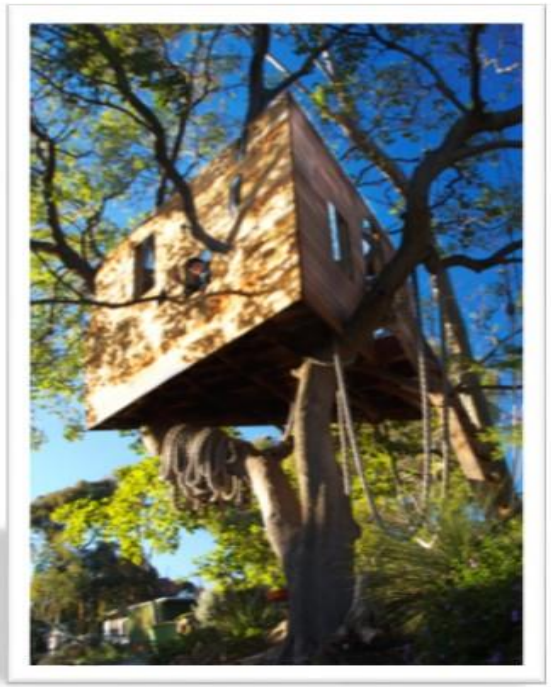


David Bylund
PhD - Architect

Australia and Sweden & Innovation in Wood

A webinar commissioned by:

Forest&Wood Products Australia
Knowledge for a sustainable Australia

PRESENTATION OVERVIEW

David - A Short Introduction

Understanding Sweden & Australia.
A brief look at some relevant similarities and differences

(Some) Swedish and Australian Timber Construction Typologies

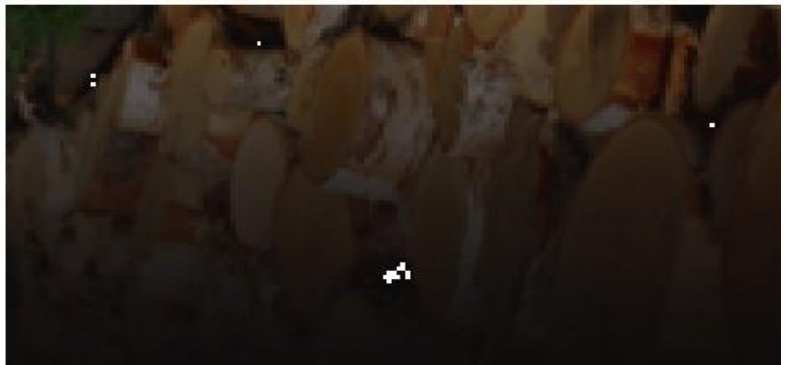
Sweden's Timber Construction Industry – Factors Influencing its growth

Five Swedish Case Studies

Two Swedish Innovative Engineered Timber Products

A Simple Engineered Laminated Timber Panel Developed in Australia

Key Findings from PhD



DAVID – A SHORT INTRODUCTION

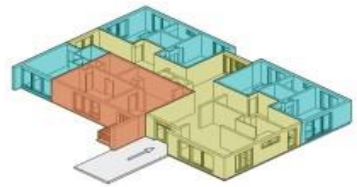
- 1998 - Completed a Bachelor of Architecture
- 2003 – Architects registration and private practice
- 2009 – 2014 – PhD and FWPA Postgraduate Research Scholarship

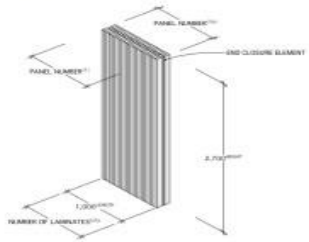
THE UNIVERSITY OF WESTERN AUSTRALIA
Achieving International Excellence

A Comparative Study of the Swedish and Australian Timber Construction Sectors

leading to…

The Development of a Prefabricated Parallel Timber Wall System





THE PHD RESEARCH QUESTION

The Question(s) the PhD looked at:

What lessons can the modern Swedish timber construction sector provide to assist Australia's timber producers to expand into modern, vertically integrated, off-site construction?

