Offsite Manufacturing in Wood Construction: A Practical Path Forward

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Wood Works | Canadian Wood Council Resource Program

FNHC
February 26th, 2026

Agenda

- Offsite Construction – what and why?
- Types of Offsite Wood Construction
  - Project Examples
- Design for Manufacturing & Assembly
- Manufacturing
- Mass Timber Construction

Project: YWKW | Image courtesy of Edge Architects

Why Offsite Construction?

“Construction Productivity”

- ✓ Parallel construction
- ✓ Minimize weather delays
- ✓ Minimize weather exposure
- ✓ Tighter QA/QC
- ✓ Less re-work
- ✓ Less waste
- ✓ Less time on-site
- ✓ Less neighbourhood disruption
- ✓ Safer labour conditions
- ✓ More houses per labourer

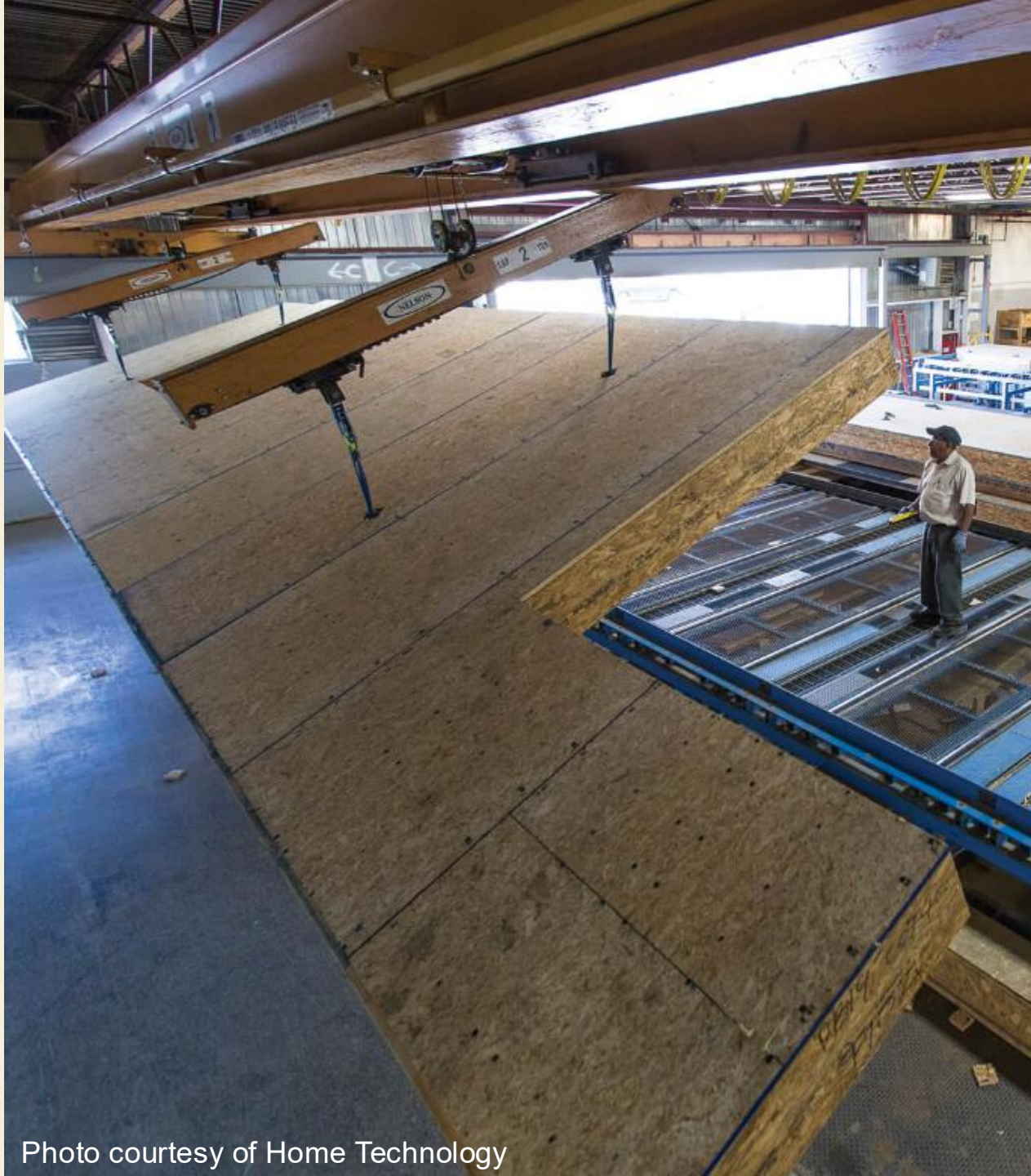
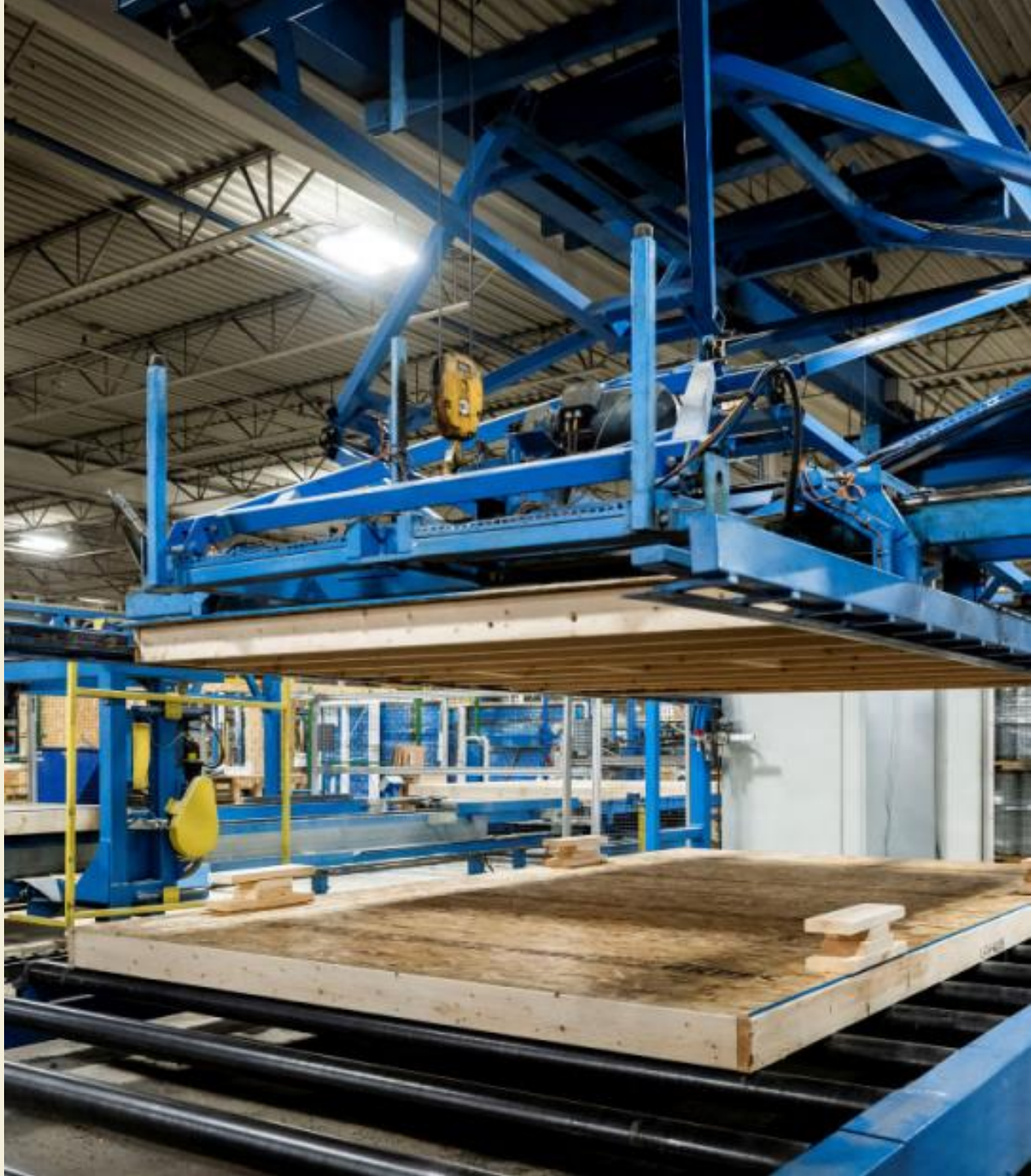


