Beneath the Veneer

Developing Resilience in the Australian Prefabrication Supply Chain

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Developing Resilience in the Australian Prefabrication Supply Chain

This presentation explores both current and emerging prefabrication systems in Australia with an emphasis on developing a mature, broad based and resilient supply chain.

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Presentation Overview

- **Defining Prefabrication … & Then De-Risking it**
- **What is Resilience & Why Do We Need It?**
- **But Why Timber?**
- **Current & Emerging Timber Prefabrication Supply in Australia**

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Presentation Overview

- **Defining** Prefabrication … & Then De-Risking it
- **What** is Resilience & Why Do We Need It?
- **But is** Timber important in this discussion?
- **Current & Emerging** Timber Prefabrication Supply in Australia

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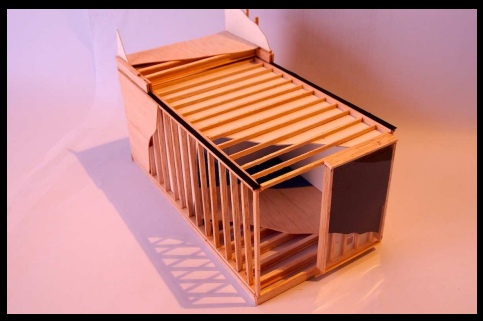
Defining Prefabrication

'The design and off-site manufacture of a *project specific* component, assembly or system that is utilized in part or as a whole, to build a structure.'



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Prefabrication can be defined as:

'The design and *off-site* manufacture of a *project specific* component, assembly or system that is utilised in part or as a whole, to build a structure.'

This means that the nominated prefabrication methodology must be considered and used to inform the project's development *at the design stage.*

The manufacture of components, and an assembly of components or a building system must be off site or adjunct to the site

The prefabricated element or component must be 'project specific'.

Commodity elements such as bricks, sawn timber and concrete, whilst manufactured off site, do not constitute prefabrication unless they have been manufactured as bespoke elements for a given or distinct project.

What about Resilience in Prefabrication & Why Do We Need It?

Resilience a*s a noun can mean:*

1. suppleness, give, spring, flexibility, elasticity, plasticity, pliability, springiness
2. strength, toughness, adaptability, hardiness

Why is this important in the context of Prefabrication?
The prefabrication sector needs to develop resilience because, as an emerging sub-sector within an established construction industry, it faces a range of challenges that will test every facet of the building procurement process, from the developer, the insurer and the financier, to the designer and consultancy teams through to the prefabricators and the builder.

To address these challenges, emphasis needs to be placed on developing a mature, broad based and resilient supply chain. Without these attributes, prefabrication will remain at the fringe of the construction sector. Mainstream developers, financiers, designers and builders will remain nervous of its capacity to reliably deliver projects on time, on budget and in a sustainable manner.

For example, recent discussion between WoodSolutions and a range of finance institutions on perceptions of emerging timber prefabrication systems, raised an interesting yet telling issue.

The banks are looking for security, both in the investor's capacity to repay so as to avoid default, but more interestingly, in the broader prefabrication sectors capacity to step in and provide an alternative supply should the original supply agreement fail. This means that for a building utilising a prefabrication process to be funded, the industry needs to have multiple and readily available suppliers capable of absorbing additional orders. In other words, a bank might be hesitant to support a proposal that is reliant on a single source of a particular prefabricated technology.

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De-Risking Prefabrication

Risk in construction:

- Unanticipated costs
- Unexpected delays
- Functional unsuitability
- Systems breakdown

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Prefabrication itself, despite its promises of higher quality control, release from the vagaries of inclement weather, high degrees of process efficiency and reduction in waste, is not immune to areas of risk typically encountered within main stream construction such as:

Risk in construction:

- Unanticipated costs
- Unexpected delays
- Functional unsuitability
- Systems breakdown

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De-Risking Prefabrication

Remediation:

- Disruptive
- Expensive
- Time Consuming

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All of which require remediation. This can be:

- **Disruptive** to the building program
- **Expensive**. Remediation adds additional expense
- **Time consuming.** Trades who might move onto new work are required to revisit work already completed.

