stand-alone offices and clinics.

The architects also noted that the more promising building applications were smaller building types (eg. churches, clinics, community halls), and stated that this is where the industry should concentrate on expanding into initially, before targeting the larger storey buildings such as warehouses and multi-storey office blocks. It was noted that there is a large difference between type A and Type C buildings in the Building Code, especially regarding fire issues.

There are three recommended promotional strategies that the Australian industry should take to enhance specifier confidence in using timber in non-residential applications:

- Address negative perceptions of timber performance and appropriateness in non-residential applications, particularly focussing on issues with perceived commercial risk
- Use environmental assessment data to highlight the sustainable benefits of using timber in place of other competing materials, to gain a pull through from the market and increase the desire to specify with timber.
- Make timber design and technical information more readily available to specifiers in a format they find useful and useable.

Ensis recommends the following priority initiatives be employed to implement these strategies:

- Create a ‘one-stop-shop’ information centre for specifiers looking for timber design information.
- Develop a market for ‘green’ buildings using structural timber.
- Develop and provide design aids for timber building structural analysis.
- Provide and promote case study publications.
- Provide technical brochures and fact sheets to address negative perceptions, particularly relating to perceived commercial risks, and market to a wider specifier audience (developers, quantity surveyors and insurers also).
- Develop and support hybrid steel-timber components and enhanced connection details.

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1 INTRODUCTION

1.1 Wood in non-residential construction

Several studies undertaken recently in Canada, the US, Australia, and New Zealand lament the lack of timber used in non-residential buildings. They indicate that there is room for improvement and provide strategies the timber industry could implement to achieve this. Most of these studies suggest that designers are not comfortable in designing with wood, and that steel and concrete are more appealing materials for non-residential building design.

Most studies point out the significant opportunity for increasing the use of timber in the non-residential sector. McKeever and Adair (1995) found that 51% by value of all non-residential projects in America could have been built with timber. This gave timber a potential market value of $US93 billion (17% of market share) compared to the $12 billion actually achieved (13% of the market share). This was similar to an earlier study by Baker (1989), quoted in Nolan's 1994 report, who found that of 26 buildings recently constructed in Europe, only two could not have been constructed in timber using NSW regulations Ordinance 70. Truskett (1997) found that Victoria had a significantly higher proportion of structural timber in non-residential buildings than other states.

Page (2005) outlined the opportunities for increasing wood products in new Government buildings in New Zealand. Presently 12% of New Zealand government buildings have predominantly timber framing. The report suggested that wood be advocated for use in new Government buildings which could be designed to utilise at least $NZ50, 000 worth of structural timber products. This equates to buildings worth in the region of $NZ750, 000 or more.

Australian fire code restrictions and a perception of higher commercial risk for large timber buildings was stated by an insurer as being the main cause of difficulties in obtaining adequate insurance premiums for buildings (especially hotels and restaurants) worth more than $AU300, 000. The challenge is therefore to prioritise initiatives, and focus on non-residential applications where timber has the best chance of breaking through the market, specifier and regulatory barriers, and gain significant traction in these new sectors.

1.2 Project purpose

The major barriers to increasing the market share of wood products in non-residential building applications in Australia have been identified in previous studies as (1) fire performance and (2) overall designer confidence in commercial and industrial timber-based construction. While the issue of fire performance is being addressed both through design solutions and amendments to building codes and standards, the issue of overall confidence in the use of wood as a structural material in non-residential applications requires further exploration.

It is recognised that materials decisions for non-residential buildings are made from interactions between many design disciplines. Owners and developers are having a greater influence on materials specifications, and a crucial limiting factor is the perceived ‘commercial risk’ of designing a large timber building, particularly in terms of insurance premiums and tenancy assurance of long-term performance.

As many of the regulatory barriers are determined via building codes, the purpose of this project is to investigate situations where non-residential are legally permitted to be built using wood, but where specifiers choose to use alternative materials.

The project aims to:

- Understand why substitute building materials (predominantly steel and concrete) are favoured over wood products by the key decision makers during material specification
- Explain the main reasons behind the lack of confidence in specifying timber as a structural material in non-residential buildings
- Provide a platform from which strategies can be developed to address these attitudinal barriers.

The key objectives of the project are:

- To identify and describe reasons for the lack of confidence in wood as a structural material in non-residential building applications, with context and relevance for Australian engineers and architects.
- To provide recommendations for promotional and product development strategies that serve to open up markets for wood products in the Australian non-residential building sector.
- To identify opportunities for improved technology transfer and areas where design-oriented information is lacking.

2 METHODOLOGY

Desk Research
Desk research to scope literature on the subject uncovered a number of key reports and studies. These were used to define the key issues, and provide input into development of the focus group and interview questions.

Focus Groups
Three focus groups were held with a cross-section of specifiers including architects, engineers, building designers and project managers during March and April 2005. These were held in Sydney, Melbourne and Brisbane and facilitated by Ipsos. A total of 26 specifiers participated in the focus groups, which investigated the current application of timber in non-residential building structures and strategies that would encourage specifiers to be more likely to consider structural timber for non-residential buildings in future.

Interviews
A total of 8 one-on-one interviews were held with a range of stakeholders, including architects, structural engineers, developers and an insurer, in order to elicit attitudes to wood use in their own practices, and experiences in using structural timber in non-residential applications. Suggestions for improved systems and the most suitable applications for timber non-residential buildings were also discussed.

The information from the desk research, interviews and focus groups was analysed to identify and describe the main reasons for lack of confidence in specifying structural timber for non-residential buildings.

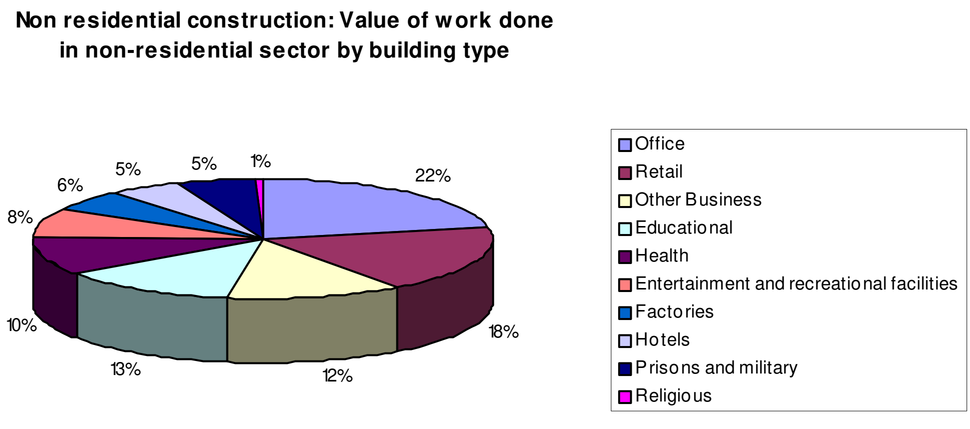
To disseminate these findings, two workshops were held during July and August 2005:

- A presentation of the major reasons for specifier lack of confidence was given at the ATIF/PMA conference on 29th July 2005.
- The various promotional strategies were presented and prioritised via a discussion forum between specifiers and the timber industry in Sydney on 29th August 2005. Participants discussed the initiatives to influence specifier's attitudes towards using structural timber in the non-residential sector, giving feedback on the main reasons for confidence and aiding in the selection of the most promising promotional initiatives with which to target specifiers. Practical technology transfer routes were also outlined to allow implementation of these strategies in the marketplace.

3 THE AUSTRALIAN NON-RESIDENTIAL BUILDING SECTOR

3.1 Size of market

The Australian non-residential market is set to rise continuously until at least 2009. As of 2005, the commercial and industrial sector accounts for two-thirds of the Australian non-residential market sector, with another 29% of the market in institutional building (Ibisworld 2004a and 2004b). The total value of non-residential building projects approved in Australia in 2002 was $15 billion, of which wood products represented a small but undefined percentage (AusStats 2002). The total value of the non-residential sector in 2004 is estimated at $18.8 billion, of which $12.6 billion comes from commercial and industrial building, and $5.2 billion from institutional building (Ibisworld 2004a and 2004b). A breakdown of the commercial and industrial building sector by value shows that most of the work is accounted for by commercial building (shops and offices), while educational and health buildings account for most of the value from institutional construction:



Source: IBIS world industry reports E4114 and E4115, 15 October 2004

The sectors with an increasing number of building consents being approved are retail, hotel/accommodation, and entertainment and recreation, while the number of religious and health building consents are in decline. Those sectors that are experiencing a significant increase in value, year on year, are retail and offices, while religious and aged care facilities are declining in value.