Photo courtesy of Home Technology

Offsite Construction Challenges

- ? Standardization
- ? Change of design thinking
- ? Certification
- ? Building approvals
- ? Financing & insurance
- ? Public perception

… Others?



Offsite Wood Construction Handbook

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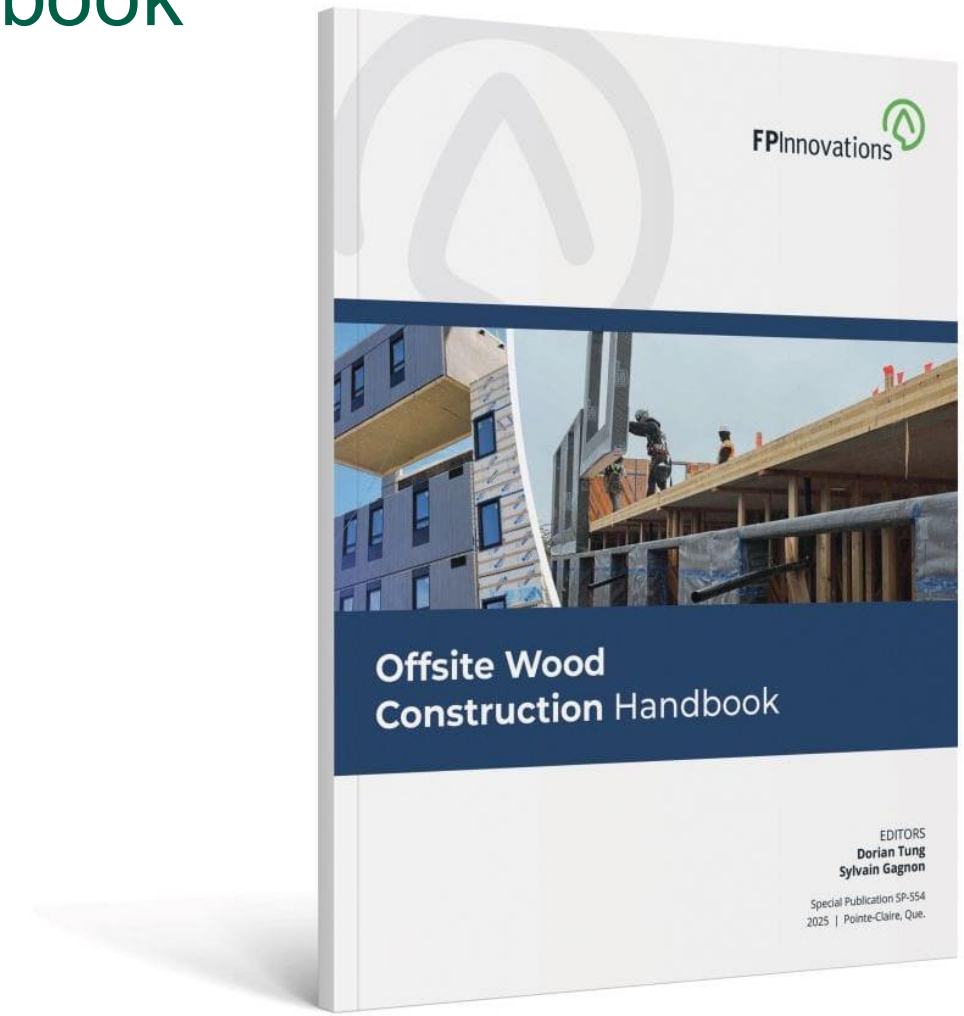


English: https://web.fpinnovations.ca/offsite-wood-construction-handbook/
French: https://web.fpinnovations.ca/fr/manuel-de-construction-en-bois-hors-site/

Offsite Wood Component Types

Wood Works

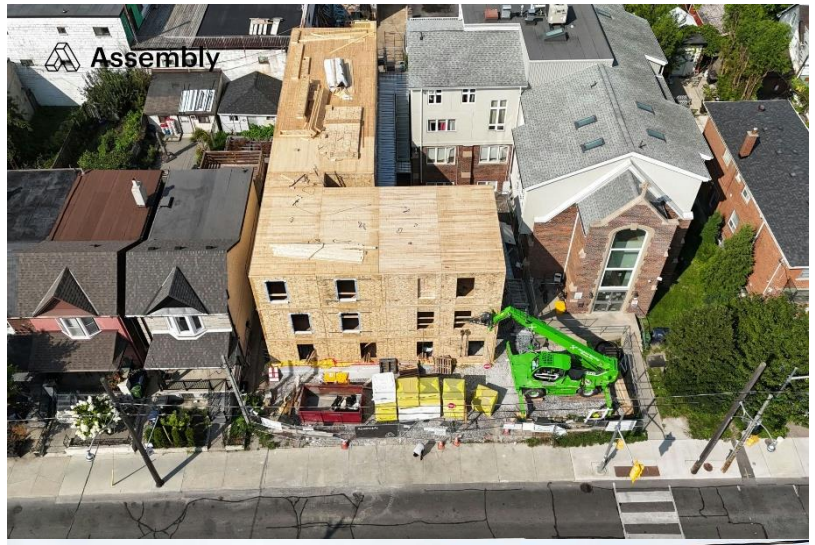
Types of Prefabricated Wood Components
2D / Panelized Components – **Light Wood Frame (LWF)**

- Exterior walls
- Interior partitions
- Loadbearing or NLB
- Hung façade
- Open panel vs closed panel

Photo courtesy of Traine Developments

Photo courtesy of Assembly Corp

Assembly Corp – 1120 Ossington Ave



Toronto – Affordable Housing
3 storeys, 25 units

Developer: St Clare's
Contractor: Loftin Management
Architect: McCallumSather
Engineer: Aspect Engineers

Types of Prefabricated Wood Components
2D / Panelized Components – **Light Wood Frame (LWF)**

- Floors
- Flat roofs
- MEP openings

Photos courtesy of Panels.ca

Types of Prefabricated Wood Components
3D / Volumetric Components – Light Wood Frame (LWF)

- Sloped roofs

Photo courtesy of Panels.ca

Types of Prefabricated Wood Components
3D / Volumetric Components – Light Wood Frame (LWF)

- Single-family homes

Photo courtesy of Royal Homes

Types of Prefabricated Wood Components
3D / Volumetric Components – Light Wood Frame (LWF)