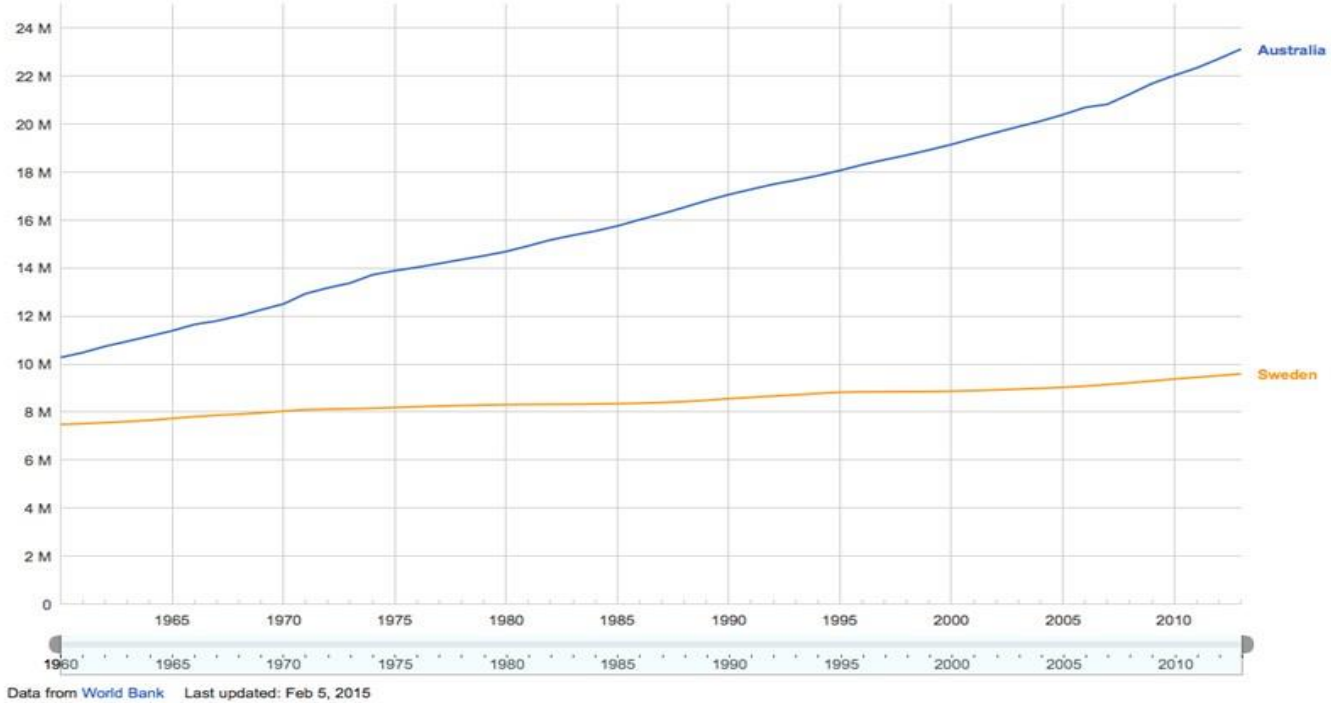
And…

Can a simple engineered timber panelised wall system using low grade plantation timber be developed for the Australian building industry?

more on this later…

UNDERSTANDING SWEDEN & AUSTRALIA
(A brief look at some of their similarities and differences)

Australia is approximately 17x larger than Sweden.



Australia's population (23.13 mill) is approximately 2.4 x larger than Sweden's (9.593 mill) and is comparatively growing by a factor of 2:1.

UNDERSTANDING SWEDEN & AUSTRALIA
(A brief Look at some of their similarities and Differences)

How does Australia house its population compared to Sweden?

Typical Australian detached bungalows.

Apart from regional construction and fashion/stylistic differences they are essentially the same nation wide.

Typical modern Australian apartment block

Typical Swedish Summer Houses

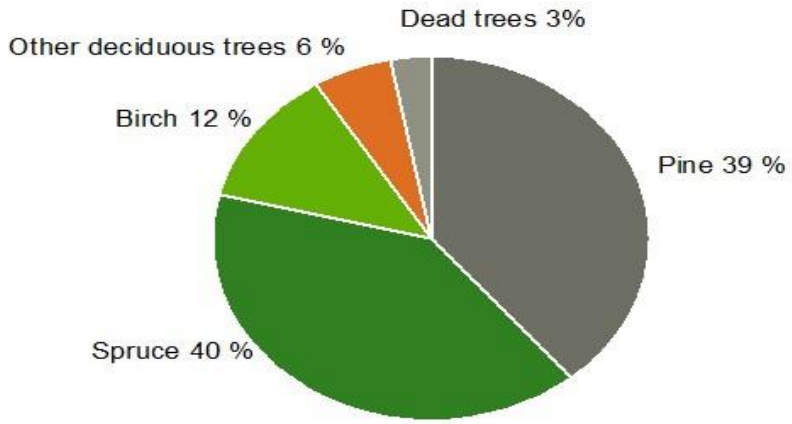
Modernistiskt Modulhuskoncept

Swedish for “modern module house concept”.

Most Swedes live in apartment blocks similar to these. Social Housing is very common. Most is of a very high standard

Sweden and Australian Forests – A Quick Comparison

SWEDISH PLANTATION SOFTWOODS:



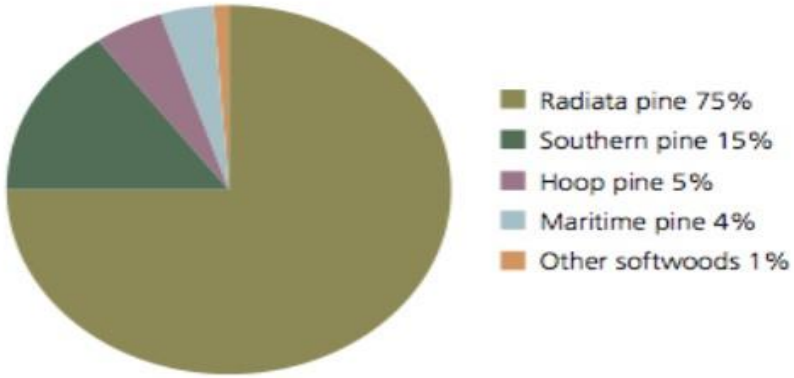
Source – Skogsindustrierna National Forest Survey

