



**Timber Buildings**

**Presented by Ali Habibi**



# Presentation Outline

- Introduction to engineered timber
- Timber projects around the world
- Timber projects in Australia
- Why timber?
- Types of timber buildings
- Fire
- Challenges

# NORTHROP

What is engineered timber?



**Glulam**

Glued Laminated Timber



**LVL**

Laminated Veneer Lumber



**NLT**

Nail Laminated Timber



**CLT**

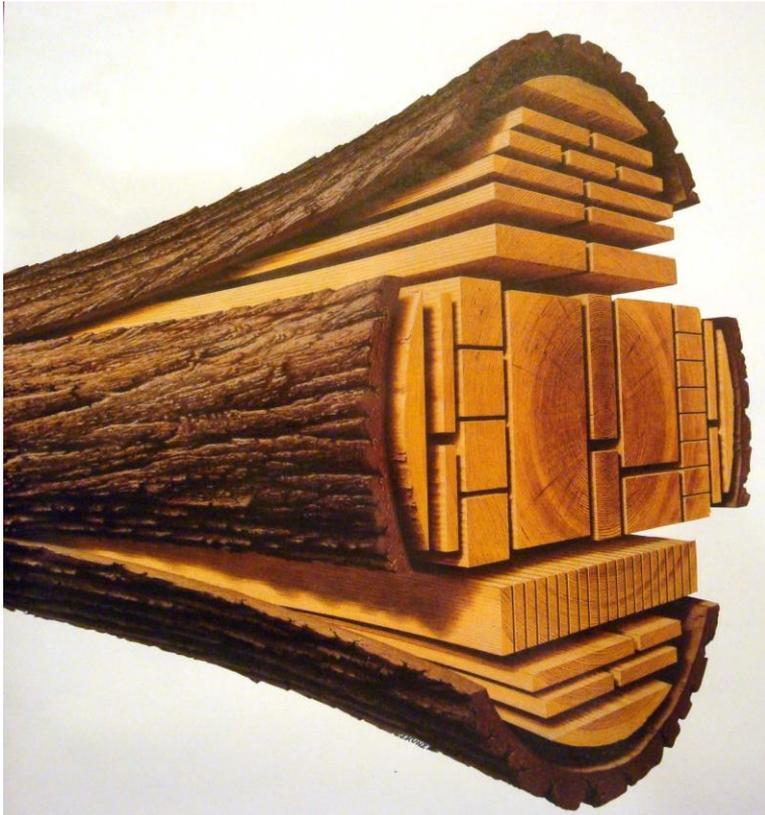