3.2 Architectural and engineering services

Architects and structural engineers work in specialised building design, and provide knowledge where there is a particular demand or problem associated with the design. The non-residential market is increasingly price-competitive due to the trend of local governments and larger private firms putting out construction contracts to tender, rather than using established architectural firms. Architects therefore must compete with a significant number of other professionals in procuring building design contracts, but they still dominate in the non-residential sector, servicing around 50% of non-residential projects.

During 2003/04, Ibisworld estimated the revenue generated from architectural services at $2.5 billion dollars, and $5.7 billion in revenue from engineering services (Ibisworld 2005a). Architectural firms average six staff per firm, of which usually two are professional architects. An estimated 85% of architectural revenue is generated from the non-residential sectors (Ibisworld 2005a). Approximately 20% of the value of engineering work in Australia is from the non-residential market sector, mainly through design and consultation (Ibisworld 2005b).

Building design is currently experiencing an increase in the specialisation required for each sector, with specialist designers emerging in particularly the institutional areas (nursing homes, schools, hospitals, etc. Ibisworld attributes the drive towards specialisation to the introduction of National Building Codes, and the applicational standards that have been in place since 1990. Several states are moving towards regulations that ensure that architects are involved in the design of large buildings. In Queensland, an architect must design all buildings of 25+ storeys, and NSW is considering similar measures for buildings over eight storeys (Ibisworld 2005a). Architects view building materials holistically, and therefore timber products cannot be viewed (or pitched) in isolation from other building materials in case studies and designed examples. The principal determinant of demand for engineering services is in the building and construction sector, particularly increasing investment in non-residential buildings, and multi-unit residential construction (Ibisworld 2005b).

3.3 Experience with timber

Nolan (1994) indicated that in 1987 the majority of work architects and engineers would undertake during their careers would be for non-residential construction, but that very little of this work was being undertaken in timber at that time. Just 3% of commercial engineering was in timber, and no architects were involved in designing timber commercial buildings. Industrial buildings were much the same, where only 2% of the architect's work by value was in timber, and none of the industrial engineering work. Public buildings such as libraries and hospitals, and recreational buildings fared better, with 5% of the architect's and 5% engineer's value from those sectors being from timber buildings. It is not known if the situation has improved over the past 15-30 years, however, from our study, it still appears that very few of the non-residential building projects our participants had worked on were in structural timber.

In 1997, Truskett's study of factors influencing architects specification of timber products found that while 89% of those surveyed 'always or mostly' used structural timber in housing, only 20% frequently used structural timber for non-residential applications (1997a). Similarly, a survey of quantity surveyors by Truskett in 1997 revealed that while 36% of residential costed projects included timber, only 20% of non-residential projects costed used timber, and only 15% of all projects costed with timber departed from conventional timber construction. A high proportion (37%) of their work was sourced from architects (1997c). Structural engineers influence architects, and while they were found by Truskett to have no innate prejudice against timber, they actively discouraged architects from structural timber solutions, possibly due to their own lack of knowledge and comfort with these systems, as they did not receive adequate training in timber structures (1997d).

4 REASONS FOR LACK OF CONFIDENCE IN USING TIMBER FOR NON-RESIDENTIAL CONSTRUCTION

The desk research gathered a number of international reports and information relating to the use of wood in the non-residential sectors, the attitudes of specifiers to using timber structurally, and the approach taken to seek information and specify materials. Some reports sought to identify the key decision-maker for materials selection; however, the indication was that this is a complex process, and very dependent on the nature of the project.

4.1 Desk research findings

O'Connor *et al.* (2003) points out that in Canada, Building Codes are one of the greatest barriers to the use of timber in non-residential construction. The authors quote Goetzl and McKeever (1999) who estimated that Building Codes alone (especially fire-related building code restrictions) restrict the total size of the market in which timber could potentially occupy to 50% of the total non-residential market. Leicester (2002) indicates that fire codes, until 1994, also restricted the use of timber in Australian non-residential buildings. Prior to 1994, building regulations did not permit combustible materials (including timber) to be used for multi-storey building inter-tenancy fire separation walls. However, due to the timber industries' use of risk analyses, providing evidence of the acceptability of timber structural fire performance, timber was permitted for "suitably designed buildings".'

Gaston *et al.* (2001) found that in Canada, for buildings over three storeys in height, timber was no longer favoured for specifiers of non-residential buildings. However, in low-rise buildings, where wood was being used (1-3 storeys), it was a more favourable option than concrete. Steel, however, was still the most favoured construction material of the three for low-rise non-residential buildings. 75% of respondents in that study cited that they would be comfortable designing a low-rise non-residential building in timber, especially if the building application was one which had a strong heritage of using timber in the past: restaurants, offices, churches and farm buildings.

This perception of what is an 'appropriate' size and type of building for timber in the non-residential market is one of the reasons given by Page (2005) for the ongoing high market share of non-timber materials in the non-residential sector. Historical usage, and images and experience of steel and concrete being the 'norm' in this sector favour the continued use of steel and concrete. Other market drivers which Page (2005) found to affect timber's ability to compete are:

- cost (quantity surveyors are conservative in pricing unfamiliar systems, and over allow for pricing margins);
- performance perceptions (in terms of biodeterioration and instability); and
- ease of use (due to standardised steel sizes and the consistency of steel and concrete material properties that are well understood by designers).

Design professionals prefer prefabricated systems because design time is reduced. Truskett (1997d) states that structural engineers like components that 'fit together like meccano'. Such prefabricated systems, using standard components and connections are also easier for quantity surveyors to cost. Despite numerous examples being given by architects and engineers, these unacknowledged buildings do not allow the information to be useful to quantity surveyors. Truskett (1997c) states that historical costings for multistorey timber buildings and non-standard structures are unlikely to be held by quantity surveyors. However, the provisioned of this information from existing buildings could be done fairly easily by the timber industry, and provide a resource which could be used alongside the standard pricing books (1997d).

Nolan (1994) proposes that designers operate in two frames of reference when considering timber as a material choice – a frame of reliability and a frame of unreliability. In the frame of reliability, timber is thought of as a versatile, aesthetic, readily available material. These attributes are well suited to stick-frame housing, and timber sits comfortably within the designer's mind in being well suited to this application. This mindset is reinforced with images showing historical usage of timber in low-rise timber housing and farm sheds. On hearing messages concerning the sustainability of timber and the economic importance of the timber industry, it is this historic, low-rise frame of reference that dominates the mindset of the designer. A quote from Truskett (1997a) concerning architects and timber use states:

"Timber as a structural and finishing material has strong aesthetic appeal, but…factors such as maintenance and durability, professional networks, industry practice, information, and environmental issues hamper it's more general use."

Nolan (1994) highlights this in what he describes as a 'frame of unreliability', which causes engineers and architects to hesitate in using timber. This is in part due to the rationalist training received from tertiary institutes advocating steel and concrete, and which is reinforced in their interaction with a diverse and fragmented timber industry whose promotional efforts point out that timber is 'as good as' or 'meets' the performance of the more conventional non-residential materials. It is therefore viewed as a second-rate alternative to steel and concrete for many non-residential applications. Nolan states that the very 'character' of timber, as depicted in images of old farm sheds and lichen-covered fence posts, reinforces the perception that timber is not a durable, long-term material, despite that the building in the image may have been structurally intact for over 80 years.

