Benefits of Using CLT in Residential Timber Construction

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Residential Mass Timber Construction
Introduction to XLam
XLam Australia

Established in NZ in early 2012

Mayflower (Hyne family) purchased XLam in 2015

Opened the Australian manufacturing facility in March 2018

Delivered over 60 projects in the first 18 months of operations in Australia

Solutions provider, not just a materials supplier:

• XLam Design
• Product Development
• Value Add
• Onsite Assistance
• Installation
CLT Processing Plant
CLT Manufacturing Process

1. Rough sawn infeed
2. Fingerjointing
3. Planing to size
4. Layup & pressing
5. CLT ready for machining
CNC Machining
Just because the CNC machine can cut it...
...doesn’t mean it has to
Factory Considerations

Pressing Capability (30 min. billet pressing cycle time)
• Minimum billet size = 2.4m x 6.0m
• Maximum billet size = 3.4m x 15.9m

Transport Capability
• 12m x 2.5m – relatively simple to most mainland sites
• 16m x 3.5m – possible under special escort
• 12m x 2.2m – for shipping containers

• If CNC time > 30 mins the factory will not be pressing to capacity. Instead, the CNC will become the bottleneck

• Do we sell timber or production time?
Model to Panel Process
Step 1: Model and Panelise

- Reverse engineer model to individual panels (panelisation)
Step 2: Installation sequence to panels

• Give panels an install sequence panels based on delivery and site conditions
Step 3: Create Detailed Delivery and QA Drawings

Please note: smaller panels must be stacked on top of larger panels despite installation sequence.
Step 4: Nesting and Arrangement

- Nesting individual panels onto sequential billets based on type, thickness and grain direction
- Arrange billets into deliveries
Step 5: Machine Tool Assignment

• Billets moved from CAD software into CAM/CNC software
• Tools and process order assigned for most efficient production
Rule of Thumb

If it’s difficult to draw, it’s likely to be difficult to manufacture, transport and assemble
Panel Size & Complexity

Very Low
- 1 x Perimeter cut (Router)

Low
- 1 x Perimeter cut (Router)
- 2 x Halfflaps

Moderate
- 1 x Perimeter cut (Router)
- 2 x Halfflaps
- 2 x Drillings
- 1 x Window cut-out

High
- 1 x Perimeter cut (Router)
- 2 x Halfflaps
- 2 x Drillings
- 1 x Window cut-out
- 1 x Door cut-out
- 2 x Circular penetrations
- 1 x Channel
- 1 x Recess

Very High
- Multiple Panels
- 1 x Perimeter cut (Router)
- 2 x Halfflaps on all panels
- 1 x Window cut-out
- 1 x Door cut-out w/supports

Increasing complexity + COST
Panel Size & Complexity

SINGLE PANEL - PUNCHED HOLES
- LESS SITE WORKS. SINGLE LIFT
- MATERIAL CUT OUT FOR WINDOWS WASTED?
- MORE DIFFICULT TO FIT IN CONTAINER

MULTIPLE PANELS - MECHANICALLY FIXED
- MORE SITE WORKS. PRE-FIXED ON GROUND OR MULTIPLE LIFTS
- LESS MATERIAL WASTE
- EASIER TO FIT IN A CONTAINER
Panel Size & Complexity

This simple floor panel requires 23 minutes of processing time and 1x lift.

This complicated set of panel requires 140 minutes of processing time and 7x lifts.
Panel Size & Complexity

M12 BOLTS AT 750 CRS (MIN 3 PER PANEL)
BOLTS TO BE EXTERNAL, COVERED BY INTERNAL MASONRY OR IN WC ONLY

10x10mm BLOCKOUT FOR RADIUS EACH SIDE OF 90BT11.1
15x15mm BLOCKOUT

N12 CAST IN LUGS AT BOLT LOCATIONS WELDED TO 90BT11.1

DETAIL A
SCALE 1:5

[Diagram showing details of panel installation]

[Sketch highlighting CLT wall, screws, and anchor details]

[Red X and green checkmark indicating correct installation]
Residential Construction - Advantages

• Eliminate the need for wet trades onsite (consider pre-fab footing systems)
• Far superior structure than conventional materials (timber/steel frame)
• Low carbon footprint, timber is the most sustainable and renewable building material
• Significant improvement in lock up time, when co-ordinated correctly
• Low noise and disruptions to surrounding residents, less trucks
• Little to no waste onsite, reduced skip bins
• Airtight construction, healthier homes (when done right!)
• Fast and accurate construction (significantly helps follow on trades)
• Thermal, fire and acoustic performance is superior, though not a requirement for domestic construction
Residential Construction - Disadvantages

• Longer upfront design duration to co-ordinate offsite construction
  • Mass timber is not a magic material / you need to allow enough time!

• Lead time to procure material is much longer than timber frame

• Much higher material cost compared to timber frame

• Follow on cost advantages not recognised without a prefabrication philosophy

• Cost can become significant if complexity is high

• Difficult to co-ordinate if other structure onsite is built traditionally to larger tolerances

• Requires crane and good site access for installation

• Installation requires up-skilling of labour onsite
DFMA Summary

- Allowing enough time for design and co-ordination
- Employ collaborative consultants who understand the requirements of the documentation
- Design for large format panels and rectangular shapes
- Simplify connection details (screws vs brackets/nails)
- Develop a sequence for transport and erection
- Understand site constraints and feed back into design
- Co-ordinate follow on trades and materials
- Consider the structure “built” when shop drawing process starts
Case Study – Ceres House
Getting the Documentation Right

Ceres House, courtesy Level AK Architects
Getting the Documentation Right

Ceres House, courtesy Vistek Structural Engineers
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The End Result
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The End Result
The End Result
The End Result
Know the Process Onsite

- Is the correct panel at the top of the pack? Check label matches loading drawings.

- Is the panel visual? What lifting technique is required? Can the temporary protection material be applied prior to lifting?

- Which side does the prop attach to? Can this be attached prior to lifting?

- Is the final position clear of obstructions?

- Can any connection brackets/plates be pre-installed?

- Are all required fixings and tools available and on hand?
Making the Structure Weathertight
Structural Connections
Lifting Inserts (Ferrules)
Lifting Clutches
Plugs for Lifting Holes
Construction Examples
Coordinating Services
Optimizing the Process
What to watch out for!
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