Cross Laminated Timber



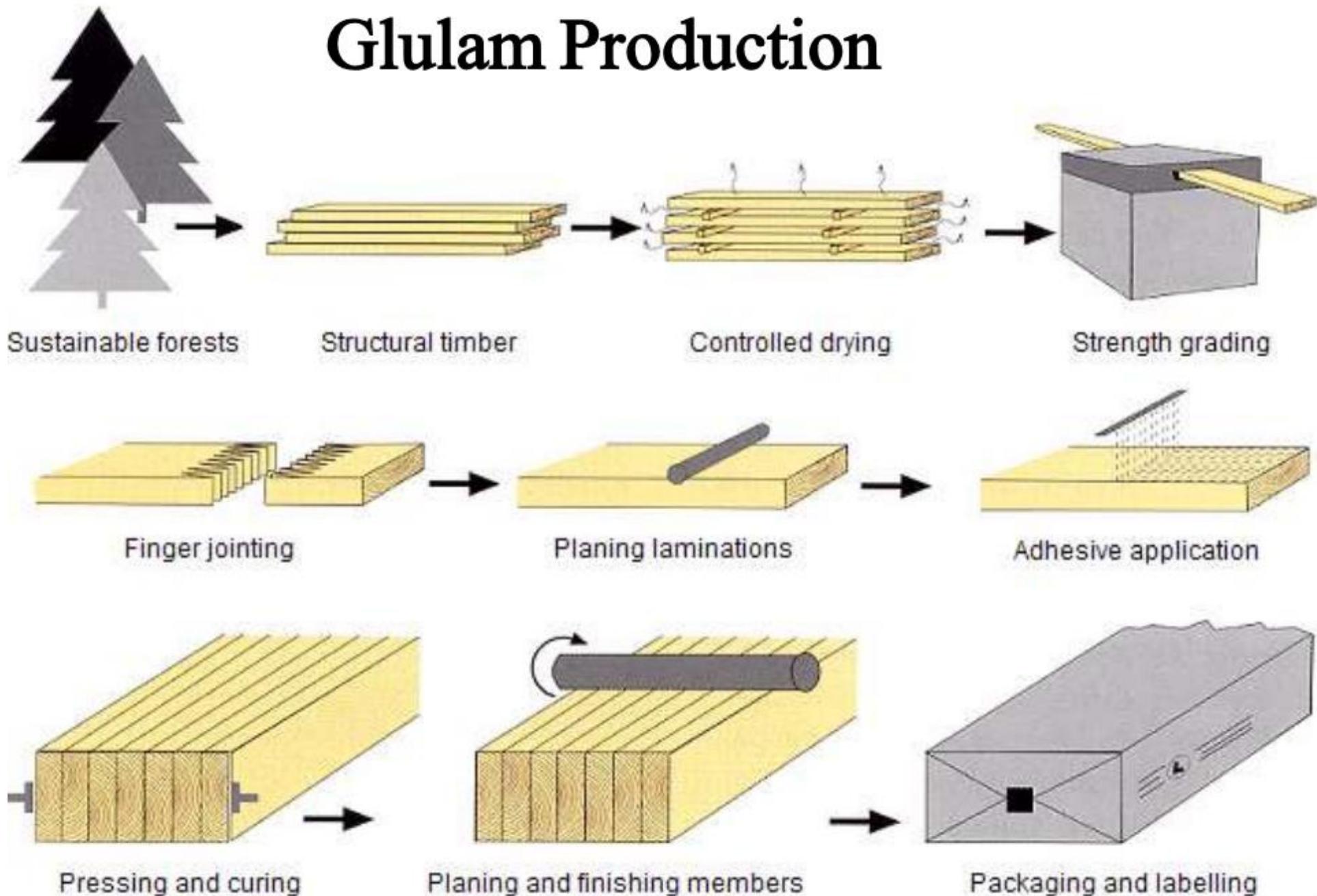
**Plywood**

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Sawing trunks into timber

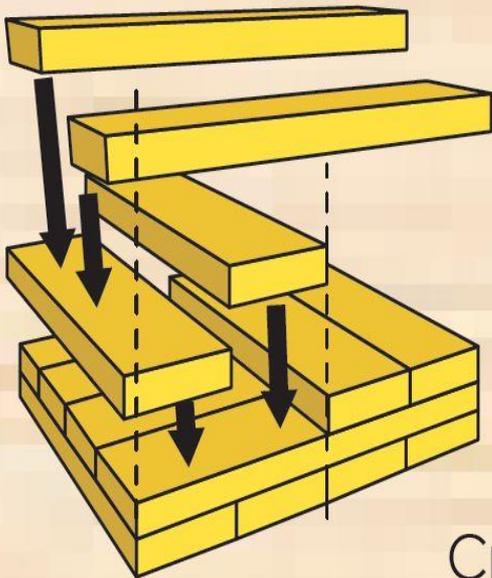


# Glulam Production

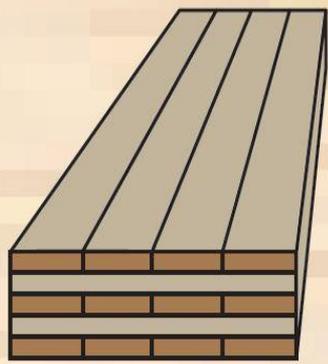


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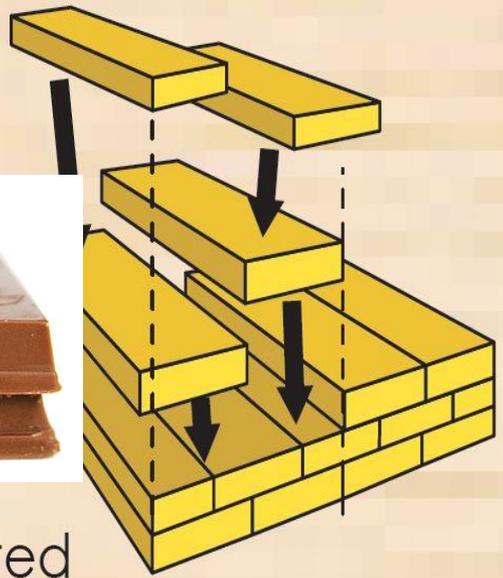
## CLT vs Glulam



Cross Laminated  
Timber (CLT)