The emphasis of steel and concrete systems within tertiary level training, coupled with inadequate specialised timber design tools, and the noticeable rarity of qualified timber design specialists, are common themes within the literature, and appears a global phenomenon. Kozak and Cohen (1997) state: a lack of understanding by design professionals in how to adequately specify in timber; lack of design education; and only a few designers with a high degree of competence in timber design, are the major reasons why wood products are not specified more often in the non-residential sector. Truskett (1997b) states that a lack of knowledge by structural engineers is at the core of the disadvantage timber faces in being adequately specified. Lack of support from the timber industry in terms of design training was also highlighted, and level of the support received from steel and concrete industries (and not just in terms of information provision) was significantly greater. Truskett (1997b) found that at least 30% of structural engineers surveyed in 1997 received no training in timber at all, and urged the industry to provide engineering educational resources, run seminars and hold professional development events for practitioners in centralised locations. Similarly, Kozak and Cohen (1997) stated that while 75% of US engineering curricula required steel and concrete design only 13% required a timber-engineering course. This issue is now being regarded as a serious threat to the forest products industry within New Zealand, and a $NZ2.26 million Government aid package to increase the level of training in timber systems has been released recently to aid wood design knowledge. The funds are targeted at creating two timber design professorships in the university engineering faculties and the creation of a software design aid for timber structures.

Testa and Gupta (2005), show that over the past 30 years the US has had a significant reduction in the both the number of timber design courses offered, and the number of students required to take courses in wood design to fulfil degree requirements. Kozak and Cohen's 1997 findings are supported by Testa and Gupta (2005) in that while 70-80% of US civil engineering programs require steel and concrete design courses, only 47% have a compulsory wood design element. Testa states the main reasons for this decline in educational emphasis in timber design include pressures on student time and course materials; shrinking budgets for research and teaching time; student career goal aspirations; and environmental concerns.

Increasing pressure on student time and resources has arisen from the trend to include new technology developments yet retain basic fundamental knowledge. This is often at the expense of timber courses, which are either reduced or eliminated altogether. In schools that do not currently teach timber, adding in an elective or optional timber course therefore becomes more difficult. Tertiary institute focus on profit-making has resulted in many faculties being reliant on research funding and industry assistance to remain viable. Lectureships are quite often appointed based on the ability to obtain research funds, or appointment from industry sectors. In the case of timber design, unless there is a dedicated funding agency willing to invest in wood design research, or wood design professionals that are supported by industry and willing to teach timber design, the faculty will be unable to support this teaching. The consequences are graduates that know little about timber performance, and are not adequately trained in timber construction and detailing of timber systems.

Rarely do students undertake training in architecture and engineering with the desire to graduate and work on large-scale timber buildings. Testa and Gupta (2005) point out that the 'wow' factor buildings (those projects which graduates are inspired by, and aspire to create and work on) are structures similar to the Twin Towers or Golden Gate Bridge – not timber buildings. Therefore the perception by students is that timber design training is interesting, but of little relevance in aiding to achieve these career goals – it is not going to aid them in designing the big projects they dream of undertaking. Testa and Gupta (2005) also note that the younger generation is becoming more environmentally aware, and the US timber industry still has an image of plundering old growth forests, and advocate that stronger partnerships between the timber industry and tertiary institutions are necessary to ensure graduates emerge with adequate timber design knowledge.

Given the reducing number of timber design professionals due to limited training in timber design at tertiary level, is there a corresponding lack of information that designers can use to design in timber? Fortunately, it appears this is not the case. However, timber design information is not readily available to designers in a package that they can easily use. Design tools and knowledge relating to the use of timber systems needs to be better targeted towards various building types, and easier for designers to locate when needed. Information is now more readily available than ever before, and in fact, literature suggests most designers operate in 'information overload' day to day.

Rhodes (1998) states that much information is now "incapable of answering the most fundamental human questions"; therefore design professionals use information more as a means to refine ideas, or to conceptually change the focus of a design brief. Due to designers being both time and resource constrained, designers are seeking and using materials information to reinforce their own ideas (which are framed from previous personal experience or inherent knowledge). They then use technical references to support these ideas. In other words, coming across technical information concerning wood materials will not make them change their inclination to use the material, unless their underlying attitude to the material is changed as a result of absorbing the information.

This view is supported by the work of O'Connor *et al.* (2003), who state that a lack of knowledge of timber material properties was not an underlying factor in the lack of confidence in it's use, and that the decision-making process is a complex issue involving multi-disciplinary teams. When selecting these materials, traditional use, builder preference, local availability and lead time to supply are just as important as the various attributes of a material in terms of performance and cost. Truskett (1997b) states that other material producers adopt a more unified approach to disseminating building and design information to specifiers, and that there needs to be a single industry provider of information, as specifiers are very aware that they no longer receive information from the timber industry as a whole. Truskett (1997b) states that:

> *" The provision of much of this information requires collaboration at the national level so that a centrally accessible bank of expertise and training is available to all design professionals. Computer technology makes this achievable…"*

4.2 Previous studies investigating design professionals' lack of confidence in specifying timber

In 1997, Truskett completed a series of four reports (1997a; 1997b; 1997c; 1997d) from surveys and interviews with architects, structural engineers, and quantity surveyors, investigating the factors influencing specifiers in their use and specification of timber and timber products. The key findings from this study were that:

- Timber is an under-utilised material in professionally designed non-residential buildings
    - 88% of specifiers used timber in housing, but only 22% used timber in non-residential buildings
- Design professions suffer from lack of timber building information
    - What little they have was seen as obsolete and unfashionable

- Specifiers are positive about timber as a material, and welcome help from the industry to enable them to design with it
- A significant number and range of non-domestic timber structures exist already in Australia, but are unacknowledged
    - Specifiers were able to list literally hundreds of non-residential buildings where they had used timber structurally during 1994-1997
- Other building materials industries and suppliers recognise the specifier need for support
    - Steel and concrete industries were praised for having updated, technically rigorous and highly professional information

Truskett recommended the following promotional initiatives by the timber industry:

- A national marketing strategy, and national database of timber products and suppliers, and grades and sizes
- Developing software aids and timber design handbooks
- Examining Australian fire codes for buildings, particularly how this issue relates to multi-storey timber buildings
- Developing an environmental labelling system
- Using case studies to demonstrate the aesthetics and cost comparativeness of timber
- Use structural engineers to design and build timber industry buildings from timber
- Develop a key mutually beneficial relationship between the building industry and the Institute of Quantity Surveyors through personal visits, trade expositions, hospitality gatherings and seminars. This is due to the key influence of quantity surveyors with regards to tendering process, and the links that each can make with other specifier groups.
- Showcasing (contemporary) timber buildings on their aesthetic merits
- Providing fire safety and durability information
- Undertaking studies to identify areas where costs of timber construction can be reduced, and performing cost comparisons with buildings of predominantly competitive materials.
- Supporting professional networks, and targeting particularly female architects, and those in the 35-50 age group.

A study in 2003 by O'Connor *et al.* identified the following as the reasons for the lack of specification of structural wood products in non-residential buildings by North American specifiers:

- <u>Restrictions from fire related codes</u>. This appears to be a major barrier to entry, especially in higher-rise buildings.
- <u>Easier and more cost effective steel and concrete design solutions.</u> Timber does not have the same off-the-shelf solutions in terms of both range of structural members available, and connection details for these, especially connections between two different product types. For engineers a large detraction to using timber is the complex detailing issues, and the requirement to design the connections and structural supports themselves, often from first principles. A lack of adequate design data is available to enable those unskilled in timber design to feel comfortable in this task, and specifiers identified the need for pre-engineered standard solutions. Without these, timber designs require more engineering time than steel and concrete, and subsequently add more overall cost to the project. The study also demonstrated that in certain instances, there is simply no known solution in timber, citing the example of

moment-resisting concrete frames predominantly used in the bottom floor of three to four storey retail blocks. The upper storeys are often timber framed. However, the need to have a wide window-front currently favours using this simple and efficient concrete system. The authors also point out the nature of wood manufacturer proprietary systems (using technical specification brochures) compared to a more information-sharing culture in the steel and concrete industries (using a design 'toolkit').