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De-Risking Prefabrication

The Traditional Remedy:

- Risk management processes
- No incentives to change
- Perpetuate less optimal solutions

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The Traditional Remedy:

- **Deliberate** and structured risk management processes - This sounds good, but an unintended by product can:
- **Remove** incentives to change an approach
- **Perpetuate** less than optimal solutions.

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De-Risking Prefabrication

Prefabrication:

- Faces resistance because…
- Impact of adverse effects are …
- Implicit lack of understanding & confidence

New methods of construction that utilise high degrees of prefabrication may face resistance to adoption as the potential **impact of adverse** events that they may cause is often given more weight than the potential *benefits* of favourable events.

This is based on an explicit sensitivity to risk by clients, architectural practitioners and partner professionals and **an implicit lack of understanding** and confidence in the delivery of an innovative prefabricated approach.

This resistance is the norm and results from real and imagined risks perceived at each stage of the building procurement process.

The level of this resistance at the key decision points in this process is critical.

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De-Risking Prefabrication

Innovation:

- If perceived risk is higher than perceived benefits

…innovation will be abandoned

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If the perceived risk of innovation is felt to be higher than its identifiable benefit at any point in the process, prefabrication and innovation will generally be abandoned.

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De-Risking Prefabrication

The Response:

- Consultants over specify
- Builders load tender prices

As novelty undermines confidence in the delivery of a prefabricated element or system, key participant caution is generated.

The standard consultant response to caution is ***over-specification*** while the standard builder response is **to *load the tender price***.

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How to Proceed?

- Collaborative engagement
- Educative phase
- Adjustment of the perceived risk/reward ratio
- Excessive discretionary tolerances
  - 1:1 Prototyping
  - Early contractor involvement
    - View
    - Cost
    - influence the prefabrication process

I propose that one method to proceed is through **collaborative engagement** between the prefabrication proponent and the design and construction team.

This is an **educative phase** where the prefabrication proponent introduces, trains and builds confidence in the design team, cost consultants and the risk managers in the delivery of their system and its benefits.

This allows all parties to adjust their **perceived risk/reward ratio**, or identify means of *reasonable* risk mitigation.

The first application of an innovative or new prefabricated system can involve **excess discretionary tolerances** until experience with the system generates confidence and increases efficiency. This can be done by:

- **1:1 Prototyping**

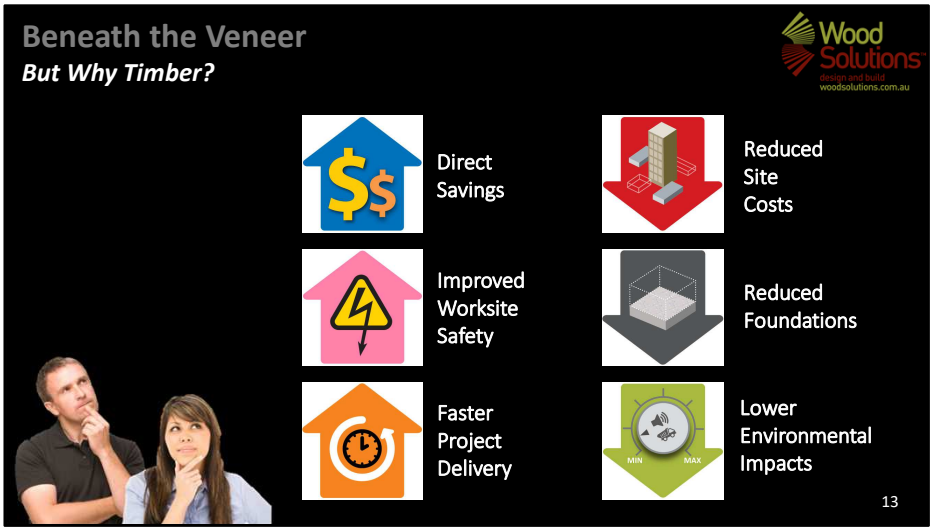
which will also allow

- **Early contractor involvement** where they can invite sub-contractor(s) to view, cost and even influence the prefabrication process