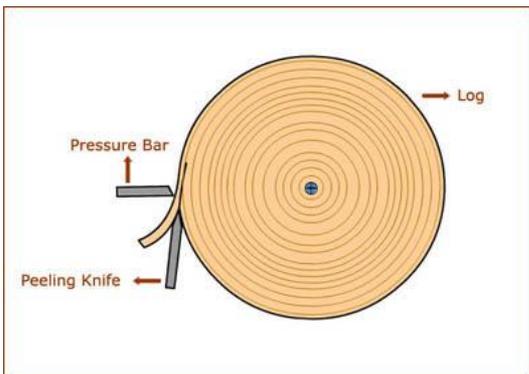


Glued Laminated  
Timber (Glulam)

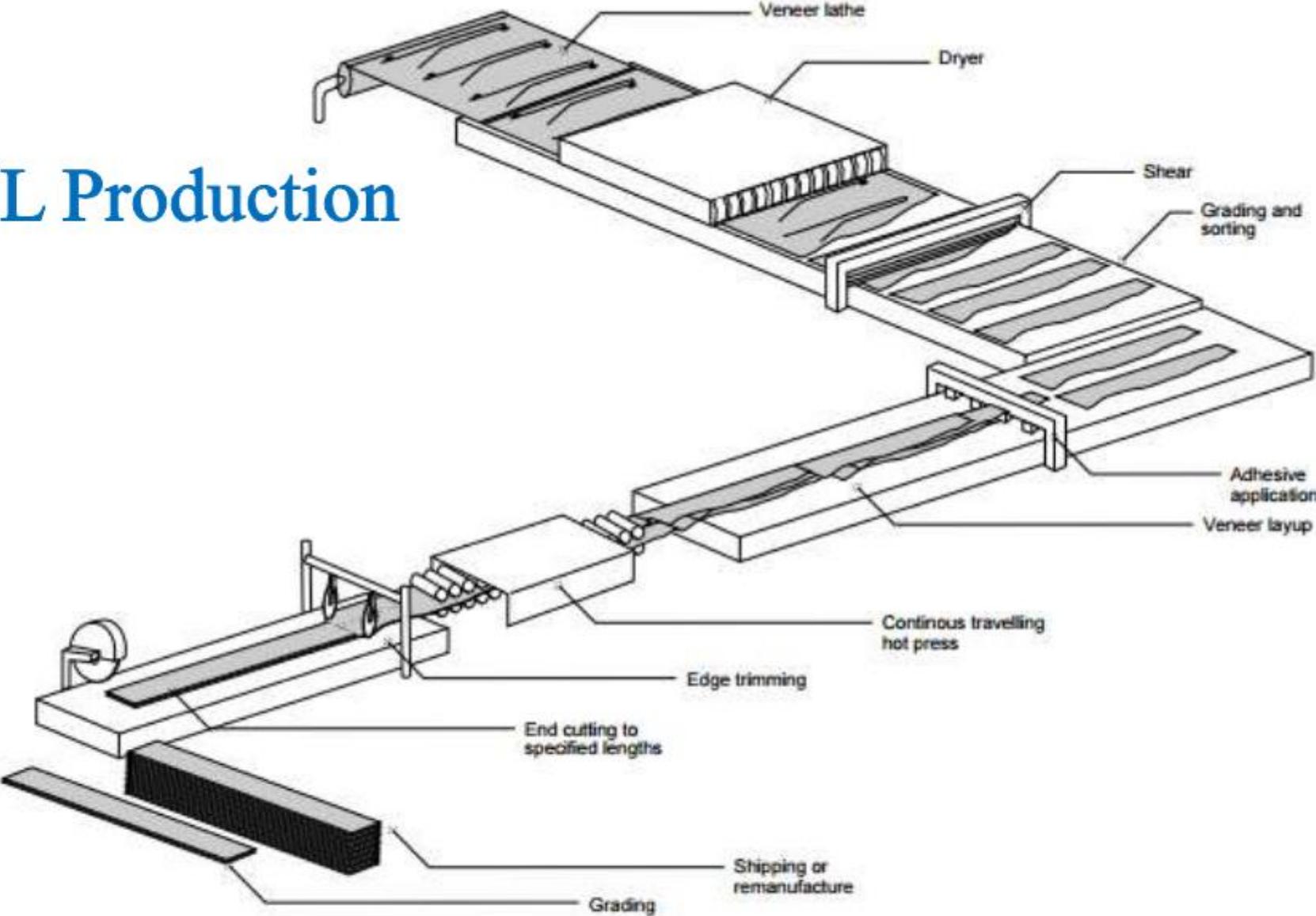


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Producing timber veneer



# LVL Production



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Timber projects around the world