- Multi-unit residential

Photo courtesy of Autovol

Photo courtesy of Black Box Offsite Solutions

Types of Prefabricated Wood Components
3D / Volumetric Components – Light Wood Frame (LWF)

Photo courtesy of Zeta Design + Build

Types of Prefabricated Wood Components

3D / Volumetric Components – Light Wood Frame (LWF)

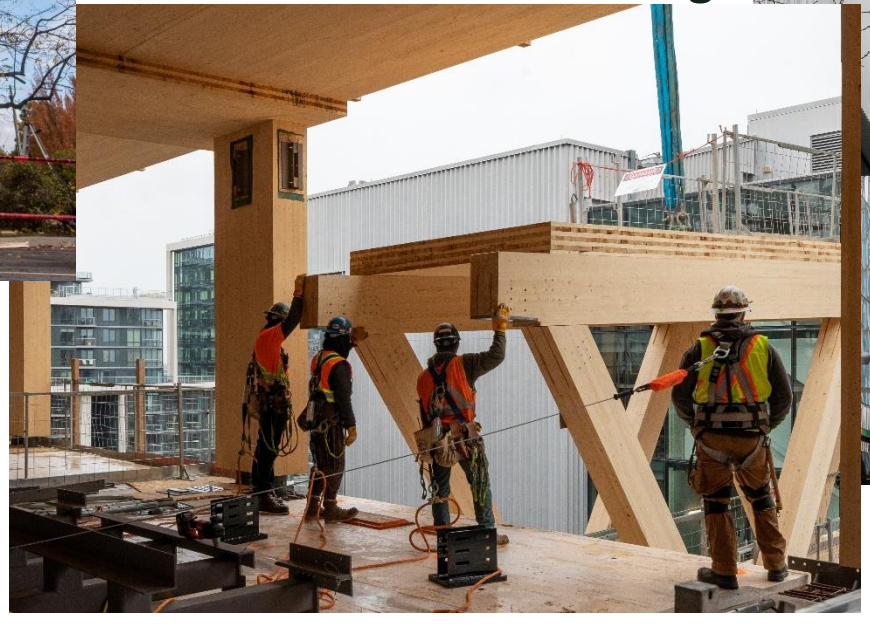
Video courtesy of BC Housing

Types of Prefabricated Wood Components
3D Volumetric Components – Mass Timber Bridges

Confederation Drive Pedestrian Bridge

Photos courtesy of Structurecraft

Limberlost Place Pedestrian Bridge



Photos courtesy of George Brown College

Types of Prefabricated Wood Components
Component Continuum

Individual elements

Photo courtesy of FII

built-up/composite elements

Photo courtesy of FII

panelized components

Photo courtesy of Auto Construct Inc.

volumetric components

Photo courtesy of Eastcut Wood Building Solutions

Types of Prefabricated Wood Components
Component Continuum

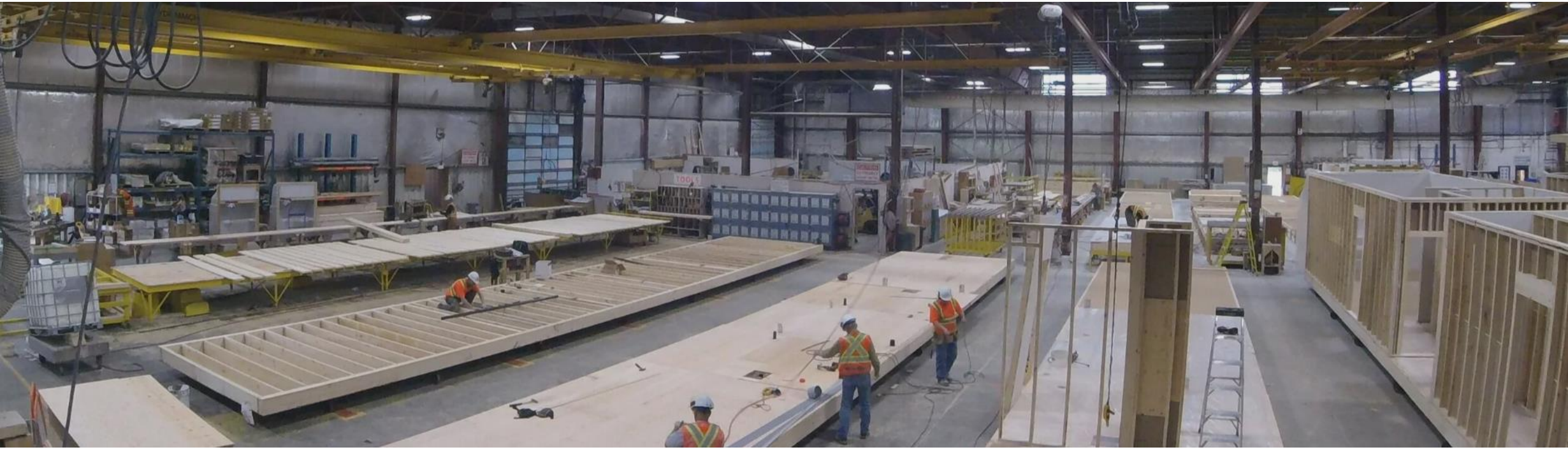
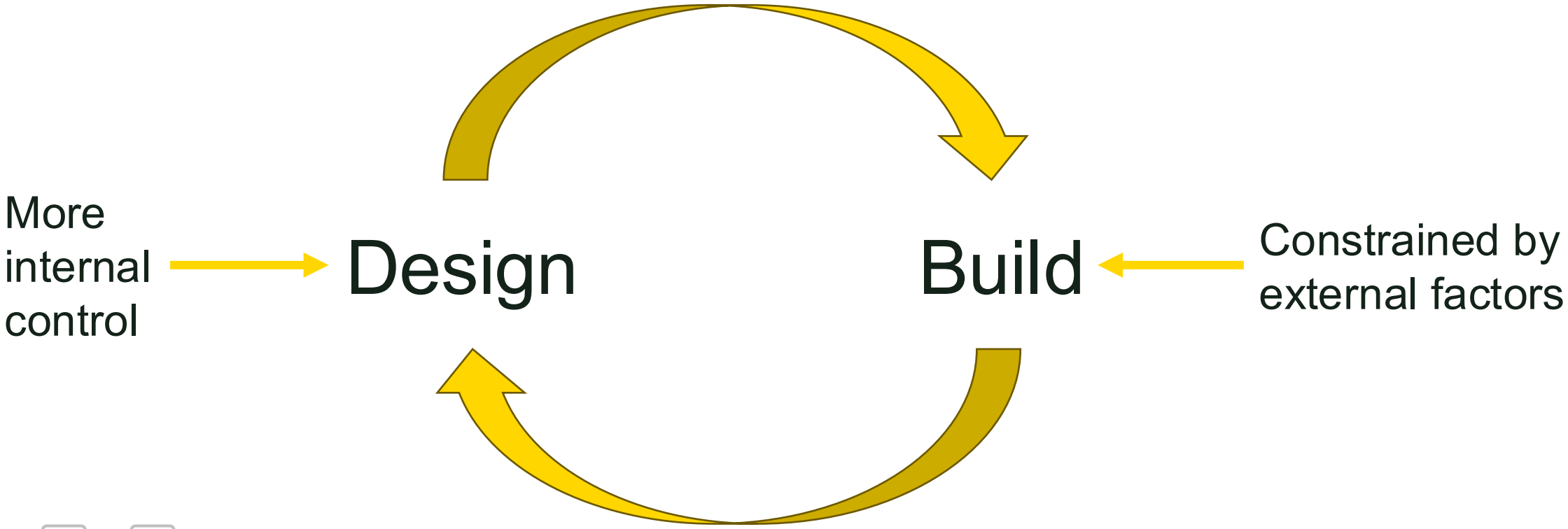