KEY FACT:

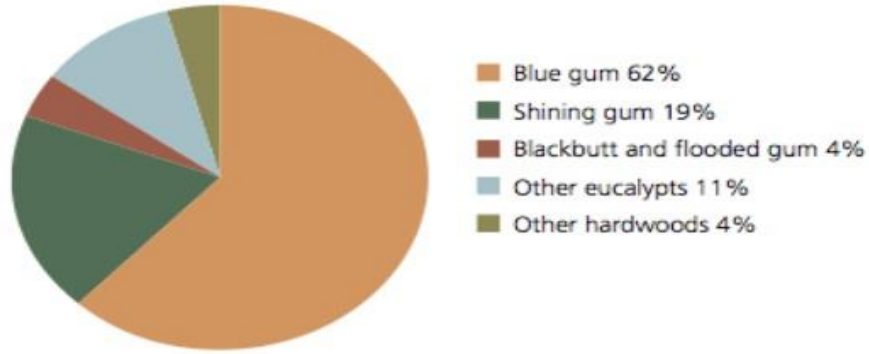
Approximately **half of Sweden's land** (22.5 million ha [55.63%]) **is considered 'productive forest land'** (Skogsstyrelsen 2012).

This equates to approximately **18.5 times more plantation timber producing land than** is currently available in **Australia** (1.8 – 2.0 million ha).

AUSTRALIAN PLANTATION SOFTWOODS:



AUSTRALIAN PLANTATION HARDWOODS:



Distribution of softwood trees as a percentage. Source - Australia's Forests At A Glance 2010

Sweden:

- Off – Site Volume Module – Readily Commercially Available
- Off – Site Planar - Readily Commercially Available
- Off – Site Heavy Timber Post and Beam - Readily Commercially Available

  - 95% of Sweden's bungalow style housing is prefabricated timber
  - 20% of Sweden's multi residential Apartment housing is prefabricated timber

Australia:

- On-site Frame Construction (Stick and Truss & Frame) - Readily Commercially Available
- Mass Produced Volume Module - Limited Commercial Availability
- Off-Site Planar - Limited Commercial Availability
- Boutique Volume Module - Limited Commercial Availability

  - The vast majority of Australia's bungalow style housing is built on-site.
  - All of Australia's multi residential Apartment housing is built on-site and it is rare for timber to be used structurally.

FACTORS INFLUENCING THE SWEDISH TIMBER CONSTRUCTION INDUSTRY

Strong cultural association with wood

Climatic conditions that prevent year round on-site construction and encourage more refined detailing

Well funded national programs aimed at **increasing awareness of timber as a modern, reliable building material** such as the 1 Million Program in the 60's and 70's and more recently Tråstad 2012 (Timber Cities 2012)

Well resourced **undergraduate and postgraduate timber based university courses** – Architecture, Engineering and Off-site Construction

Well established tradition of **private/public sector partnerships**

Proximity **to neighbouring countries** that share similar values and actively participate in **knowledge exchange** such as the Nordic Collective

Predominately privately owned Forests managed in large collectives with **vertically integrated industries**. New systems and market growth are pushed from the forest sector and pulled from the construction industry and developers

Legislated ongoing **forest renewal** ensures timber stock is replanted after logging at a greater that 1:1 ratio

SWEDISH CASE STUDIES - Limnologen

What: The "Limnologen" block

Where: Växjö

Type of building: Eight storey residential building

Construction: CLT on concrete plinth

Developer: Midroc Property Development

Architect: ArkitektBolaget

Material Suppliers: Martinsons byggsystem, NCC (concrete), JSB (framebuildings)

Builder: Martinsons Byggsystem (woodproducts), Tyréns (concrete)

Completed: 2008.

More info: Limnologen – Experiences from an 8-storey timber building by Erik Serrano Växjö University, School of Technology and Design.