Federal Bank/Bozeman, MT-USA



Pedestrian Bridge in Bahrain

# Timber projects around the world

Richmond Olympic Oval, Canada



# Timber projects around the world

Zurich Zoo, Switzerland



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# Timber projects around the world

Pyramidenkogel, Austria

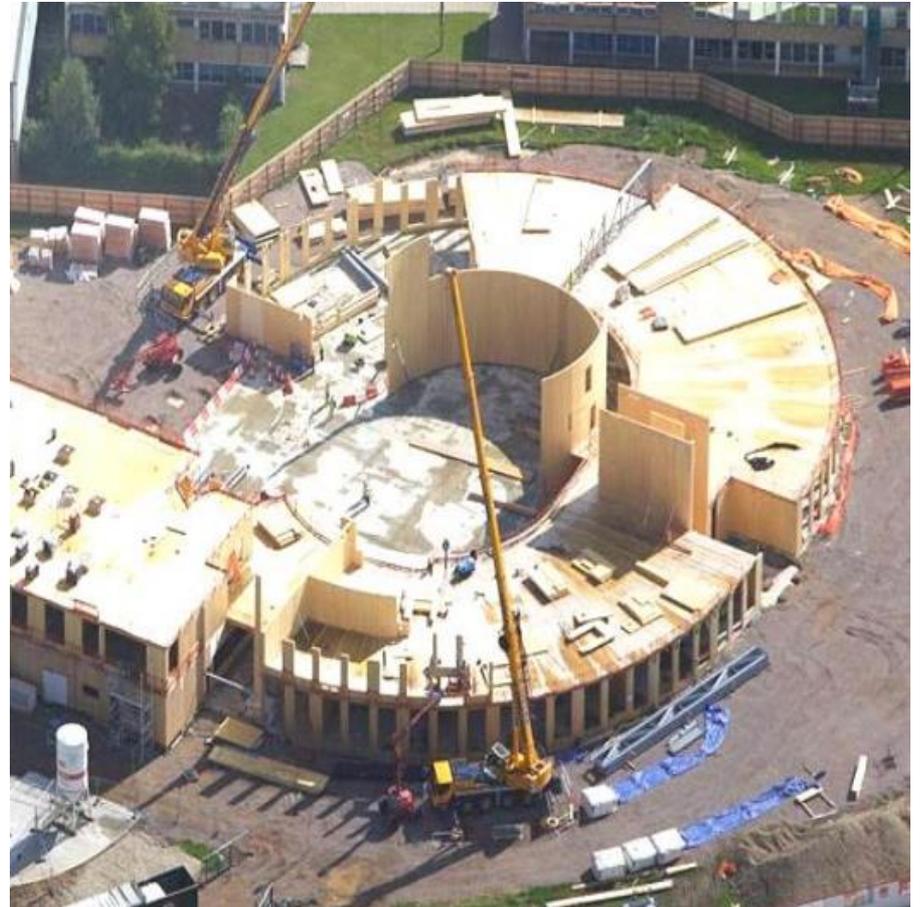


**24 Storey  
2019**



## Timber Projects around the world:

9 storey-Hackney London (left)  
School in UK (Right)



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Timber Projects around the world:

Believe in Better Building, West London



# TIMBER PROJECTS around the world:

Treet, Norway (Tallest Residential building – 14 storey)



# NORTHRUP

Timber Projects around the world:

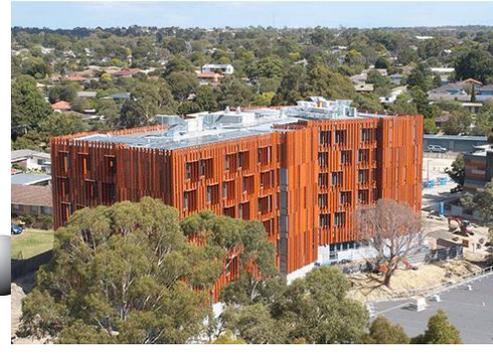
Brock Commons, UBC, Canada (World tallest timber building-18 storey)





# Projects in Australia

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## Why timber?