- Inadequate skilled labour in wood construction. While a fairly straightforward light timber frame code construction system can be used in residential design, most non-residential developments require more specialist engineers and architectural design skills. Most of those trained in light-timber framed systems work on residential developments, also, which leaves limited supply of skill base for 1-3 storey non-residential timber-framed developments.
- Designers' lack of training and familiarity with wood. Steel and concrete systems have a strong performance history in non-residential markets, and therefore much research data and testing has been undertaken to support their use in the non-residential market. This research data has also been used to develop many training tools, and a number of off-the-shelf design solutions, including software tools. There is not yet a comparative level of research or design tools for using large structural timber systems in this building sector.
- The perception that wood is not an 'appropriate' structural material for non-residential buildings. Specifier perceptions of fire performance, structural spanning, timber aesthetic and durability lead to the conclusion that wood is "inappropriate" and "risky" for larger-scale building developments. Other perceptions are that timber is not as stiff or strong as steel and concrete, given that it requires larger sizes and depths for beams, and is perceived as a poor material for taking up lateral loads. The long-term creep resistance of timber compared to concrete is an issue when specifying timber floors. Wood is therefore not seen as a structurally 'serious' material like steel or concrete.

5 RESEARCH FINDINGS

5.1 Focus group and interview feedback

Interviewees and those attending the focus groups have had a considerable range of experience in using timber for structural purposes in non-residential applications. Some of the main uses highlighted included constructing trusses, frames, beams and flooring in commercial and industrial buildings. Other applications included structural use in bridges, boat sheds, shelters and refurbished warehouses. Most specifiers typically enjoy the opportunity to work with timber when project opportunities arise. However, many find this to be a frustrating process. One interviewee (a structural engineer) shared an experience that appears to have experienced many elements in common with others that were interviewed or came to the focus group sessions. He utilised heavy timber (LVL) beams in a supermarket development project in suburban Melbourne. Having not undertaken a lot of work with timber, he found he had to educate himself in the application and design of timber for the project. When undertaking this he discovered that there was a lack of standard information that could help him, particularly relating to the connection of the beams to other building elements. Subsequently, his overall project costs were altered when accounting for 'up-skilling' time. He believes similar experiences encountered by other construction professionals may be enough to scare them off using timber all together.

The focus group and interview notes along with taped conversations were analysed to identify the reasons that specifiers were reluctant to design structural non-residential buildings in timber. The following list indicates a wide variety of different reasons, which fall broadly into three key themes (overleaf):

Many reasons identified for lack of confidence

Commercial risk

- Lead times
- Cost
- Misperceptions
  - -Maintenance
  - -Swimming pools
  - -Termites
- Fire risk
- Commercial risk
- Availability of sizes and grades

Lack of competence and comfort

- No fabricators/prefabrication
- Never had an opportunity to use it
- No timber courses at tertiary level
- Take advice from engineer, but engineer reluctant to use spanning ability
- Lack of standard connection details

Need for support/ tools and examples

- Sustainability myth
- Lack of reliable advisors
- Need for local, ordinary examples
- Difficulty in accessing knowledge
- Timber industry image
- Poor marketing

5.2 Key reasons identified from focus groups and interviews

The following analysis seeks to describe and explain the factors behind some of the major reasons that specifiers have lack of confidence in designing with structural timber for non-residential buildings.

Lead times and cost implications of timber logistics

The current construction market is driven by a high throughput, tight budget mentality. This allows little scope for variation in cost structures, specifications and project length and marginal additional time to research applications and specifications (all factors perceived to be encountered when using timber). Many participants noted that steel members go up fast and are simpler to put together due to standard connections. This particularly benefits steel choice in industrial building designs, which are often path-critical. Speed of erection can heavily influence choice of material, as revenues from tenancies are required as soon as possible to carry the upfront capital construction costs. The slower erection speed with timber-designed buildings was seen as a major deterrent to use, particularly for timber buildings using custom-designed components, as the shop-drawing process was considered too slow compared to steel. On the other hand, off-the shelf timber components were recognised as often being a quicker delivery option than steel, as timber does not require fabrication time. Steel can take longer in planning due to the need for specialist and specific shop drawings to be developed, whereas timber can be adjusted on site – so sometimes it makes sense to use timber (especially engineered wood products) if steel shop drawings are needed or going to take a long time.

"Speed of erection is the main downfall"

"Steel is quick. You can get the roof up and under weather protection faster than with timber"

"There are long lead times if you're not using laminated beams"

"I choose steel because of its definable qualities, structural capacity and cost. It often proves more economic than timber."

"If you're using timber as a component you can buy it off the shelf and be building on day one"

"With steel you can expect the product to arrive on site within 6-8 weeks of ordering"

The larger sizes and depths of timber required to span large open spaces can drive up the cost and make timber an uncompetitive option. There needs to be additional benefits from the timber design to offset these costs. Rapidly increasing steel prices are currently making a timber option more competitive, but if a small non-visual structure is required, then steel is used because the section size is smaller.

Timber usually takes longer to price up (several participants noted that quantity surveyors had very little experience in pricing for timber designs, and thus the process took longer than for steel and concrete) and designers needed to obtain engineering approvals to prove conformance to code specifications, if the design was a one-off or seen as non-standard (ie. not steel or concrete). The 'unknown' quantity of timber unfairly disadvantages this option when compared to steel, as quantity surveyors will price up a higher margin to accommodate this risk.

"You can push timber through if you can show cost offsets"

"people are used to dealing with steel and concrete, so if they need to get timber specified then the price increases….they price it differently"

"Spans would be the main problem. ….you'd require at least 30 metres"[1]

"Dollars are the key driver….unless you're after a specific aesthetic"

"Quantity surveyors don't know how to price or work out quantities for timber or erection costs."

"It all comes back to fees – if it's going to take longer we need to charge more"

Lack of (pre)fabrication and connection details

Participants saw the lack of a fabrication stage in timber designs as a major issue. This seemed to show (in their minds) a lack of thought by timber manufacturers as to how the whole building and assembly process operates, as if there was a single step between the manufacturer supplying the materials/components, and the builder/ contractor erecting the building. This may be due to the residential mindset of the timber industry, where builders and subcontractors can easily deal with a single packet of

[1] Note this developer was not aware of some of the more recent, long-spanning timber structures such as the CHH plant at Marsden Point with 32m spans

lumber on a building site, and have sufficient knowledge in terms of how to assemble and connect the various components together. Due to the complexity of larger-scale buildings, this is not nearly as simple a procedure, particularly regarding the detailing of connections, and the need to store and assemble items on-site. A steel fabricator has the responsibility to erect the building, and if there are any problems with members and connectors, the responsibility lies with the fabricator to put things right. Steel fabricators are a common sight in non-residential construction, and the lack of such a 'middle-man' step is seen as a significant commercial risk in taking on a timber design. The many manufacturing firms selling timber components also appears to be a concern, due to proprietary systems, and lack of standardised connection details.

"Engineers and manufacturers seem to like designing members, but don't always think about the nitty gritty"

"Need to get industry development in how timber products can be put together . Steel members go to a fabrication shop…..building apprentices aren't properly trained (in putting together timber buildings)"

"finishing should be done in the factory rather than on-site"

"Big problem was finding someone to put it up"

"Construction – only a few people are able to construct a timber structure, but lots can do steel. This adds to the cost."

"There is a perception that timber goes straight to the builder. But you really need an intermediary step …as there is no fabricator. …. to deal with connections. …. then unskilled labour can put it up."

"…lack of standard details….need to reinvent the wheel every time (for connections)"

"*Steel fabricators usually have a contract to draw, fabricate, deliver and erect. So they have on-site and delivery issues in mind throughout the project"*

"Who has the responsibility to put the thing up ….no fabricators like the steel industry has".

Greater off-site prefabrication and better (standardised) connection details were seen as something that could improve attitudes to using timber for non-residential buildings. Timber trusses were seen as a system benchmark, due to their efficiency, having standard systems useful for many different applications, and being easily understood by designers, economical, easy to erect, and prefabricated. Gangnail was mentioned as a good example of a composite system with standard nail-plate connectors. The focus group members pointed out that Australia doesn't have the same level of emphasis on timber connections design like in the US or Europe. The perception was that Europe (particularly Scandinavia and the UK) had much more skill in timber design and construction overall, with a lot of money being spent to develop complex yet cost effective connection details. Scotland is spending money to utilize spruce low-grade material via holistic prefabrication of walls with everything in it, including insulation and windows.