See: www.forum-holzbau.ch/pdf/ihf09_Serrano.pdf

SWEDISH CASE STUDIES - Strandparken

What: Strandparken

Where: Sundbyberg, Stockholm

Type of building: Eight storey residential buildings

Construction: CLT with Cedar cladding

Developer: Folkhem

Architect: Wingårdhs Architects

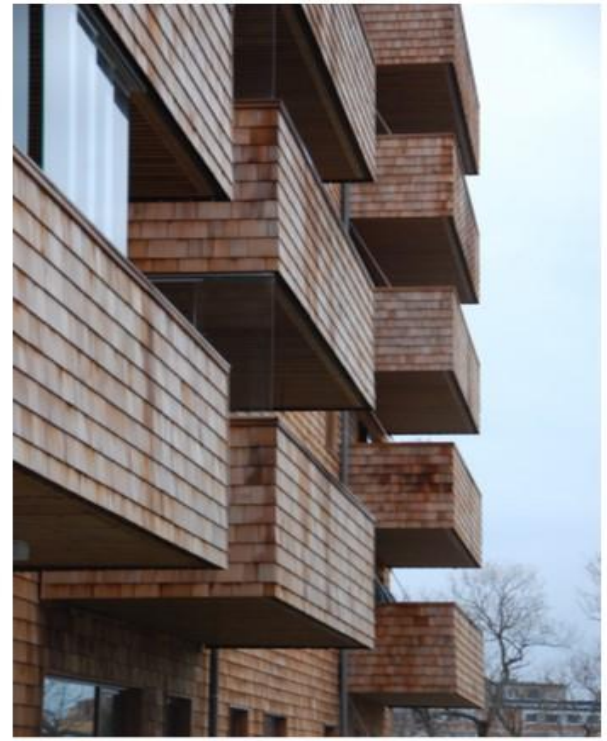
Material Suppliers: Martinsons byggsystem

Builder: Martinsons Byggsystem (woodproducts)

Completed: 2014.

More info: www.folkhem.se

(Swedish only. Use a translator)



SWEDISH CASE STUDIES - Strandparken

SWEDISH CASE STUDIES - Älvsbacka Strand

What: Älvsbacka Strand

Where: Skellefteå

Type of building: Seven storey residential buildings

Construction: CLT and Volume Module Hybrid

Developer: Martinsons Byggstystem AB and Lindbäcks Bygg AB

Architect: White Architects

Material Suppliers: Martinsons and Lindbäcks

Builder: Martinsons Byggsystem (woodproducts)

Completed: 2010.

More info: http://www.white.se/en/project/29-alvsbacka-strand

What: Trä8

Glulam pillars at 8m centres in an orthogonal grid with Glulam beams and cross bracing/shear elements

Where: Sweden

Type of building: Commercial buildings up to six+ stories

Construction: Gluelam

Developer: Moeleven

Architect: NA

Material Suppliers: Moelven

Builder: Moelvem

Completed: 2009.

More info:

pure.ltu.se/portal/files/4915243/stabilising_system.pdf

What: Råcksta Redevelopment

Where: Råcksta, Stockholm

Type of building: Six storey residential buildings

Construction: Volume Module

Developer: Sundsvall AB Real Estate

Architect: Bergkrantz Arkitekter

Material Suppliers: Lindbäcks Bygg

Builder: Lindbäcks Bygg

Completed: 2009.

More info:

lindbacks.se/bygg/page139.php?newsid=31&nrnext=2

(Swedish only. Use a translator)

Newbeam Sweden AB

Three Dimensional OSB
interlocking structural ‘C’ and ‘H’ members.

Suitable for:
- Construction
- Furniture
- Packing

- More Info: newbeam.se

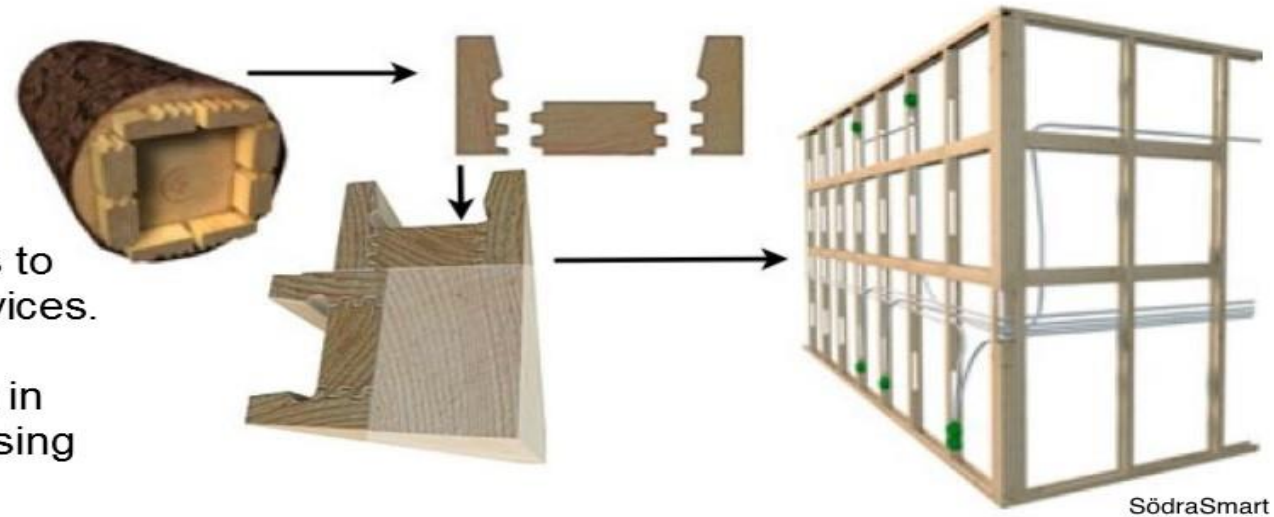
Images: newbeam.se

SödraSmart

Interlocking Stud Wall System

Three laminated parts:
Two side pieces joined with 300mm spines positioned at 200mm centres to create longitudinal openings for services.