- Benefit of building in timber
  - More sustainable
  - Lightweight
  - Less trades and labourers
  - Safer worksite
  - Less complex
  - Faster
  - Marketable

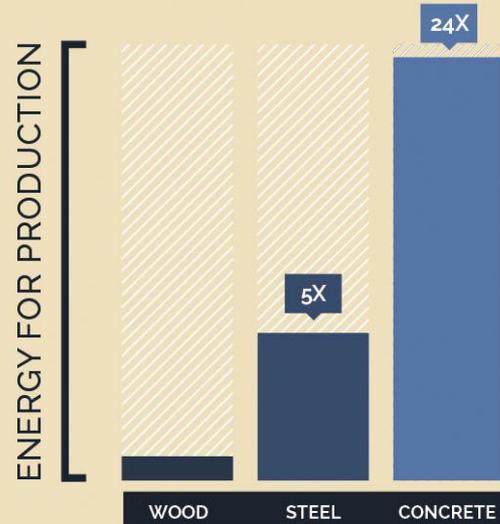
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Why timber?

More sustainable

## BENEFITS OF BUILDING WITH **WOOD**

Wood and wood products need the least amount of energy to manufacture and has the lowest impact on air and water quality.



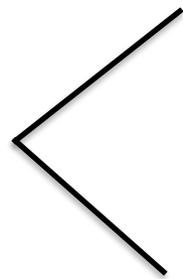
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Why timber?

Less trades and labour = Safer worksite



Mass timber



- Light timber framing
  - Low rise residential buildings
- CLT floors and loadbearing walls
  - Low-medium rise residential buildings
- Heavy timber framing
  - Office buildings
- Hybrid structures
  - Tall buildings (>10 stories)

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## Types of timber buildings



- Light timber framing
  - Low rise residential buildings
- CLT floors and loadbearing walls
  - Low-medium rise residential buildings
- Heavy timber framing
  - Office buildings
- Hybrid structures
  - Tall buildings (>10 stories)

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Light timber framing in Australia  
The Green (Melbourne)



# NORTHROP

## Types of timber buildings

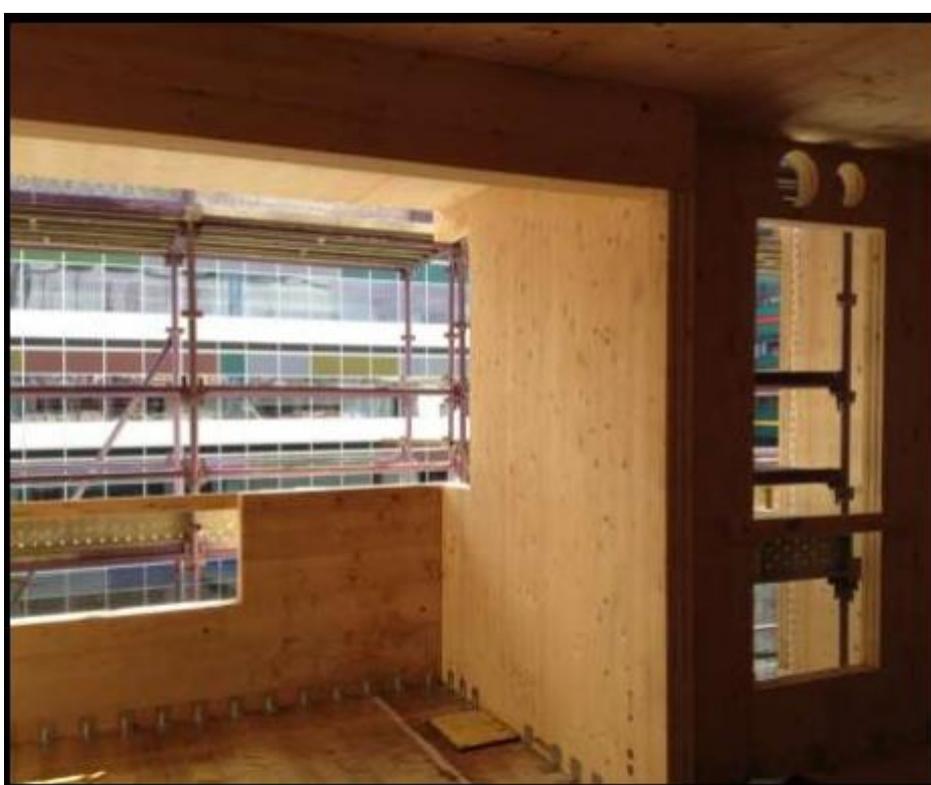


- Light timber framing
  - Low rise residential buildings
- **CLT floors and loadbearing walls**
  - Low-medium rise residential buildings
- Heavy timber framing
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CLT floors and walls in Australia  
Forte (Melbourne)





# NORTHROP

CLT floors and walls in Australia  
Campbelltown affordable housing (Sydney)