Photo courtesy of BlackBox Offsite Solutions

Design for Manufacture & Assembly (DfMA)

versus *Manufacture & Assemble* (construct) for Design



Design for Manufacture & Assembly

Manufacture	Assembly
Production size	Transportation
Materials	Site logistics
Standard details	Crane size
Minimize Waste	**Maximize efficiency**

- Prioritize prefabrication and the understanding of how things are built
- Supplier constraints are included in design process
- Develops efficiency based on specific supplier abilities/constraints

Offsite Wood Manufacturing

Wood Works

Offsite Wood Construction Handbook

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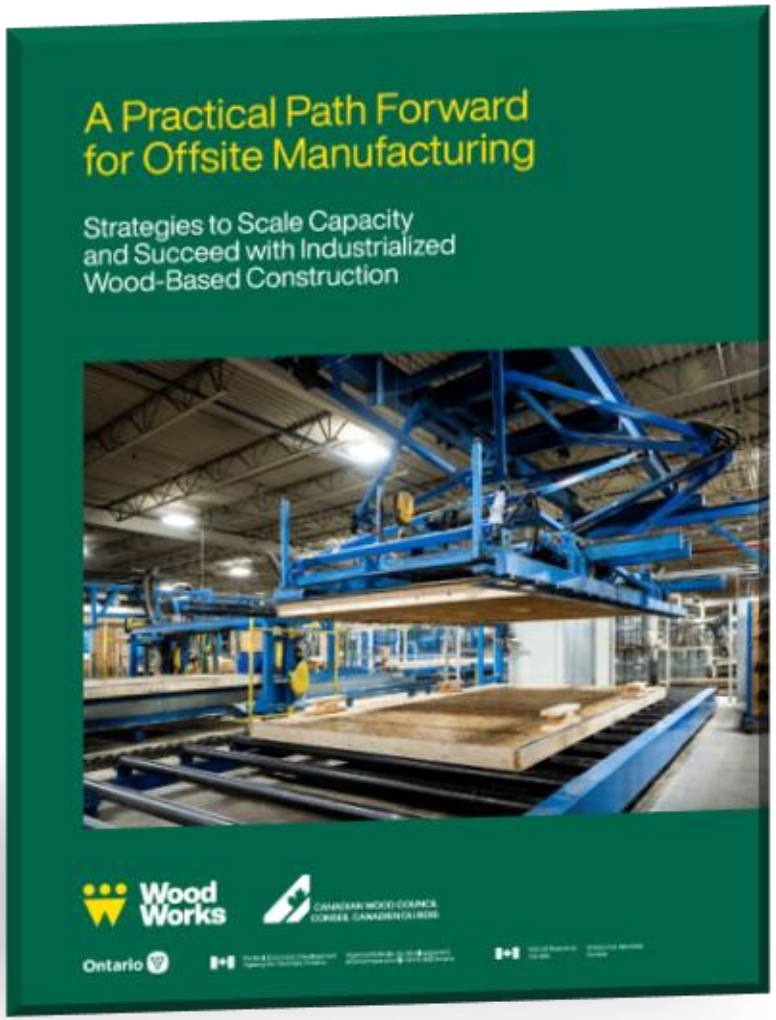
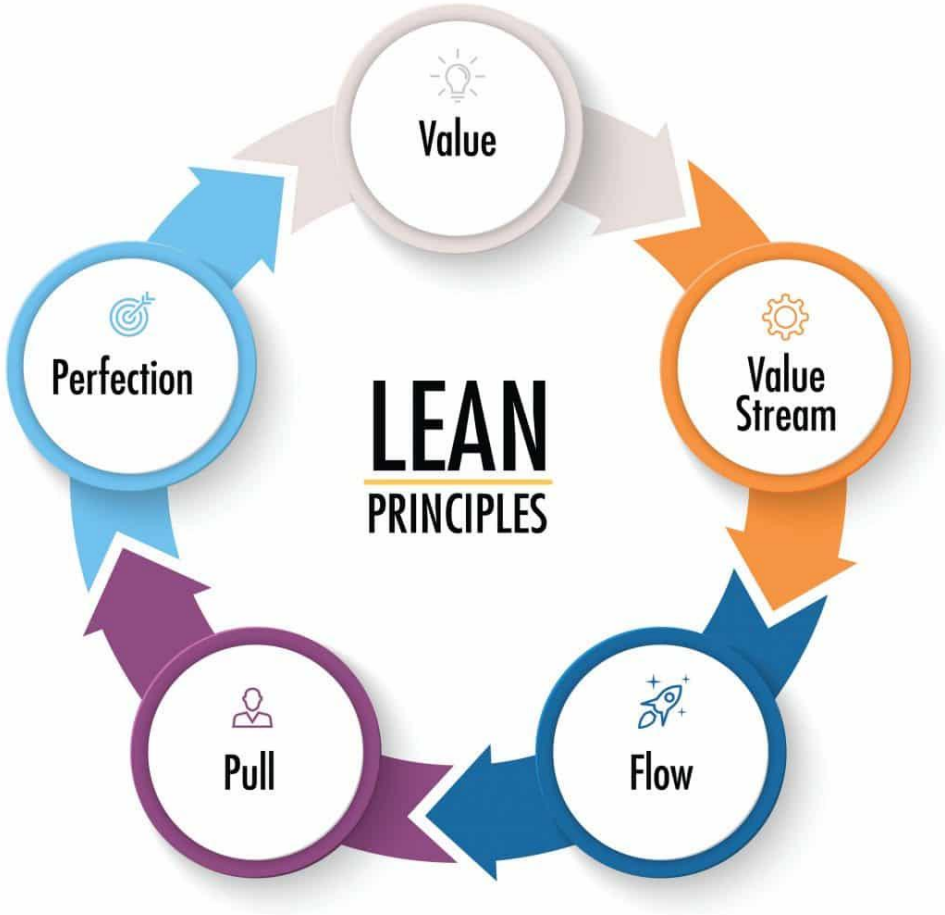


[A Practical Path Forward for Offsite Manufacturing | The Canadian Wood Council (CWC)]

Manufacturing Mindset

Three primary objectives:

- Labour efficiency
- Throughput per hour
- Waste elimination



"Expect this cultural transformation to be an extremely challenging, and sometimes painful exercise, but don't avoid it."

Manufacturing Mindset

“calculating the value of time is important”

Traditional Homebuilders

- Fixed overhead minimal
- Hard costs proportional to work performed & project income

Time = relatively low value

Prefabricated Homebuilders

- Fixed overhead exponential growth
- Hard costs fixed regardless of output

Time = critical

Practical Path Forward

objectives ➔ prefabrication ➔ product design ➔ process ➔ technology ➔ continual improvement

1 **2** **3** **4** **5** **6**

1. What are our business differentiators?
2. What type of construction is required to get us there?
3. What type of product do we want to deliver?
4. What offsite manufacturing process will be most effective to build it?
5. What type of technology can we implement to improve productivity?
6. What can we add to our manufacturing to capture more value?