Segmented format prevents tension in the spine affecting the stud and causing it to warp



SödraSmart

Suitable for:
•Non Loading Bearing Walls

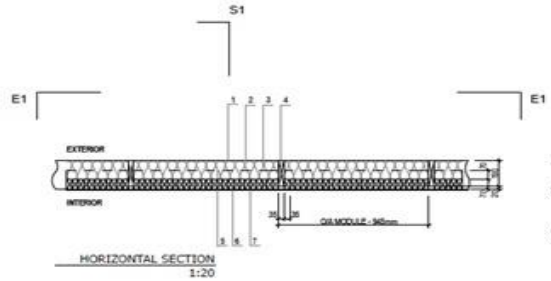
•More Info:
www.sodra.com/Documents/Timber/Produkter/Smart-svensk-montering.pdf

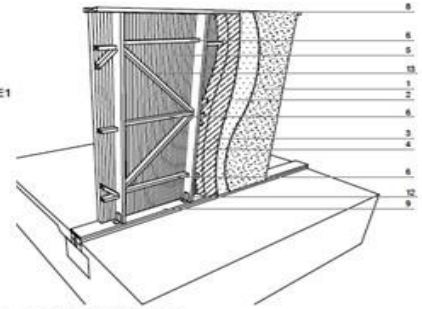
or

FWPA Report:
A Review and Update of Emerging Technologies in Residential Timber Construction, 2012
PROJECT NUMBER: PRA245-1112

Low Grade Timber Panelised Timber Wall System

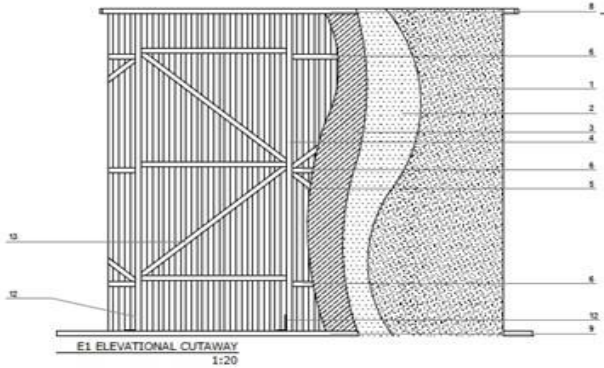
A SIMPLE ENGINEERED TIMBER PANEL CONSTRUCTION SYTEM FOR AUSTRALI

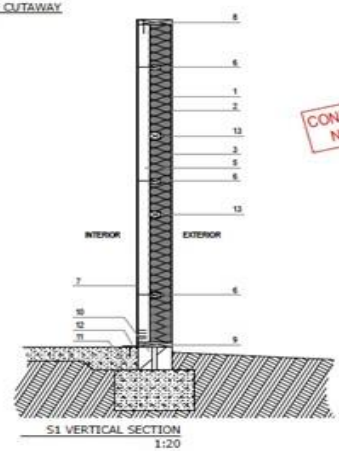




Legend

1	8mm Scyon Matrix external cladding/bracing
2	Sarking
3	140mm Wool Batt Insulation
4	190x35 vertical timber stud
5	70x35 vertical timber stud
6	35X70 horizontal bracing timber stud. Fixed to 70x35 vertical timber stud and offset heights to allow end fixing through 190x35 vertical timber stud
7	10mm Gryprock internal lining
8	210x35 Continous top plate
9	210x35 Continous base plate fixed to footing
10	Two course masonary footing
11	100mm Concrete slab and footing to engineer's specification
12	120x60x55 Rothoblass Steel Angle Bracket (WVS 12060) fixing to engineer's specification
13	70x35 Timber cross brace