Availability

Difficulties in obtaining required sizes and grades of material led to a perception that timber merchants were reluctant to stock certain sizes if there were limited orders and that limited timber resources has led to quality being compromised in order to fill orders. This caused long lead times and increased costs for designers and specifiers. This contrasts with ready availability of steel in standard sizes and grades.

"less around and (the) quality is not as good"

"can't always get certain sizes locally"

"Merchants won't advertise if they can't meet orders"

"It is available but it's not readily available"

"Long lead times if you're not using laminated beams"

"Unless you design using bits of timber that are very simple and easily obtainable ….you've got a problem"

Negative perceptions regarding performance

Practitioners and specifiers are confused regarding what timber can and cannot do. Common misconceptions include (1) timber spanning abilities; (2) suitability for use in swimming pools due to the humid environment, and the effect of chlorination on glued joints; (3) long-term deflection; and (4) durability. Timber was regarded by many as incapable of being engineered into long spans (20+ metres), despite there being a number of recent examples of longer-spanning timber buildings. Specifiers do not have access to information quantifying durability and deflection performance for different species, making them hesitant to specify timber.

"Stainless steel has failed in swimming pool environments…ideal application for glulam"

"swimming pool structures might not be suitable due to humidity and water. Although wood might be more breathable….get rid of wet damp smell"

"timber has good durability…wise in swimming pools and other hostile environments"

"timber is variable"

"But does humidity affect the veneers?" (swimming pools)

"Timber is very volatile, it moves and dries out in a structure"

Commercial risk

One of the main reasons for lack of confidence in timber as a building material in non-residential construction is due to perceived (and actual) commercial risk. The major risks perceived include (1) fire, (2) insurance, (3) ability to obtain tenant given maintenance requirements, (4) long-term termite resistance, and (5) the difficulty of finding qualified people in timber building design and construction.

The perception of a fire risk indicates that the message regarding timber's structural integrity in fires is not reaching this market segment. The perception may be due to higher insurance premiums, and in some cases inability to gain consent or insurance, for timber buildings. One insurer indicated that a timber building worth $3 million would be the threshold beyond which insurers would be nervous, as they would need to get reinsurance, and underwriting, which would be 'tough'.

" need to publicise successes - the fire engineering success"
"TRADA built an 8-storey building then set fire to it – this proved it worked"
"In NZ in certain applications you can get better insurance premiums if you use timber. …. not in Australia, even when the same underwriter is used."
"Combustibility ratings is an issue "
"Can rarely insure a timber hotel or restaurant due to the number of fires that have occurred."
"You can't use timber 'cos it'll burn down"
"being creative also means taking bigger and potentially costly risks"
"you couldn't let it out to a restaurant as they'd find it difficult to get insurance"

There was also the risk of the 'unknown'. Timber has not proven itself to designers and specifiers as an option for consideration as there are currently very few timber buildings. For developers, on-selling was a perceived risk, as buyers want to know that the whole-of-life issues – fire rating, maintenance, etc. – have been taken care of.

"What's the building going to be like in 10 years?"
"It's a long term problem ….won't know till 10-15 years down the track whether something works"
"New chemicals often need retreating…maintenance, inspections "
"The lack of predictability…people get nervous"
"What ongoing maintenance needs are required? What do I have to do to it?"

Lack of assistance/ timber advice

A lack of information and education typically created problems for engineers, architects and designers. It was felt that the required information was 'out there somewhere' but the source of reliable and comprehensive knowledge was unknown. Universities were seen as a good starting point, however, the knowledge base was diminishing. The lack of a 'one-stop-shop' which included design aids and software tools was frustrating for designers. The need for engineers to rely on first principles was time-consuming and demanding, especially as many timber buildings were 'one-off's'.

There was a strong demand for wood product manufacturers to provide reliable engineering calculations for their products, and a sense that the industry should work towards a package of standardised design details and span tables, preferably as a software design aid. One idea raised was that the timber industry could sponsor a hotline to a knowledgeable timber engineer, who could talk through the holistic design rather than just answer an isolated query.

“Availability of assistance if you want to do something a bit different – who can you contact?”

“University is a big influence at the moment. Get quite good timber knowledge at Queensland Uni.”

“Commercial frame analysis software (e.g. SpaceGass) doesn’t have timber hardwired into it, although it has steel and concrete. You need to punch in your own numbers for timber”.

“give anecdotal evidence, but you need to make a call and you carry the can – you therefore need good firm advice you can trust.”

“if an owner knocks back the idea specifiers don’t have time to re-educate themselves to sell the concept to the client.”

“Need someone to work alongside you – can ring an engineer, but nice to have someone available to help with the holistic design”

“timber is time consuming…availability of information…quality…is an issue”

“an engineer wanted to know if they could do a curved LVL beam and treat it. Couldn’t get an answer so went to steel.”

“You can’t have a room full of industry professionals like this and have everyone say they struggle to find the information they need in using timber.”

“Hard to get full acoustic data on timber”

“ if someone for free could come and help you sort out the barriers ….if a project is over a certain value ($1 million), they’ll provide some free help.”

“Hard to get one point of contact for questions like “can I source material from a particular forest?””

“Points of contact? Who can I go to?”

“only look it up when you need it”

“ would be good if you could ring up your “timber consultant” for help, who’s someone who knows about architecture”

Inadequate tertiary education in timber

The lack of teaching on timber engineering at Australian universities was seen as a core reason for timber not being used in larger projects. Australia is perceived to lack the depth of timber research of other nations such as NZ, Scandinavia, UK, USA, and Europe. This limited emphasis on timber in engineering and architectural teaching is mainly due to the lack of skilled lecturers. Australian universities realise the need for these skills, but believe they should be addressed by the timber industry. Past industry efforts, however, have been less than fruitful.

One participant mentioned Geoff Boughton’s difficulty in finding suitable personnel to teach in the universities for the FWPRDC education program. Universities work on ‘economic grapple-points’ and the effort requires a person with passion and support from industry to make this work. If trained timber engineers were to emerge, they would require timber-based projects to 'cut their teeth' on, and these are few and far between at present. Examples are:

- The National Maritime Museum built during the 1980's was initially designed in steel, however, due to timber industry lobbying timber designs were considered. Three timber proposals were submitted, but no one could be found to build them.
- The Sydney Dome was perceived to have lost out to a steel structure due to the lack of adequate workforce in timber fabrication, and the misinterpretation of the engineering design details.

"Geoff went out to universities to get some champions, but these people are retiring and no one's replacing them"

"Nobody around with skills to build in timber. But even if there was, there's no work."

"Less education in timber at university."

"People aren't educated how to detail properly. Leads to weathering and durability problems"

"Until it's the norm it'll always be a specialist area."

Reluctance due to lack of training

Many structural engineers expressed their inexperience in engineering with timber. This was attributed to the emphasis on steel and concrete structures in their university education. Architects interpreted this as an 'engineering reluctance' to work with timber, even when timber was requested, stating that engineers were 'lazy' and 'unwilling' to work with timber as it 'took longer'. Engineer's also expressed the view that for non-residential construction timber was not the 'done thing' and that it was not an 'appropriate' material choice in many cases.

"We had projects at uni where you had to detail concrete and steel structures ….but never had that opportunity with wood."

"engineers are reluctant to work with timber because it takes longer"

"Timber work often takes you back to first principles in design – you often can't overlay what you have done in other projects."

"There is a lack of engineering expertise and willingness (in wood)"

"engineers don't like heavy timber structures … need for self-education"

"engineers don't like using it"

"Engineers are typically lazy – it takes longer for them to work out the design of a truss using timber than it does for steel."

"All too hard".