Practical Path Forward – don't get ahead of yourself!

objectives ➔ prefabrication ➔ product design ➔ process ➔ technology ➔ continual improvement

"If offsite construction is mandated, as opposed to selected, it will immediately rule out the possibility of better solutions."

"as the manufacturing assets that were meant to enable production are now the constraint"

"Benchmarking is useful, but context is critical."

Automation

- Break implementation plan into **Production Centres** (i.e. design, component cutting, wall panel assembly) & *decouple*
- Identify technical talent & manufacturing technology required for each
- Prioritize & deploy investments in stages
- Have competent staff in place prior to equipment to ensure rapid up-start & production optimization

Photo courtesy of Intelligent City

"Technology is a tool, and it has its place. It enhances our performance, but it does not negate the need for skill and ability"

Practical Path Forward – don't get ahead of yourself!

objectives ➔ prefabrication ➔ product design ➔ process ➔ technology ➔ continual improvement

"If offsite construction is mandated, as opposed to selected, it will immediately rule out the possibility of better solutions."

"as the manufacturing assets that were meant to enable production are now the constraint"

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Manufacturing Mindset

Managing relationships

- Vertical integration affects external stakeholders
  - Downstream = taking on role of suppliers or trade partners
  - Upstream = encroaching on customer's territory

Home Vendor

Project Financing

Entitlements

Project Design

Home Builder

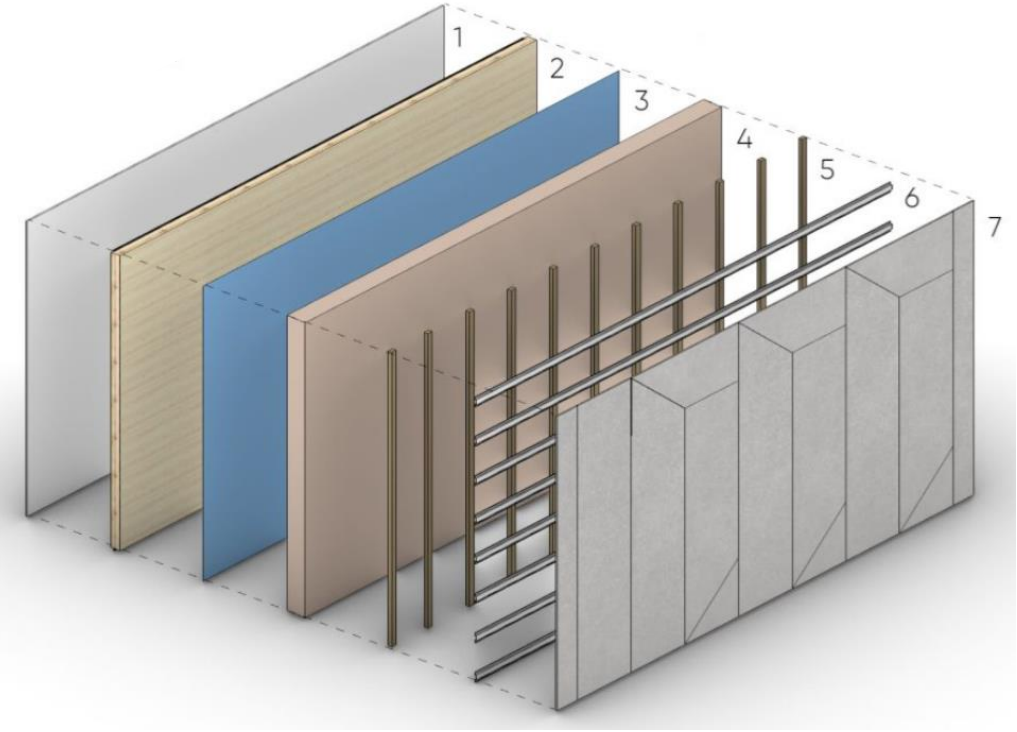
Rough Carpenter

Lumber Supplier

"At what point do we cross the line from supplier [or customer] to competitor?"

Types of Prefabricated Wood Components
Level of Completion Continuum

- Structural elements
- Membranes & flashing
- Windows & doors
- Cladding
- Insulation
- MEP
- Interior finishes
- Fixtures



“Closed panels” require CSA A277 certification

What We Do

- Mission - to expand market access & increase demand for Canadian wood products through excellence in codes, standards, regulations and education.
  - Maximize and Protect Market Access
  - Make Wood and Building Systems Easier to Use
  - Position Wood as the Preferred Building Material

Wood Works

What We Do

- ✓ Continuing Education
- ✓ No Cost Project Support
- ✓ On-demand Resources

Wood Works

WoodWorks Ontario

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Executive Director

Hailey Quiquero
Technical Manager

Dammy Olafimihan
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Mass Timber

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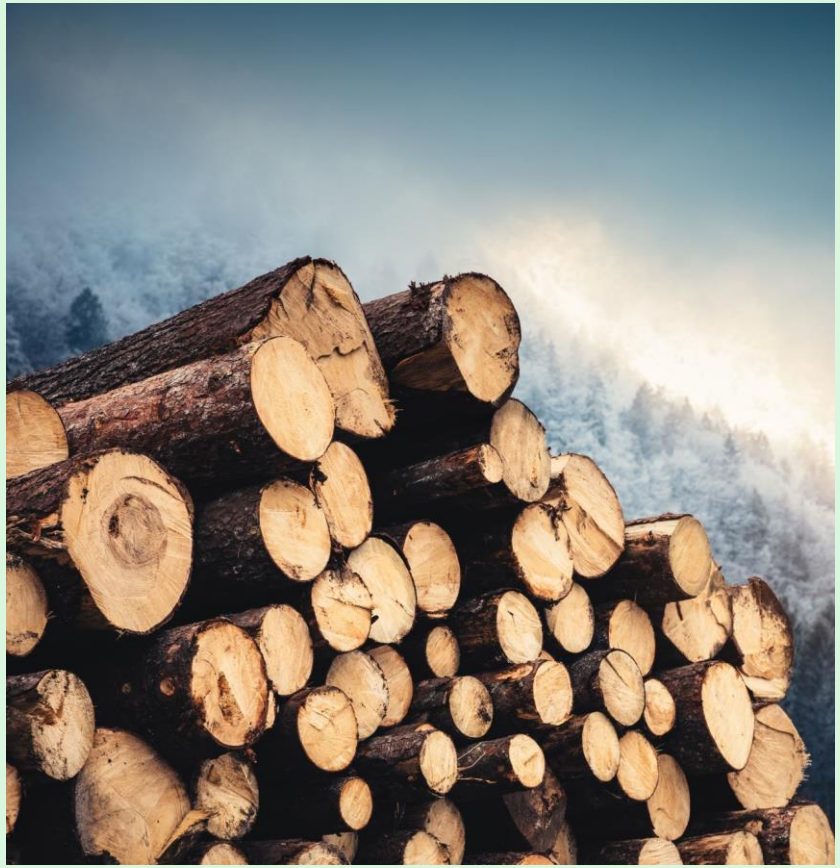
What is Mass Timber