# NORTHROP

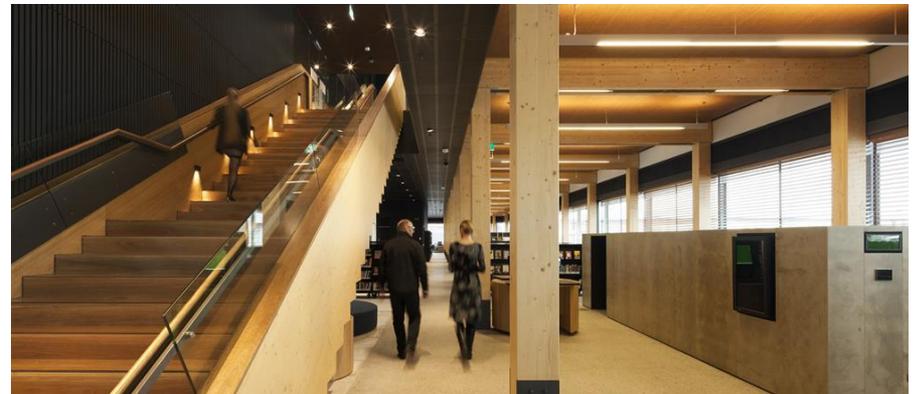
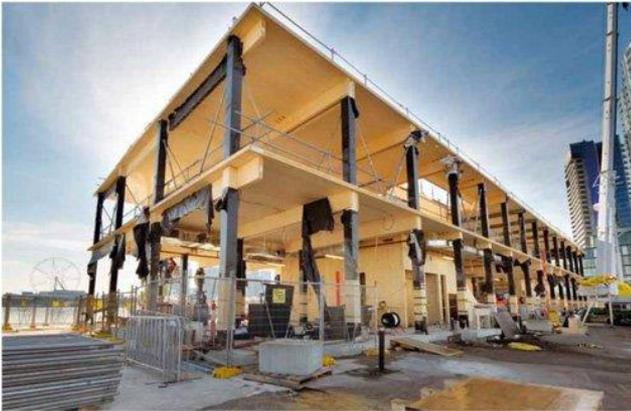
## Types of timber buildings



- Light timber framing
  - Low rise residential buildings
- CLT floors and loadbearing walls
  - Low-medium rise residential buildings
- **Heavy timber framing**
  - Office buildings
- Hybrid structures
  - Tall buildings (>10 stories)

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## Heavy timber framing in Australia Library at the Dock (Melbourne)





## Types of timber buildings

# NORTHROP



- Light timber framing
  - Low rise residential buildings
- CLT floors and loadbearing walls
  - Low-medium rise residential buildings
- Heavy timber framing
  - Office buildings
- Hybrid structures
  - Tall buildings (>10 stories)

## Fire



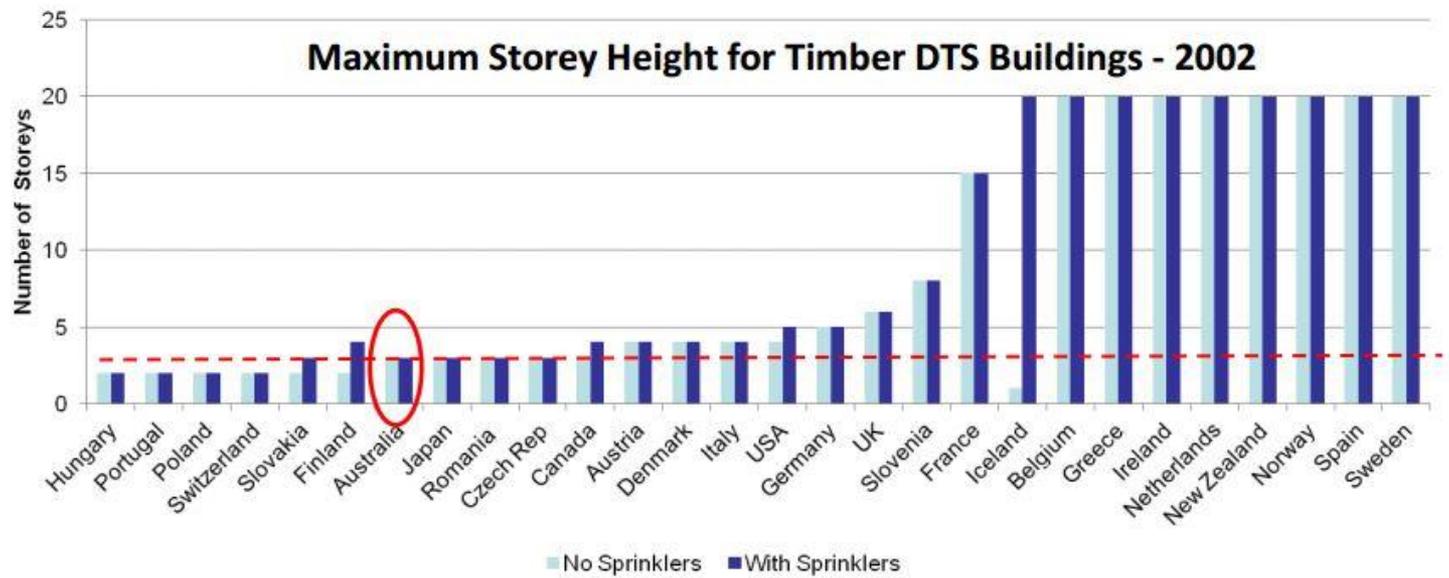
- **Option 1 – Deemed-to-Satisfy**
  - Recent Changes in BCA