"timber is more thought of with domestic structures and not commercial"

"Haven't been into it and didn't think that it (ie structural timber) was 'the done thing'"

"building surveying course didn't have much timber"

Developers and architects did not express a predisposition against timber, in many cases stressing that they would like to see more timber used and made available. However, developers expressed clearly that the ultimate decision on materials use was usually left to the engineers or contractors. At the very least, developers would rely heavily on the engineer's opinions. This suggests that the decisions against the use of timber in the design are ultimately coming from the structural engineer. Specialist engineers and designers however crave the opportunity to undertake timber-based construction but currently lack information and education to know where to start, and face resistance from parties unskilled in timber construction.
Certainly the developers and architects did not have any predisposition against timber, in many cases stressing that they would like to see more timber used and made available.

> *"The scale of project, function, need for flexibility, location, availability of material and labour"*
>
> *"It comes down to the 4 F's: form, function, finance, fashion"*
>
> *"When working, everything is influenced by where you work, who with, and the sorts of projects you work on. Product selection depends on the context of job"*

There also appears to be a discrepancy between designed/specified products, and those used in the final design, due to decisions made by builders and contractors. This occurs when builders and contractors are able to make time or cost savings from materials substitution.

> *"On-site – even if you specify a product the subbie or builder often wants to change it"*
>
> *"Builders will build what they're told to, but will speak up if there's a competitive edge by using a better product that'll do something quicker or cheaper"*

'One size fits all' sustainability messages

Wood sustainability was seen as a mixed-bag by the designers. Specifiers agreed that ecology and sustainability issues are becoming increasingly important in designers' minds, but the key drivers remain — cost, availability and performance. The performance issues in particular need to be addressed first before the sustainability messages are to be fully believed.

A common perception was that timber in general was being labelled 'sustainable' by the industry, whether it required treatment or not, had glues present, or was from old growth or plantation timber. There is a very distinct difference in the specifiers' mind about the sustainability of these various products, and branding all as 'sustainable', due to the base wood material source, was seen as naive. Wood marketing therefore requires segmentation of different products and their sustainability benefits.

"Sustainability of resource ….old growth forests and imported rainforest timbers from ….Malaysia"

"Plantation timber is OK, but it needs better marketing"

"There have been instances with public buildings …. required to use timber for environmental reasons"

"In middle Europe there is concern over preservatives so they don't treat timber, but they detail for durability"

"If timber showed it was more sustainable… gave sustainability kudos then it would be good"

"LVL….the glue is bad… needs treatment for outdoor use. So you can't just talk about timber in general"

"Timber industry is famous for seeking the most cost effective solutions"

"Timber has had problems in recent years because they can't supply what they say they will"

"Couldn't deliver what it promised"

Poor marketing

Timber has suffered from the vast majority of marketing being geared to the residential sector. In contrast, concrete is seen as being imaginatively and creatively marketed. Timber marketing also appears all-encompassing, with a single message for every design professional. Marketing needs to be focused on at least three groups – architects and designers (who are seeking a more holistic and application-based message); the general public and developers/ owners (who need to be persuaded of the benefits); and builders and engineers (who want specific, technical information, particularly regarding performance and detailing).

"Timber industry tends to preach to timber people – need to preach to the masses"

"Information is overwhelming and the ability to apply it is limiting"

"Timber has less thought in the way benefits are marketed"

"lots of individual literature from each company where you don't know if they're just promoting their own products or if there are actual important differences"

"Lack of promotion and readily available info for non-residential building systems

"No use relying on industry associations – the companies need to get into the market themselves"

Discussion Forum

Feedback from architects during the discussion forum verified that commercial risk was an important issue, and that this was coming from clients, rather than the architect. Specifiers verified that there was little tertiary training in timber engineering. A tertiary curriculum available for University and TAFE is apparently getting little use at present. The discussion forum also focussed on the feeling that environmentally sustainable design is becoming a marketing edge for designers, as well as becoming a requirement due to legislation.

5.3 Positive and negative attributes of structural timber

A range of strengths and weaknesses relating to the structural application of timber for non-residential purposes were highlighted (Appendix 1). Negative structural aspects concerned performance, cost, and speed of erection. These confirm that specifiers have reservations about the use of timber in high-performance applications. Positive aspects related to

- Natural timber aesthetics, especially when used in exposed structures
- Easy construction and adaptability of design
- Personality and warmth
- Fire performance – keeps structural integrity
- Embodied energy
- Requires less heavy equipment to erect

5.4 Most promising non-residential opportunities

Specifiers indicated that timber would work better in buildings where there was a link to human growth and development, or community spirit, so that timber could be enjoyed (Appendix 2). These building types included residential care facilities, educational buildings, community and public buildings, and small stand-alone offices and clinics. The architects also noted that the more promising applications were smaller buildings - churches, clinics, community halls. This is where the industry should concentrate first, before targeting larger, multi-storey buildings such as warehouses and office blocks. It was noted that there is a large difference between Type A and Type C buildings in the Building Code of Australia, especially regarding fire issues.

5.5 Promotional and product development

A number of promotional and product development initiatives were suggested by specifiers (Appendix 3). The following opportunities were selected and presented to the discussion forum as promotional initiatives:

- Easily available performance data via searchable databases, and technical brochures
- A consolidated marketing message from industry member, with a common message or logo/slogan on all individual timber industry company product literature
- A 'one-stop-shop' web portal, hotline phone, construction guide(s) and software package for non-residential timber design
- Non-residential timber design case studies
- Technical brochures addressing whole-of life and commercial risk perceptions
- Promoting timber as ideal for 'small buildings' rather than for 'residential'

There was a suggestion during the discussion forum that the promising applications should also include small scale retail (shopping centres) and 'one-off' designs. Most architects use a variety of informational sources, both hard and soft-copy, but do not want to be targeted with 'Spam' unsolicited approaches directly from industry. Rather, industry needs to get information to architects via list databases such as Selector, or internet centralised portals. A collective marketing message was viewed positively, but the message needs to be focussed on key technical issues and specific sectors. Industry-based detailing manuals and CD's that focus on product type, e.g. I-beams, rather than individual proprietary systems would also be useful.

6 RECOMMENDATIONS

From the discussion forum, three main strategies arose to address specifier lack of confidence in timber, and increase the use of timber in non-residential building projects:

1) Address negative perceptions of timber performance and appropriateness in non-residential applications, focussing on issues with perceived commercial risk
2) Use environmental assessment data to highlight the sustainable benefits of using timber in place of other competing materials, to gain a pull through from the market and increase the desire to specify with timber.
3) Make timber design and technical information readily available to specifiers in a format they find useful and useable.

The following six priority promotional initiatives are recommended to implement these strategies:

1) **Technical brochures and fact sheets to address negative perceptions, particularly relating to perceived commercial risks.** Initially these should target issues relating to fire risk; building maintenance; and erectability of timber structures for non-residential applications. Specific messages could include
    - Demonstration of the fire safety benefits associated with timber structures
    - Demonstrating the cost competitiveness of timber compared with steel and concrete
    - Providing data relating to termite issues, timber treatment, durability, and structural loading and spanning ability
    - Giving instances and examples of successful, timely and cost effective project management and construction in a non-residential timber building. Australia could also showcase and encourage the use of European systems of project management for larger timber buildings, giving examples of how the construction and erection of these buildings works on-site. Stating HOW the assembly of the building was achieved is a critical aspect of these examples.
    - Make available a booklet of timber costings from previous timber structural designs to quantity surveyors, developers, and insurers, perhaps in a folder set.

2) **Case study publications.** In the use of case studies, the need for a middle-ground between pictorial and technical is required. Specifier design magazines should be used, approaching the editor to produce a special issue on timber. Many of the timber architecture design award entries would be suitable to be published annually in a book as they have both the pictorial and the technical requirements. The design awards could be expanded to include engineering. It should be ensured that the designs meet building code requirements, and have correct timber specifications that are suitable for the envisaged application/ climate. The range of initiatives include:
    - Packaging design award entries (both those that won along with those that did not win) into a yearly booklet/publication for dissemination to specifiers. Additionally, a range of entries could be placed on a website with a search function by type of building.