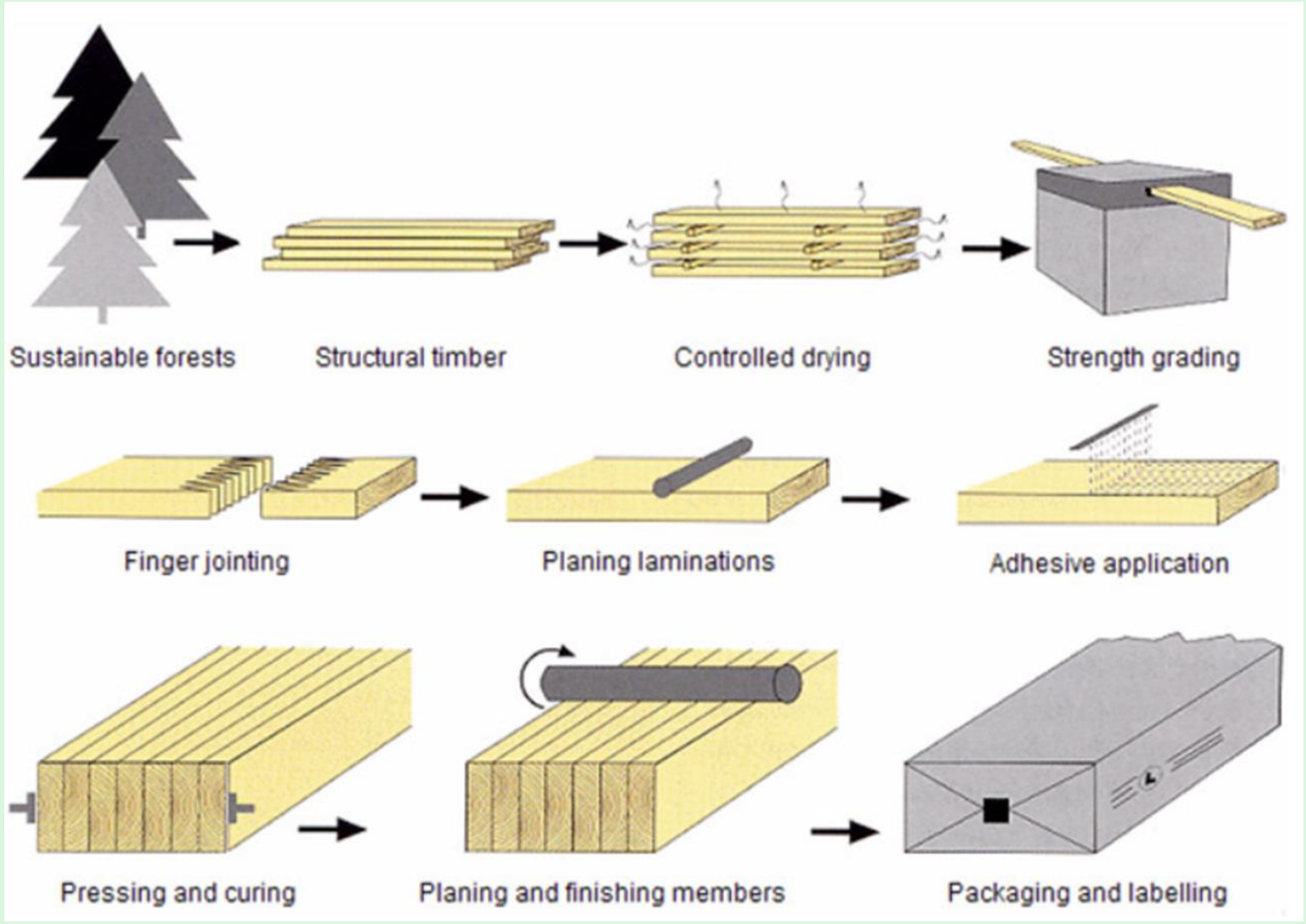
- Mass timber is a category of engineered wood products—formed by laminating or fastening layers of wood together
- Strong enough to replace steel and concrete in mid- to high-rise building structures.
- It is a sustainable, low-carbon alternative that offers faster, pre-fabricated construction, improved fire resistance through charring, and significant carbon storage.



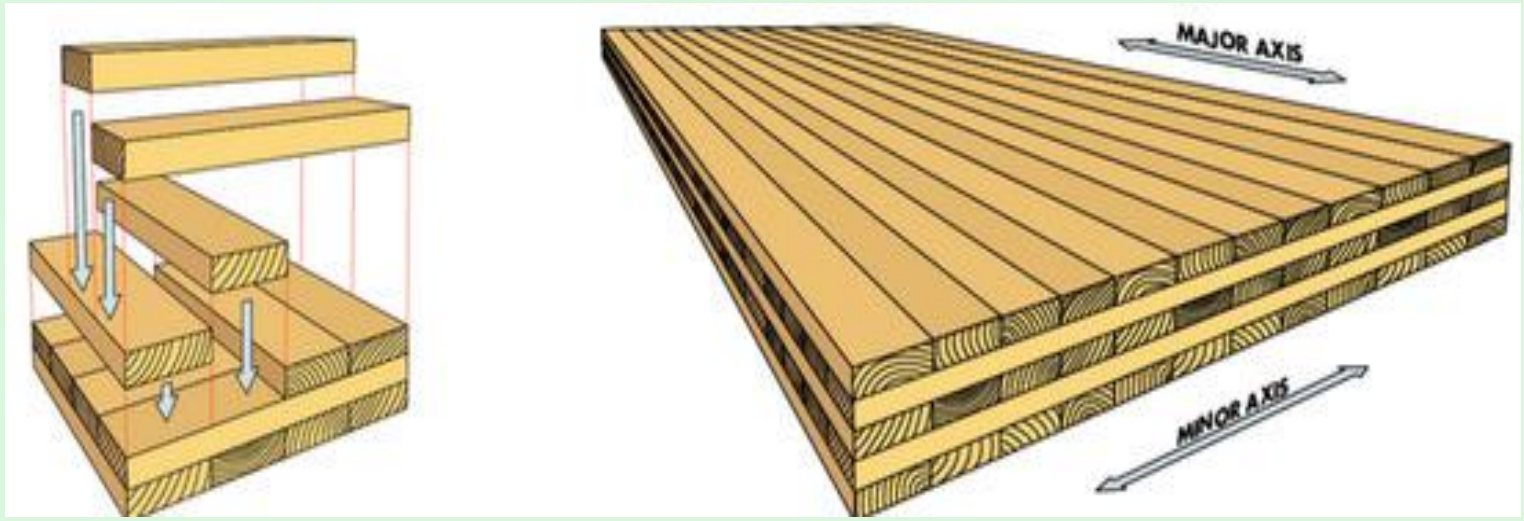
Common types of Mass Timber

- Glue Laminated Timber (GLT or Glulam)
- Cross Laminated Timber (CLT)
- Nail Laminated Timber (NLT)
- Dowel Laminated Timber (DLT)