Australia's Current & Emerging Timber Prefabrication Supply Chain

There are now three distinct prefabricated timber systems that have emerging in Australia. These are:

- **Massive Timber Systems.** NCC Definition massive timber states that sections greater that 75mm x 75mm that are chemically bonded can be considered as 'massive timber. This is relevant to the new 'Fire-Protected Timber' provisions allowing structural timber to be used in mid-rise multi-residential hotels and offices. Typically these include
    - Cross Laminated Timber (CLT)
    - Larger section and panelised Laminated Veneer Lumber (LVL)
    - Glue Laminated Timber in heavy post and beam applications (GLT)
- **Lightweight Timber Systems**
    - Semi-closed or fully closed wall frames
    - Floor cassettes
    - Volumetric construction
- **Hybrid Timber Systems**
    - Timber concrete composites
    - Steel reinforced timber



Why should we use timber in Prefabrication?

- **Direct Savings** – Timber rich buildings can be more to economical to construct – Independently verified research by Forest Wood Products Australia, has indicated potential savings of between 4% and 10% over other building materials.
- **Improved worksite safety** – Building with wood creates a safer work environment – Timber construction sites are dry sites. Building with timber can reduce the amount of high-risk work. There is no burning of metals to fuse them together or worker exposure to the toxic chemicals contained in concrete.
- **Faster Project Delivery** – Timber buildings can be built faster and safer than steel or concrete. The 9 storey Forte building in Melbourne only took 2 tradesmen and two apprentices 3 months to install the timber super structure.
- **Reduced Site Costs** – Site costs can add up to 25% of a projects budget. Timber buildings can require less trades, less preliminaries on site, and combined with prefabrication, can eliminate the need for scaffold.
- **Reduced Foundations** – Foundations are expensive and time consuming to construct. A timber building will typically be 50% lighter than a concrete equivalent. This equates to significantly smaller footings which can save time and money.
- **Lower Environmental Impacts** – Building with man-made synthetic materials such as concrete and steel contributes up to 10% of the world green house gas emissions. When sourced responsibly, wood can play a significant part in helping tackle climate change as wood is a low carbon option for construction - when used in long-lived applications it stores carbon for the long-term. Timber is our only truly renewable building material and it has a significantly lower embodied energy than other building products.

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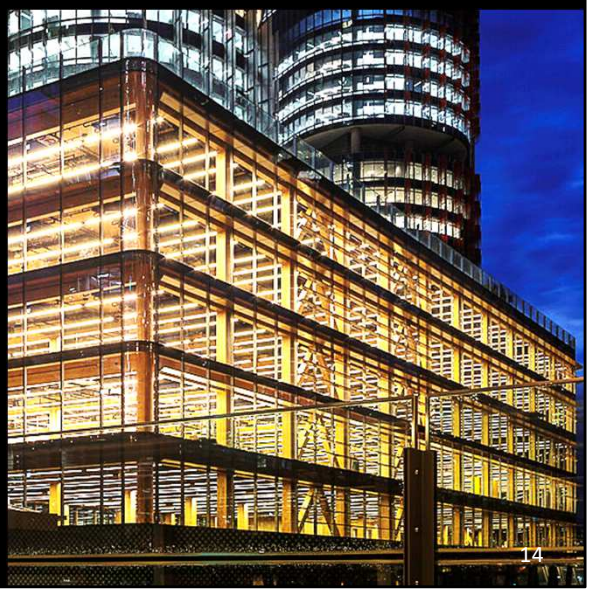
Emerging Prefabrication Systems in Use

Completed:

- Forte, Docklands Library and the Green (Melbourne)
- International House Sydney and Macarthur Gardens (Sydney)
- Verde Living (Adelaide)
- NRAS Inveresk apartments (Launceston)

Proposed:

- K5 (Brisbane)
- C1 (Sydney)
- 55 Southbank Boulevarde (Melbourne)



Capacity and demand for an increase in prefabrication is growing across Australia.