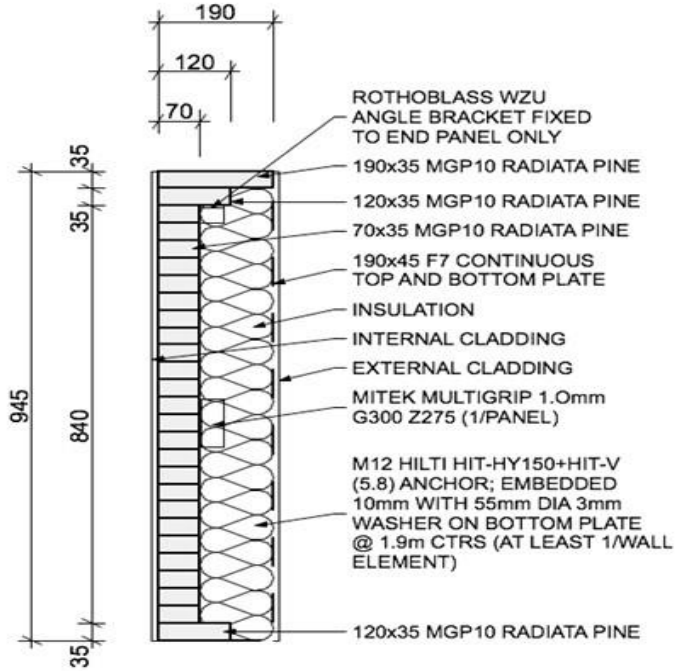




CONFIDENTIAL CONCEPT ONLY
NOT FOR CONSTRUCTION

DAVID BYLUND
ARCHITECT

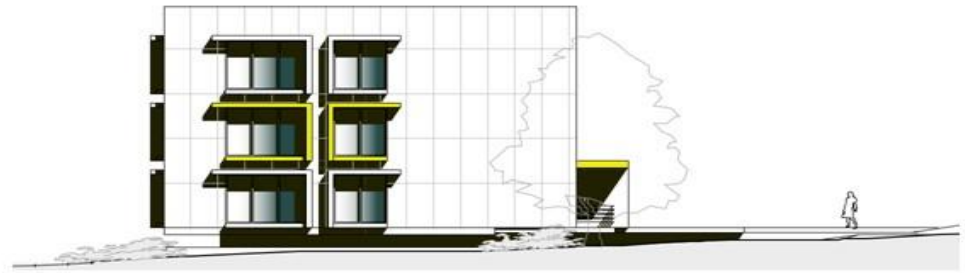
D.BYLUND
MODULAR LAMINATED TIMBER WALL - V2a
PLANS
11_01
01.1



david.bylund@uwa.edu.au

Low Grade Timber Panelised Timber Wall System - Prototypes

Currie Hall - Theoretical Application



LEGEND

200 mm (+ LINING) DOUBLE SKIN STRUCTURAL GUN-NAILED PARALLEL LAMINATED (GPL) WALL

90 mm (+ LINING) TIMBER FRAME WALL

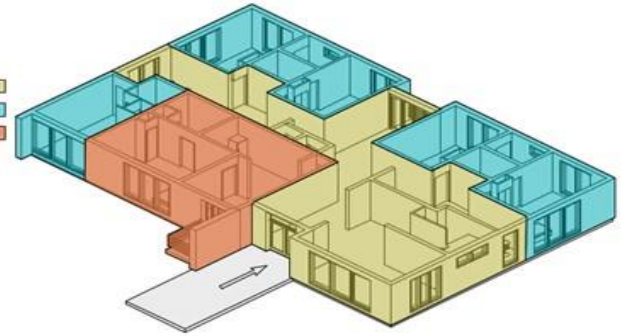
PUBLIC/CIRCULATION AREAS

1 BED APARTMENT

SELF CONTAINED APARTMENT

GROSS INTERNAL FLOOR AREA - 314m2

CEILING HEIGHT - 2700 mm



A SIMPLE ENGINEERED TIMBER PANEL CONSTRUCTION SYTEM FOR AUSTRALI

Currie Hall - Theoretical Application

A SIMPLE ENGINEERED TIMBER PANEL CONSTRUCTION SYTEM FOR AUSTRALI

INDEX

DRAWING #	TITLE
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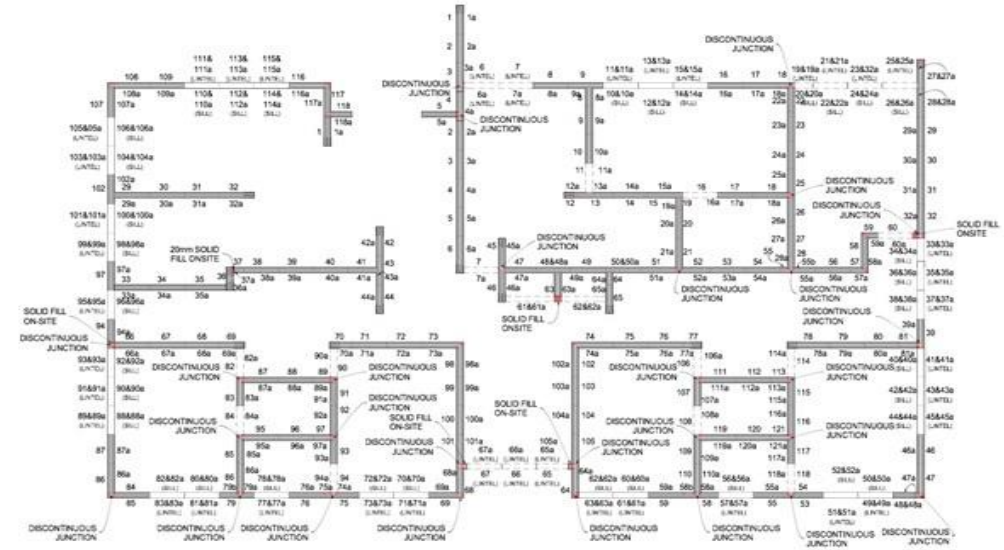
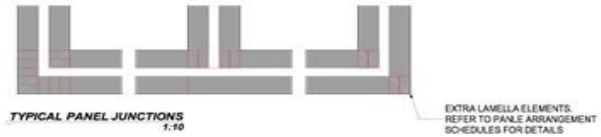
A1.2	SITE PLAN
A1.3	FIRST FLOOR (GROUND) PLAN
A1.4	FIRST FLOOR GPL WALL PANEL ARRANGEMENT PLAN
A1.5	FIRST FLOOR EXTERNAL WALL PANEL ARRANGEMENT
A1.6	FIRST FLOOR INTERNAL WALL PANEL ARRANGEMENT
A1.7	SECOND FLOOR PLAN
A1.8	SECOND FLOOR GPL WALL PANEL ARRANGEMENT PLAN
A1.9	SECOND FLOOR EXTERNAL WALL PANEL ARRANGEMENT
A1.10	SECOND FLOOR INTERNAL WALL PANEL ARRANGEMENT
A1.11	THIRD FLOOR PLAN
A1.12	THIRD FLOOR GPL WALL PANEL PLAN ARRANGEMENT
A1.13	THIRD FLOOR EXTERNAL WALL PANEL ARRANGEMENT
A1.14	THIRD FLOOR INTERNAL WALL PANEL ARRANGEMENT
A1.15	ROOF PLAN
A1.16	ELEVATIONS
A1.17	SECTION S1 & S2
A1.18	DETAILS 1 - 4



