Trends in prefabricated timber building

Welcome and introduction

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Learning Objectives

- Participants completing this activity will be able to understand:
  - The scope for prefabrication in design and construction and factors that influence it.
  - Trends in timber prefabrication locally and internationally.

- For architects - AACA Competencies:
  - Design
  - Documentation
Seminar content

- An introduction to prefabrication.
  — Greg Nolan, CSAW
- Structural prefabrication trends in Australia
  — Phil Ladson, MultiNail
  
  Tea and coffee break

- Prefabrication trends internationally
  — Jon Shanks, CSAW
  — Karl Zankl,
    Wuerzburg University of Applied Sciences

This presentation

- Definition of prefabrication
- Scales of prefabrication
- Prefabrication’s key aspects
- Types of fabricators in Australia.

Vertical board cladding
Definition: prefabrication

• To manufacture sections or components of a building, usually in a factory or workshop, so that they can be easily transported to and rapidly assembled on site.

Scale of prefabricated sections

<table>
<thead>
<tr>
<th>Scale</th>
<th>Description</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>Buildings</td>
<td>A discrete enclosure.</td>
<td>Classroom</td>
</tr>
<tr>
<td>Components</td>
<td>Major sections of a building with common or similar performance requirements.</td>
<td>Floor, roof, wall façade.</td>
</tr>
<tr>
<td>Elements</td>
<td>The pieces assembled to make up a component.</td>
<td>Trusses in a roof, joists in a floor.</td>
</tr>
<tr>
<td>Detail</td>
<td>The pieces assembled to make up an element.</td>
<td>A window sash.</td>
</tr>
</tbody>
</table>

• There is often overlap, especially at the element and detail scale.
• A piece of sawn timber can be:
  – a joist in a floor (an element in a component) or
  – a part of a nail plate truss (a detail in an element).
**Component types**

<table>
<thead>
<tr>
<th>Component</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Superstructure</td>
<td>The primary load-bearing frame found in most buildings.</td>
</tr>
<tr>
<td>Roof</td>
<td>The roof and roof structure.</td>
</tr>
<tr>
<td>Upper floors</td>
<td>The upper floor surfaces and support structure.</td>
</tr>
<tr>
<td>Ground floor</td>
<td>The base floor and ground support structure.</td>
</tr>
<tr>
<td>External walls</td>
<td>The wall structure and associated cladding and external joinery such as doors and windows.</td>
</tr>
<tr>
<td>Internal fabric</td>
<td>Internal non load-bearing walls, linings, architectural surfaces, and internal joinery.</td>
</tr>
<tr>
<td>External elements</td>
<td>Verandas, decks and associated landscape structures.</td>
</tr>
</tbody>
</table>

- Components can be structural, architectural or envelope items.

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**Timber is a good base for prefabrication**

Timber systems offer solutions that:

- Are lighter, more adaptable and easier to handle than mass materials.
- Are a safer construction method
  - without the hardness, weight and danger of high mass materials.
- Are cleaner and create less site noise and waste.
- Offer savings in other areas of the structure and the foundations.
- Provide builders with an alternative to steel and concrete.

Courtesy of Herman Kaufman
Prefabrication moves work from:

- uncontrolled site conditions
- to controlled workshop conditions.

This can offer:

- Reduced exposure to risk:
  - adverse site conditions and
  - the demands of maintaining a skilled site workforce.
- Potential increases in building quality.
- Significant reduction in site construction times.
Key aspects of prefabrication

Moves detailed decision-making from construction to the design documentation stage.

• This can
  – Increase the volume, cost and criticality of documentation.
  – Decrease acceptable tolerances while increasing their importance.
  – Increase demand for skilled labour and efficient equipment in the workshop.

Key aspects of prefabrication

• It increases transportation costs.
  – Commodity products first have to be delivered to the workshop.
  – The items being transported to site are generally larger, more valuable and less robust than its constituent commodity products.
Prefabrication and site construction

Prefabrication *thrives* if:

- The savings from:
  - Lower risk.
  - More consistent quality (fewer costly mistakes).
  - Quicker building.

- Outweigh the costs of:
  - Additional documentation.
  - Workshop infrastructure and equipment.
  - More expensive transport.

Viable levels of prefabrication

A relationship exists between the viable prefabrication level and the project.

This is governed by:

- The conditions on the site.
  - The costs penalties incurred by access, climate, proximity of labour, etc.
- The regularity and volume of construction.
Viable levels of prefabrication

- The prefabrication company’s skill and equipment base.
- The potential to channel design information directly to production equipment.
  - This limits the additional cost of documentation and associated management.

High-level production capacity

Courtesy of Herman Kaufman
Types of fabricators in Australia

In Australia, there are three general types of timber product fabricators.

Types of fabricators

• Frame and truss manufacturers (F&T)
• Specialist structural fabricators
• Joiners
  – General
  – Window and door joinery
### Scope for prefabrication

<table>
<thead>
<tr>
<th>Element type</th>
<th>Australian</th>
<th>International</th>
</tr>
</thead>
<tbody>
<tr>
<td>Superstructure elements</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Envelope / fabric systems</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wall frames</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Roof and floor trusses and modules</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Flooring modules, such as cassette floors</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Structural insulated panels</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cross laminated timber panels</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Envelope elements &amp; components</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Window and door joinery</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Envelope systems</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Appearance elements</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Stairs and general joinery items</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Specialist joinery</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Timber construction & prefabrication

### More Information

Wood Solutions
design and build
Questions?

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