- Development of a ‘sustainable timber building’ award as one of the design awards
- Showcasing demonstrations of where steel beams and high-tech structures are usually would, but timber products have been used instead, outlining the added benefits from using timber in place of more conventional materials.
- Promote manufacturers and structural engineers who regularly use or provide large timber structural members (especially beam producers) as ‘timber specialist companies’. Showcase examples of how their products have been used in the design of non-residential projects, and interview the specifiers to outline their experience in designing with timber in the project. If a positive testimonial is given, they could be used in further marketing and promotional literature targeted to other specifiers.
- Encourage design collaboration between timber specifier companies
- Showcase the use of timber alongside conventional and ‘hightech’ materials so that timber is viewed as another ‘high-tech, contemporary, and stylish material’.
- Ensure that there are case study examples and publications showcasing both the simple, everyday offices and clinics, as well as examples of unusual or striking designs. These examples should particularly focus on smaller buildings, and possibly be segmented for different building types, such as: Religious; Care facilities; Public/community facilities; Office and retail; Schools.

3) **Design aids for timber building structural analysis**. Structural engineers currently use structural analysis software packages with inbuilt steel and concrete design aids to determine loading and spans for structural members.
   - A software component for timber design could comprise either an add-on to an existing, well-used structural analysis package, or a full timber design version. The former is preferable, and may be a stepping stone to the development of a modular, dedicated timber-based design aid.
   - A timber design and construction handbook, dealing with both engineering and construction/ assembly requirements onsite, would be very useful, and address the issues surrounding detailing, fabrication and construct ability of timber. The handbook ought to be system specific rather than proprietary product specific, and outline manufacturing aspects, connection details, and building techniques for various timber structural members. The handbook could also be a useful tool for undergraduate engineering studies.
   - Ensure data is readily available on different design and specification applications, along with information on possible sources and timber types.
   - Outline European connection details and construction techniques for large timber members, giving examples of where these have been used in practice.

4) **Develop a market for ‘green’ buildings using structural timber**. Get timber specified on sustainability merits. This will address the negative aspects of timber in terms of plantation versus natural forests; glues; resins; and durability issues.
   - Use the Greenstar and Ecospecifier programs currently available to architects to get timber listed as sustainable, and specifiers made aware of the green attributes, and the various range of timber products and systems available. Individual manufacturers should ensure their products

are listed in packages such as Greenstar and Ecospecifier (and BASIX, which is being superseded by AccuRate).

- There is a need to prove chain of custody and certification to provide specifiers with good documentation showing reafforestation on harvested areas, and figures for supply and regrowth of various forested areas and species.
- Undertake life cycle analysis (LCA) studies to assess the benefits of using timber compared to steel and concrete. These should not be done in isolation in terms of individual products; but whole building case studies on actual constructed projects showing the environmental impact if the building had been built using some (or a majority of) timber structural components.
- Conversely, use LCA case studies of actual timber buildings to show the negative environmental effects if the building had been constructed from steel or concrete structural components.
- Indicate how timber can work together with steel and concrete structural elements to reduce these environmental impacts and gain higher environmental performance and energy star ratings for a building. These messages should demonstrate that the timber industry recognises the positive design characteristics of other materials, but gives the message of enhancing sustainability overall through increased timber use.
- Develop and promote hybrid steel and timber or concrete and timber structural systems, as greener high-performance structural members.

5) **Create a 'one-stop-shop' information centre for specifiers looking for timber design information.** An easily searchable database of information, as a portal to manufacturer sites. The portal needs to have different doors for architects, engineers, surveyors and developers. The emphasis should be on enabling elimination of unwanted materials quickly, to avoid information overload, or they will simply Google™ for the information needed, instead of using the portal.
    - Portal should provide doorways to:
        - Manufacturer sites
        - Design aids and handbooks
        - Product technical sheets
        - Environmental data
        - Advice/ helpline
    - Ensure specifier involvement in the development of such a web-based portal.
    - Establish an Association or Society for timber design professionals, supported by industry. Use this member group to advocate timber design to other specifiers via Royal Australian Institute of Architects (RAIA) and other specifier professional body meetings.
    - Provide forums whereby specifiers and designers using timber can meet and exchange ideas
    - Specifiers view the Timber Development Association (TDA) as a key industry group that ought to be the central advocate for timber use and advice. However, Timber Queensland and other industry groups are also seen providing this function. There is a need for a national, centralised umbrella group to co-ordinate messages to specifiers, or else the need to establish one Association as the primary voice to specifiers.

6) Product development focal points for non-residential market

- Connection details are key. Investigate whether European connection details can be incorporated into Australian building practice under current product standards.
- Establish novel fixing mechanisms for faster construction and more interesting visual appeal.
- Focus on the development of hybrid systems between timber and steel such as PosiStrut, especially if these systems can use standard steel connectors.
- Develop enhanced exterior coatings, stains and treatments that will reduce the long-term maintenance requirements of exposed timber components in commercial building applications.

APPENDICES

Appendix 1: POSITIVE AND NEGATIVE ATTRIBUTES OF TIMBER

Appendix 2: MOST PROMISING TIMBER BUILDING APPLICATIONS

Appendix 3: PRODUCT DEVELOPMENT AND PROMOTIONAL INITIATIVES

Appendix 4: SUGGESTED FUTURE PRIORITIES FOR INCREASING MARKET DEMAND

Appendix 1: POSITIVE AND NEGATIVE ATTRIBUTES OF TIMBER

Timber Product Features	Positive attributes	Negative attributes
Form	• Uniqueness, character, and range of styles • Aesthetic appeal, warmth, look, earthy • Link with nature	• Hard to source required timber, little specifications, numerous grades and styles • Timber seen as for low-quality 'matchstick' housing forms
Function	• Durability, adaptability, lightweight • Flexibility (easy to work with on-site…e.g. cut to length) • Easy to erect if well-planned • Strength to weight ratio • Excellent as a secondary construction material – for infilling and non-load-bearing walls.	• Perceived limitation in its application, loading and lifespan compared to concrete and steel, difficulty in connections • Concerns about product requiring greater on-going wear and tear maintenance (e.g. external treatments, termites etc.) • Slower to erect • Less durable, risk of termites, decay and fire. • Less thermal mass and acoustic ability than concrete
Finance/cost	• Competitive cost (when user is competent with its application and can appreciate end product quality offered) • Steel prefabrication time can put engineered wood products at an advantage • Timber frame is an easy construction type in complicated/ complex situations where tolerancing is crucial (where there are tricky angles and small spaces)	• Expensive, high time cost to construct…and even in overcoming resistance of product from other parties • Commercial risk from lack of fabricators/ people who can erect timber buildings • Larger beam sizes
Fashion	• Prestige, boutique nature, niche market appeal, ability to value add to a structure and complement its personality • Looks good when exposed as a feature	• Easily supplemented by a lower cost option that has proven itself over many years • Timber construction perceived as a 'craft' – not a serious structural material • Pine not seen as attractive, and limited supply of

		hardwoods
Other	• Ability to reclaim structure post fire damage • High energy rating • Can easily cut wood, so can fix mistakes/ tolerances easily. Easy to adjust on site. • Pine glulam a good substitute for hardwoods • Requires less heavy equipment to erect with timber – good for OSH issues onsite	• Lack of costing/fee structure • Variable availability and access to product and skilled users • Noise buffering ability • Perceived lack of fire safety • Speed of fabrication • Sustainability of the resource being used (deforestation and use of chemicals and glues) • Steel sections can be recycled but glulam offcuts cannot be – difficult to dispose of.