- **Option 2 – Alternative Solution**

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## Code compliance worldwide



Source: FWPA



# NORTHROP

## Code compliance worldwide



Source: FWPA

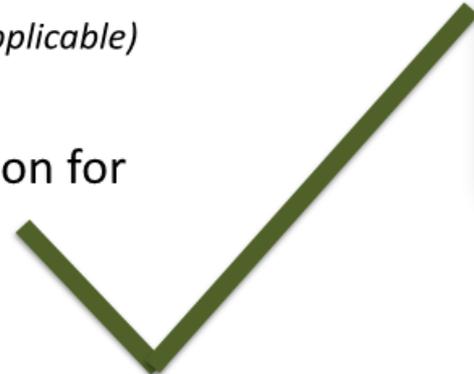
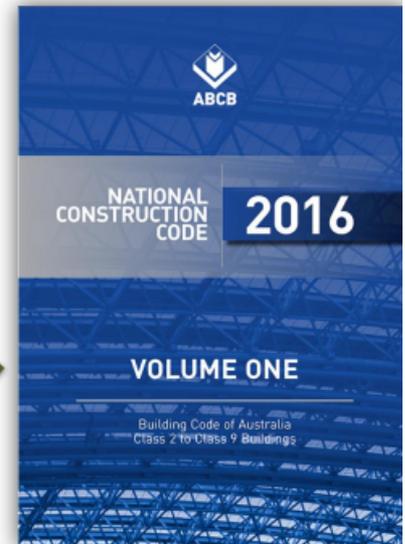


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## BCA Changes in May 2016

- If, the building or building part is Class 2, 3 or 5.
- the building has an *effective height of not more than 25m*;
- and utilises:
  - *fire-protected timber*
  - *automatic sprinkler systems*
  - *non-combustible insulation*
  - *cavity barriers (if applicable)*

Then it meets the DtS Solution for Mid-rise Timber Buildings



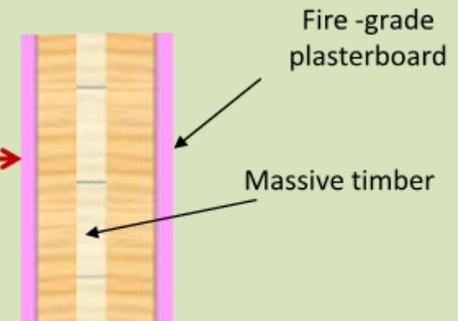
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## BCA Changes in May 2016

### Massive Timber *(Lower level of protection to timber)*

- **Minimum 75mm thickness** of massive timber element, with required FRL, with no concealed spaces between plasterboard coverings and timber  
e.g. CLT, Glulam, LVL

- Fire protective covering required:
  - Element with appropriate layers of fire protective covering, generally 1 layer of **16mm** fire-grade plasterboard for walls and ceilings



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## Alternative Solutions

- Practically all buildings will require some “alternative” components
- A ‘fire engineered’ solution with input from the structural engineer



**Holmes Fire**



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## Supply chain in Australia / Fire



Austria



Italy



storaenso

Austria



Australia & NZ

**RUBNER**

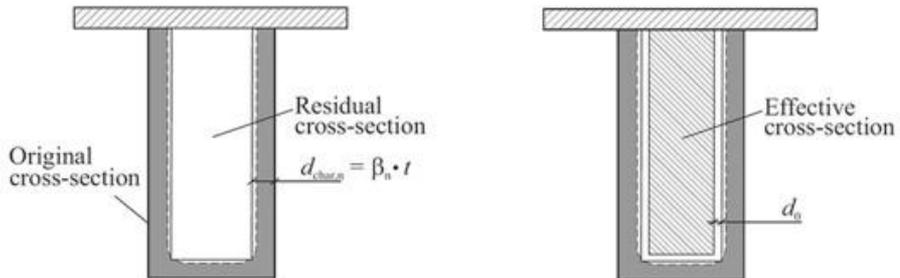
Italy

Distributors/fabricators



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## Fire and Glulam (Charring Rate)