Key completed projects such as…

- Forte, Docklands Library and the Green in Melbourne
- International House Sydney and Macarthur Gardens in Sydney
- Verde Living in Adelaide
- NRAS Inveresk apartments in Launceston

…have paved the way by demonstrating the viability of both engineered timber systems and sophisticated prefabricated construction in the Australian context.

They have prepared the way for the next wave of large scale signature projects such as K5 in Brisbane and 55 Southbank Boulevard in Melbourne, both designed by Bates Smart and C1 in Sydney, designed by Tzannes Architects, and for the broader acceptance of both timber as a modern and capable building material and advanced prefabrication in mainstream construction.

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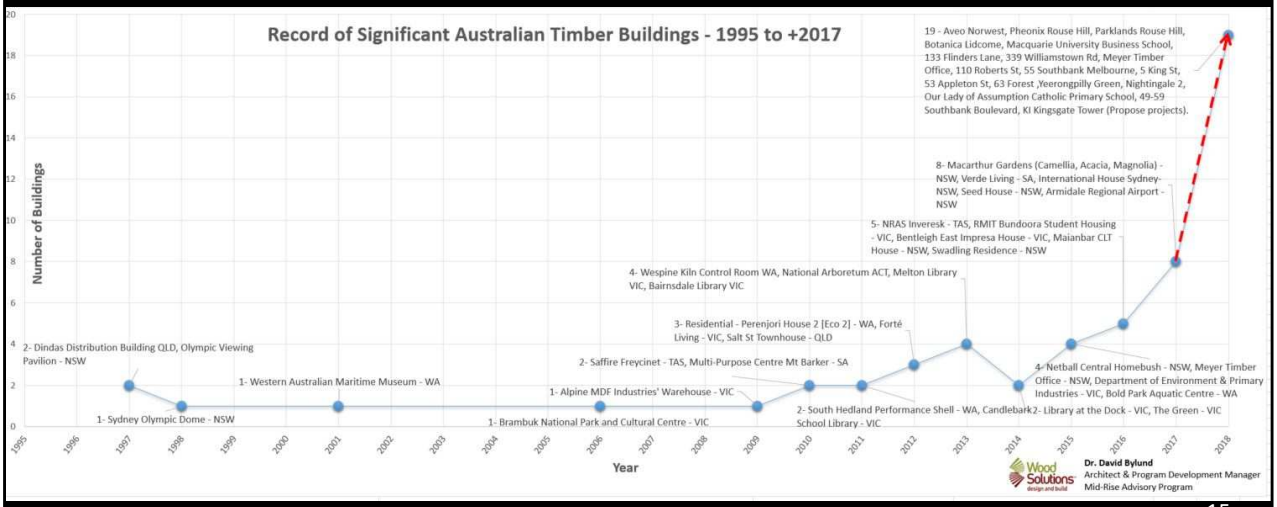
Significant Timber Building in Australia



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To further demonstrate this, this graph shows 20 years of significant timber buildings in Australia from the late 1990s to today – The trend is clearly increasing

Some of Australia's current prefabricated timber supply chain positioned to supply a range of Massive Timber Systems, Light Weight Timber Systems and Hybrid Timber Systems.

Note:
WoodSolutions does not endorse these companies.

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Three Key Take-out Messages

- Prefabrication is …
- Uncertainty remains -

  Prefabrication supply chain must develop
- Timber will be pivotal!

To conclude - Three key take-out messages:

- **Prefabrication is** the off-site fabrication of discrete building components for bespoke application in a building or structure
- **Uncertainty remains as to the suitability of prefabrication** in mainstream construction and as such, it is critical that a mature, broad based and resilient supply chain develop.
- **Timber *will* play** an important role in the both current and emerging prefabrication systems

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Thanks.

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