Appendix 2: MOST PROMISING TIMBER BUILDING APPLICATIONS

Worthy Applications	Poor Applications
CHURCHES AND RELIGIOUS BUILDINGS • Opportunity to expose timber • Often want a 'feature' building • Smaller sizes • Aesthetics • Human element*	**WAREHOUSES** • Cost • Spanning ability • Suits tilt-slab and steel very well – hard to compete • Heavily dependent on a quick erection time • Cost driven
COMMUNITY CENTRES • Not so dollar driven as more commercial buildings • Often want a 'feature' building • Libraries also • 'Show-case' buildings	**INDUSTRIAL** • Well suited to concrete and steel • Large open spans needed • Cost is critical • More risk of fire (factories etc.)
SINGLE-STOREY INSTITUTIONAL BUILDINGS • Such as nursing homes and aged-care facilities • Usually large-footprint buildings, with multiple small rooms – so lots of non-loadbearing partitions • Country hospitals ideal as there is not as much of a restriction on land-use footprint as in suburban environments • Easy to frame up if there are lots of angles and bay windows • Human element*	**COMMERICIAL HIGH-RISE (6-8 storeys)** • Business/ financial image suits glass, steel and concrete image • Architects drive through the 'sparkle' factor – want clean lines and glossy finishes • Need to fit in with other inner-city buildings
COMMERCIAL OFFICE • 2-4 storey office buildings, with retail below • Have been done to good effect in the UK	**HOTELS AND RESTAURANTS** • Fire insurance premiums
COMMERCIAL SERVICE • Commercial buildings which service the public • Medical centres and vet clinics ideal • Human element* • Need to ensure these are made aesthetically into places that people enjoy – banks etc. might not be a good application • Usually 3-4 storey maximum	**SPEC BUILDINGS** • Large commercial risk in doing an 'unusual' timber building, especially in being able to on-sell and tenant it.

SCHOOLS • Usually low-rise • Need for flexible, relocatable modules • Short spans • Easy to modify, remove walls etc. later • Better for chemical laboratories and photography suites than steel and concrete- chemicals • Human Element*	
SWIMMING POOLS • Hostile environment • Chlorination issues • Many examples already that use glulam portal frame	

Appendix 3: PRODUCT DEVELOPMENT AND PROMOTIONAL INITIATIVES

Promotional	Product Development
• Education of actual wood properties • Look at how wood was promoted in Architecture of 1950's and 1960's – how did timber get to be fashionable and modern then? • Joint promotional efforts between manufacturers – a timber industry stand at trade shows • International benchmarking – how is timber promoted internationally, what is working? • Promote fire resistance of timber • Emphasise aesthetics of portal frames, as there are only marginal cost differences with steel, often • Need to create demand, and then industry can supply it • Price timber components 10% lower if they are used in buildings over a certain $ value. (Apparently this was done effectively by steel industry in 1970's) • Advertising exposure showing holistic solutions (architecture) followed up by trade show presence in how to assemble and erect (builders) • Need for segmentation of information. 3-prong segmentation of technical information (same information put out in three different ways): 1. Architect and designer 2. Public and developers 3. Builder/ engineer • More design and sustainability awards • Cost comparison case studies would be good. • Timber needs to reinvent itself in the same way BHP has. • MGP example – when that came out it was advertised, so you'd specify it and ring the merchant and they'd say "never heard of it". But Pine Australia spent a lot of money on this. • Promote at national engineering associations, meetings etc. • "You wouldn't know the TDA are there" • Promote to city councils on basis of ESD. Thousands of people will see them.	• Effective clear coatings for exterior finishes Architects are key – they come up with lots of innovative system ideas • Product development e.g. composites. Timber hasn't moved forward as much as other materials. • Penetration through solid beams for services – compromise strength. • In the UK there are software packages for holes through steel. Timber could develop similar software (glulam has done it in the UK). • Future for off-site prefabrication – have to go that way as apprentices aren't properly trained. • Timber and another product for fire-rated walls. Currently used in residential (timber/gyprock). Eliminates bricklayers on site. • Prefab walls that meet sound or fire ratings. • Product development could be walling systems e.g. concrete/timber walls. • Spend millions of dollars in multi-residential on fire. • Sound / acoustic transmission through floors is a problem for timber. • One timber construction guide and software – not lots of individual literature from each company • a database of products so you can see the companies that make the same products. • Termite protection • Composite use (e.g. Posistrut) where you can get away from some of the problems of connections.

Appendix 4: SUGGESTED FUTURE PRIORITIES FOR INCREASING MARKET DEMAND

Focus group attendees suggested a number of actions for the timber industry to consider for the future. These have been summarised below by IPSOS.

- **Build public and industry awareness of timber applications, benefits and aesthetic appeal**
  - Reinforce the positives of timber (e.g. flexibility, different styles, weight, re-useable, aesthetic strength).
  - Address negative perceptions attached to timber (e.g. cost, availability, lifespan, termite issues and safety etc.).
  - Demonstrate fire safety benefits associated with timber
  - Create the situation where the client will come to the designer and generate the projects.
  - Learn from steel industry and development programs to educate engineers, architects and the general public about the genuine benefits of using timber. *Example: Carter Holt Harvey Newsletter showing commercial buildings with timber applications and client perspective.*
- **Fully utilise overseas technologies available**
  - Investigate available European technology and its use in Australian industries.
  - Lobby investment in timber industry R&D.
  - Encourage the use of European systems of project management for timber projects.
  - Promote overseas timber 'showcase' projects using the latest technology
- **Distribute design and cost examples of timber applications throughout the industry**
  - Ensure data is readily available on different design and specification applications, along with information on possible sources and timber types.
  - Develop design examples and demonstration of the cost competitiveness of timber i.e. compared to the cost of steel
    - *Example: develop data similar to American Industry (ABA) costings/data relating to timber floors vs. concrete floors, timber frame vs. solid brick.*
- **Adopt a concerted effort in developing target markets for timber**
  - Encourage development of 'Landmark' and 'boutique' timber construction. These projects should encompass the true strengths of timber (durability, visual appeal and functionality).
  - Help businesses explore the benefits of timber applications in developing markets.
  - Look outside typical industry to expand audience for timber application (designers, clients and architects).
  - Develop pull through of timber from client side e.g. provide a carrot through 'sustainability awards' or positive media attention with timber use.
  - Develop a marketing campaign with examples of timber applications and designs.
  - Demonstrate the ability to substitute steel and high tech structures with timber.
  - Encourage industry companies to build their own buildings using timber (similar to Carter Holt Harvey LVL mill in New Zealand).

    - Sponsor innovative development projects to help fill the short-term gap in cost (similar initiatives have been done in the brick and the steel industry with major inner city projects).
- **Take a more proactive stance on political issues**
    - Take control of the political issues surrounding environmental impact, costs of timber production and structure safety.
    - Place own 'spin' on the issues to plantation timber from Australia and overseas. This is likely to have a significant impact on the success of any marketing initiatives.
        - *Example: Promote the actual environmental costs of timber applications relative to other building materials and lobby for lower insurance premiums for timber structures.*
- **Facilitate improved education of non-residential structural applications of timber**
    - Ensure timber takes a higher priority in tertiary and post-graduate education programs and related materials.
    - Greater involvement in wider industry events e.g. sponsor architectural and designer prizes surrounding best use of structural timber.
    - Establish project based demonstrations of applications to build publicity and knowledge.
    - Develop integrated information (software) packages on the extent of the timber product offering for easy reference by professionals…e.g. a 'one-stop-shop' for timber information…handbooks for builders was also suggested.
    - Provide better/more advice on how to deal with termite issues, treat timber for greater durability, access product etc.

IPSOS Recommendations

Based on the focus group feedback, we recommend the following course of action:

- **Further engage industry stakeholders**
    - Continue to draw on experiences of industry professionals relating to application of timber domestically and overseas to help assess and brainstorm potential development concepts and ideas. Develop case studies of successful project management
    - Engage international and domestic experts to help fill the current knowledge gaps in the innovative application of timber in non-residential projects.
- **Facilitate the development of specialist skills in timber construction amongst industry professionals.**
        - *Examples may include:*
            - *Assisting the development of 'timber specialist companies' who help in showcasing 'benchmark' constructions. Similarly, encourage design and company alliances.*
            - *Facilitate the development of specialist training courses in non-residential timber construction matching the current capabilities and limitations of Australian timber manufacturing technology.*
- **Undertake a number of initiatives that will reduce the possible 'transaction cost' when considering using timber in a non-residential application. The ability to firmly and quickly establish costs and speed up the project processes will aid timber uptake. Specific to this:**
    - Improved availability of industry data and benchmark costing.

    - Develop an industry help line or make available an industry consultant for readily available advice on timber based constructions.
    - Communicate to industry professionals via a mixture of mediums including face-to-face, written media and electronic.
- **Look to reposition the timber industry and its product offer to capture greater market appeal and ensure an ongoing sustained presence against competing materials.**

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