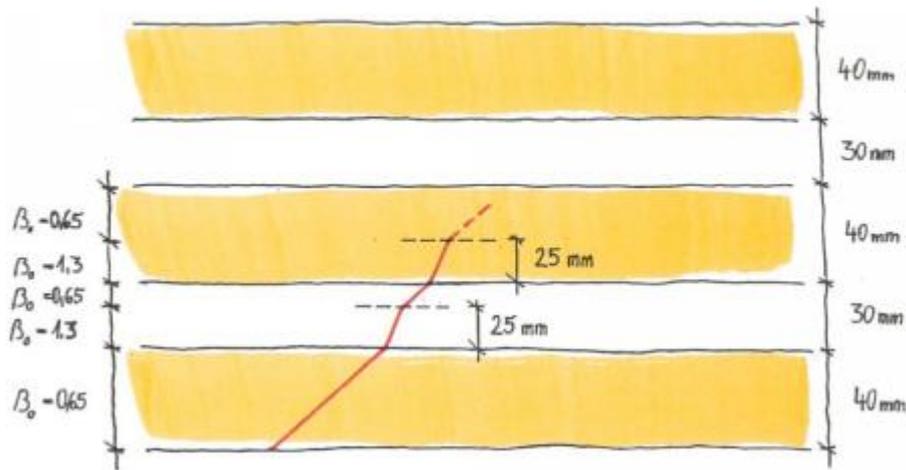
**Step 1:** Calculation of residual cross-section using the notional charring rate  $\beta_n$  and the time of fire exposure  $t$

**Step 2:** Calculation of effective cross-section using the zero-strength layer  $d_0$

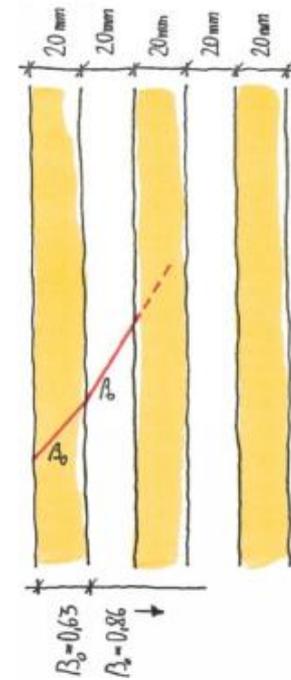
CLT Wall

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## Fire and CLT (Charring Rate)



CLT Slab



CLT Wall

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## Fire in beam with large penetration

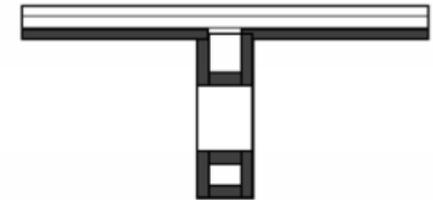


Diagram showing residual section after char around a penetrated primary beam.

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## Fire & Connections

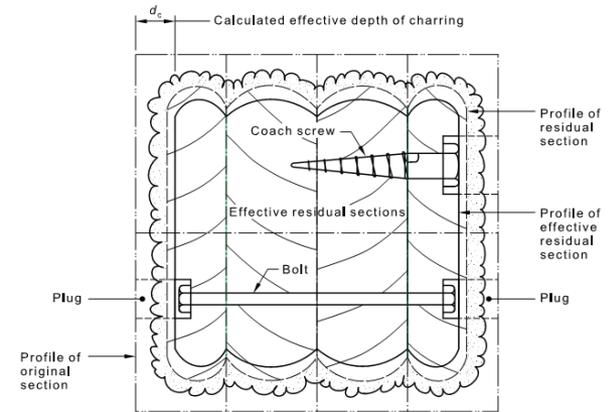


FIGURE 3.1 A METHOD OF PROTECTING METAL CONNECTORS



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## Structural Engineers Challenges

- Early involvement on the job
- Higher portion of the work upfront
- Services coordination
- Fire engineers with timber experience
- Fire authorities vs Fire engineers
- Neighbouring property
- Fit-out
- Progressive collapse solution
- Selection of supplier/builder

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Q&A?