FIRST FLOOR GPL WALL PANEL ARRANGEMENT PLAN
1:75



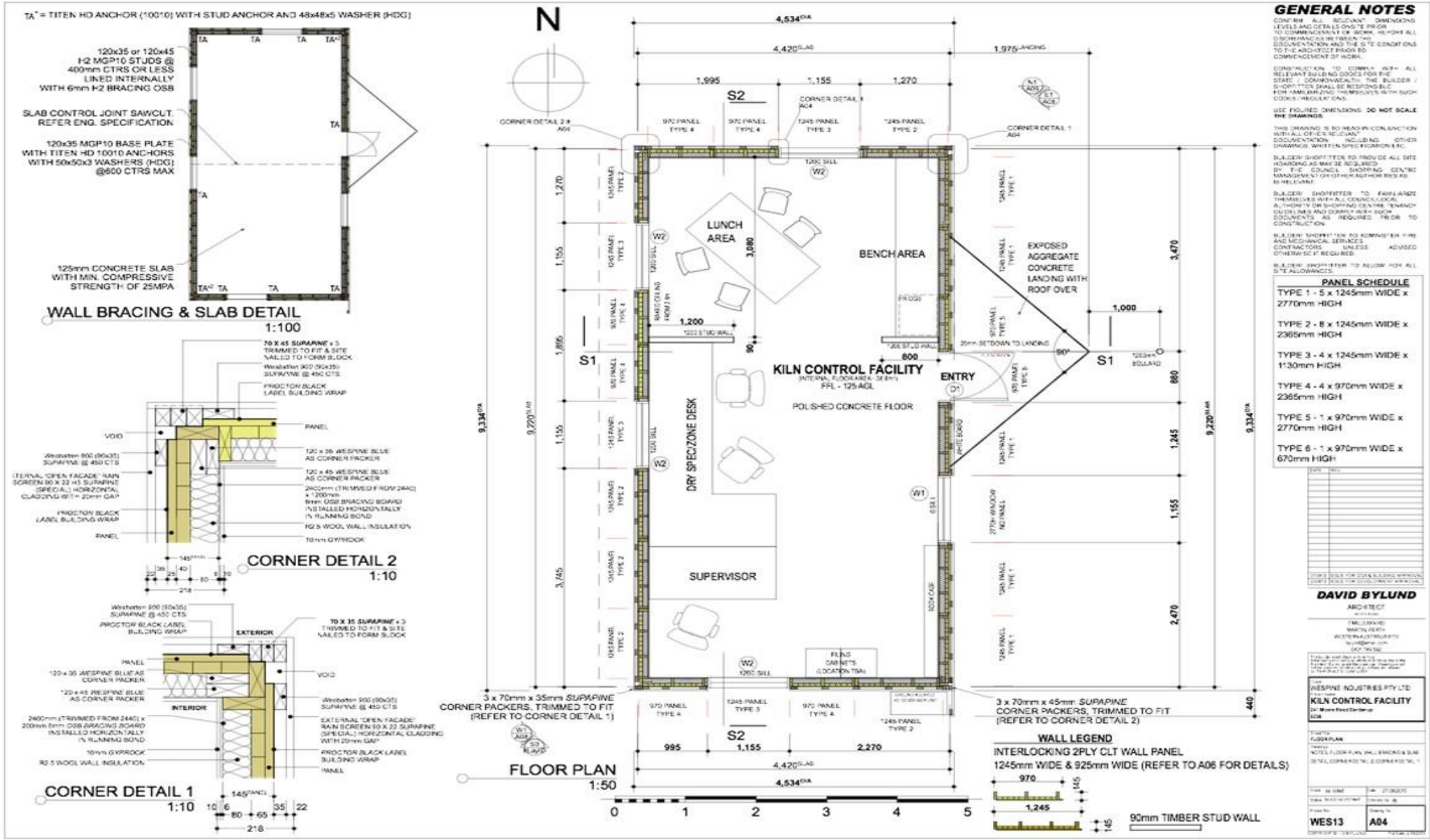
TYPICAL PANEL JUNCTIONS
1:10

CURRIE HALL 2 (CH²)

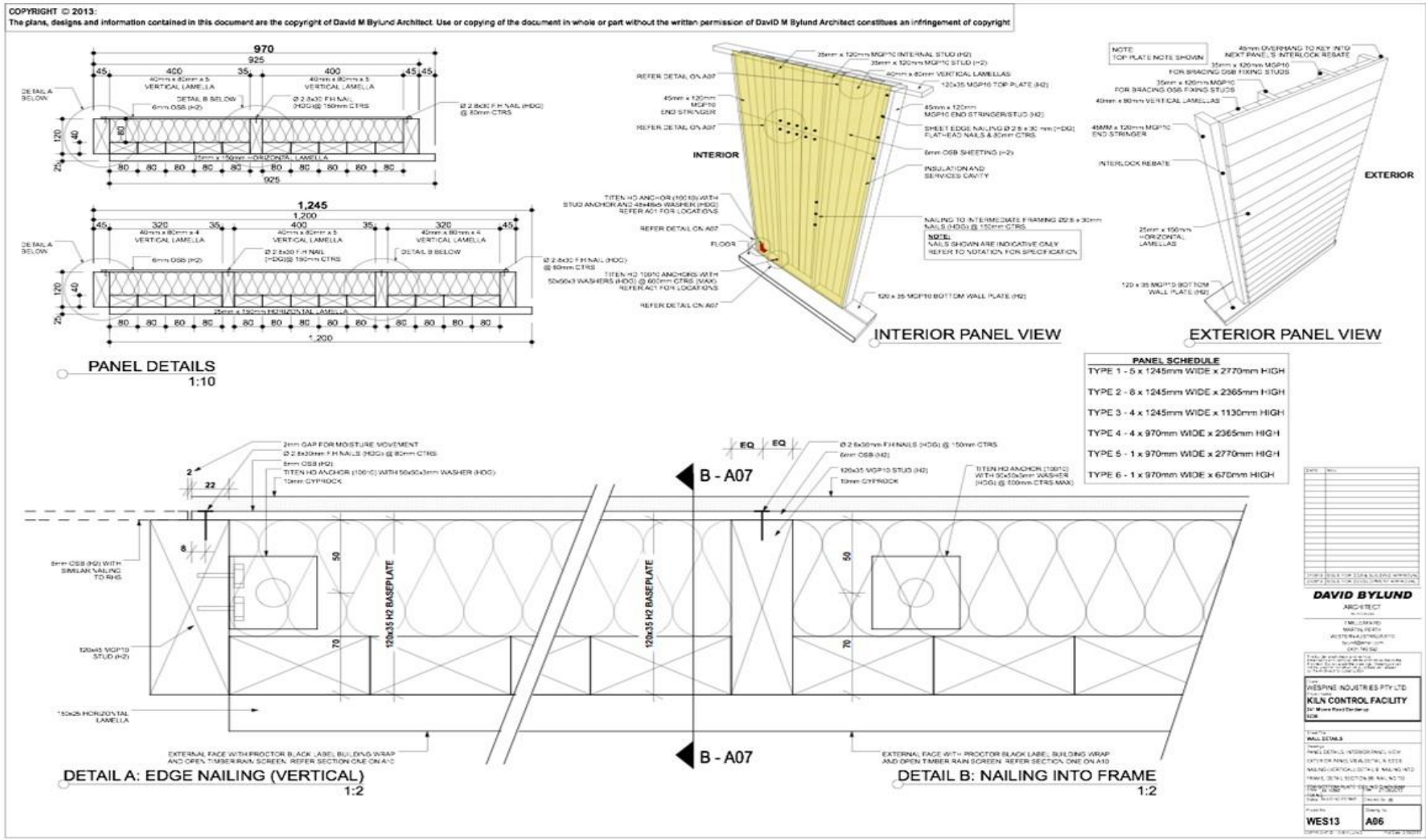
THE UNIVERSITY OF WESTERN AUSTRALIA

GUN-NAILED PARALLEL LAMINATED TIMBER (GPLT) WALL CONSTRUCTION

Wespine Kiln Control Facility - Practical Application



Wespine Kiln Control Facility - Practical Application



Wespine Kiln Control Facility - Practical Application

PHD - KEY FINDIMGS

Engineered timber construction has **the potential to suit small, medium and large scale, off-site and prefabricated buildings in Australian** residential and commercial sectors

Timber's **perceived structural limitations** will continue to be resolved **through new technical solutions**.

New timber based construction methodologies have the prospect of becoming **a significant alternative** to existing Australian building methodologies

The BCA/NCC's Deemed-to-Satisfy provisions will **need to recognise new timber construction methods** across a range of building classes and heights.

The technical skills required for manufacturing, access to affordable source material, transport and erection infrastructure, junctions and fixing methodologies, associated build costs and suitable design opportunities **appear to be readily available** for planar structural elements and systems

The development of localised products that create new possibilities for **value-adding to non structural grade plantation timber** could be used **to encourage timber processing companies to expand** into value-adding and even provide vertically integrated building solutions.

Australia and Sweden & Innovation in Wood
David Bylund © 2015

THANK YOU

David **Bylund**

PhD - Architect

bylund@email.com

A webinar commissioned by:

Forest&Wood Products Australia
Knowledge for a sustainable Australia