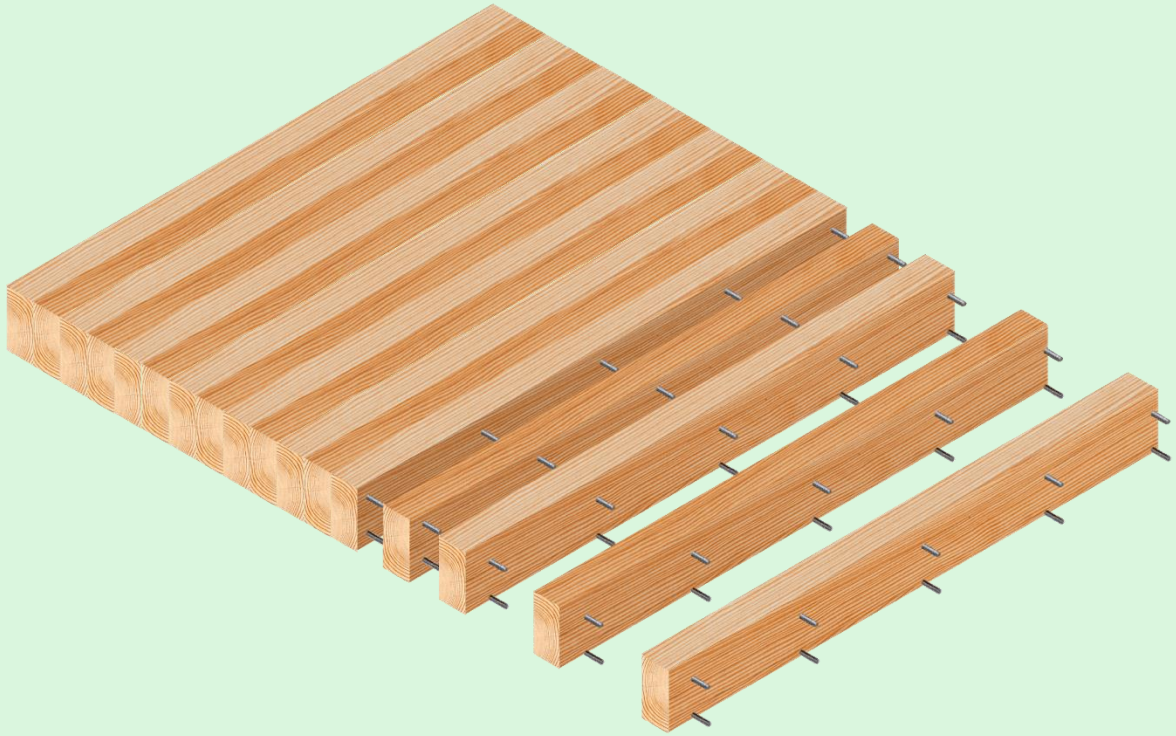
Glue Laminated Timber



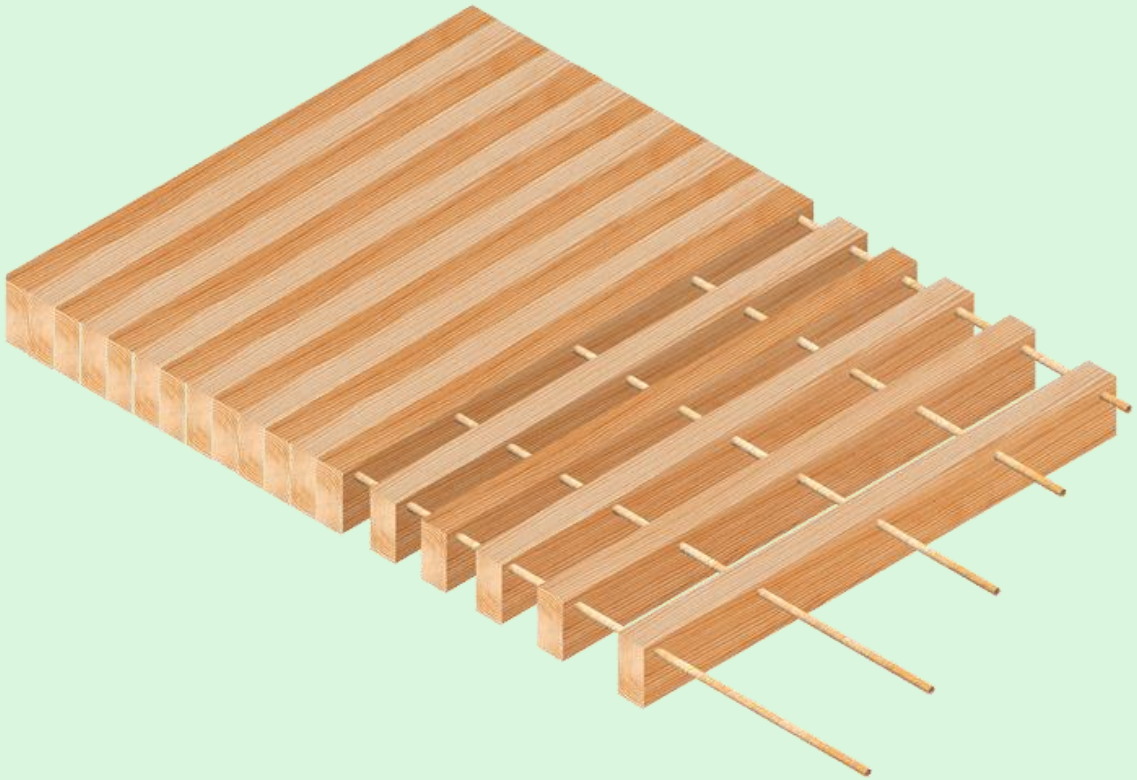
Cross Laminated Timber



Nail Laminated Timber



Dowel Laminated Timber

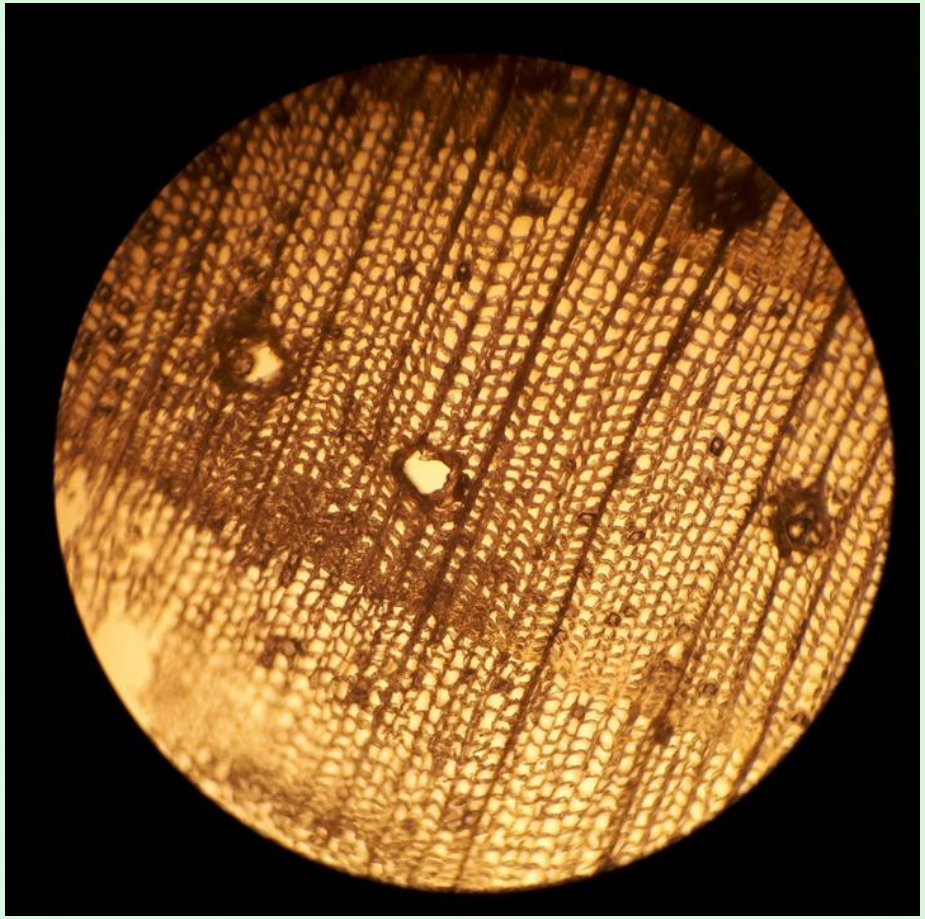


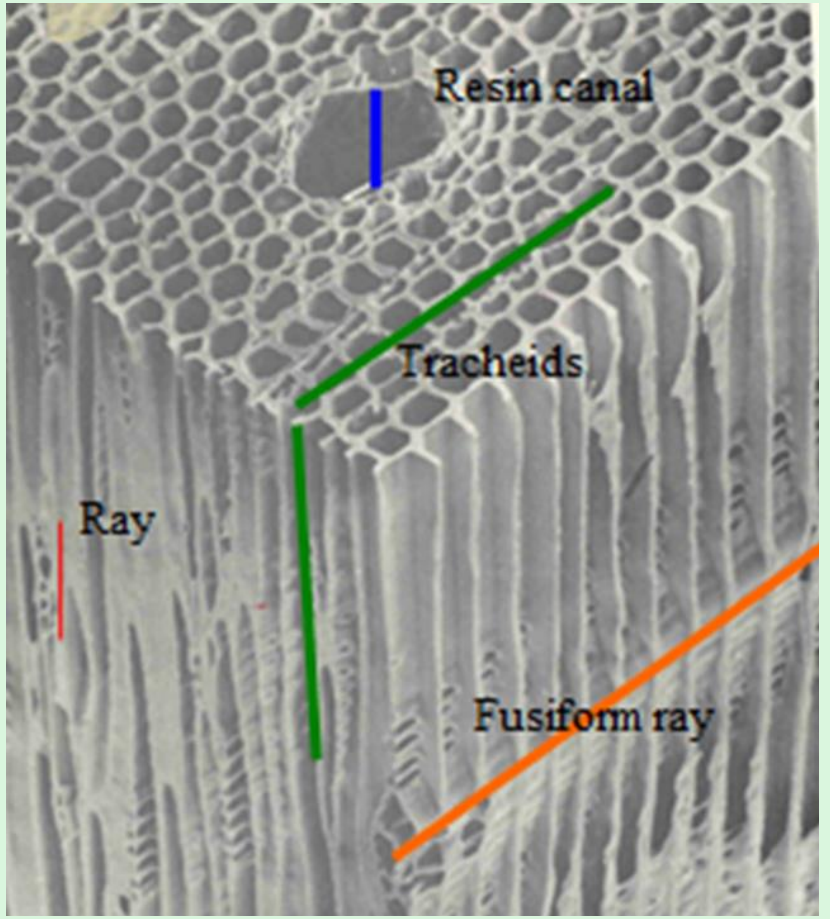
Fire Design

Fire Design

Fire Design

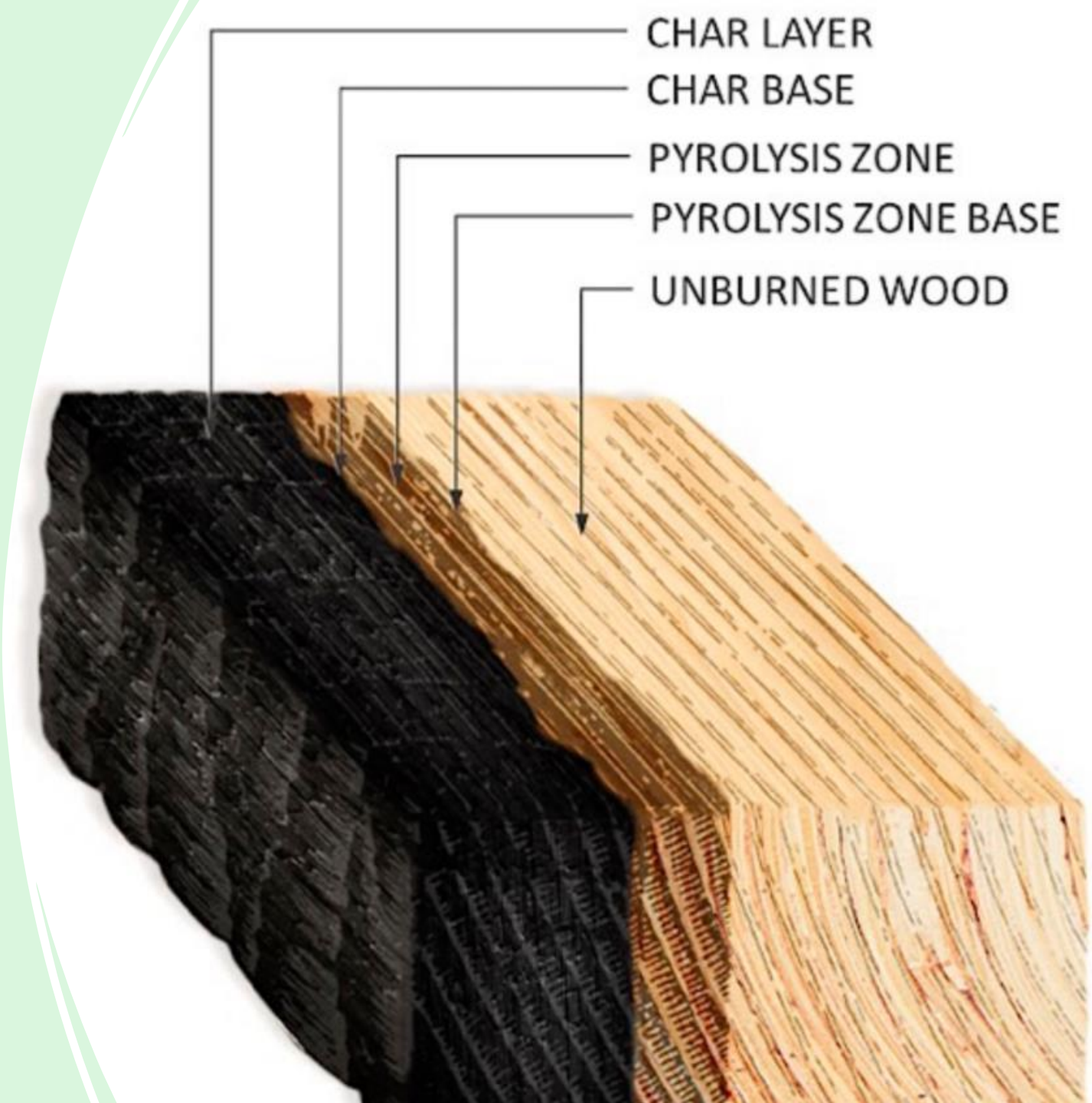
Wood up Close





Charring Effect

- The structure of wood makes it an insulator
- The charred layer amplifies the insulation properties of the wood, which protects the rest of the interior cross-section



Fire Testing

Lakehead UNIVERSITY

Prof. Sam Salem, Ph.D., P. Eng., M. SFPE

Dept. of Civil Engineering

Founder and Director, LU Fire Testing & Research Laboratory (LUFTRL)

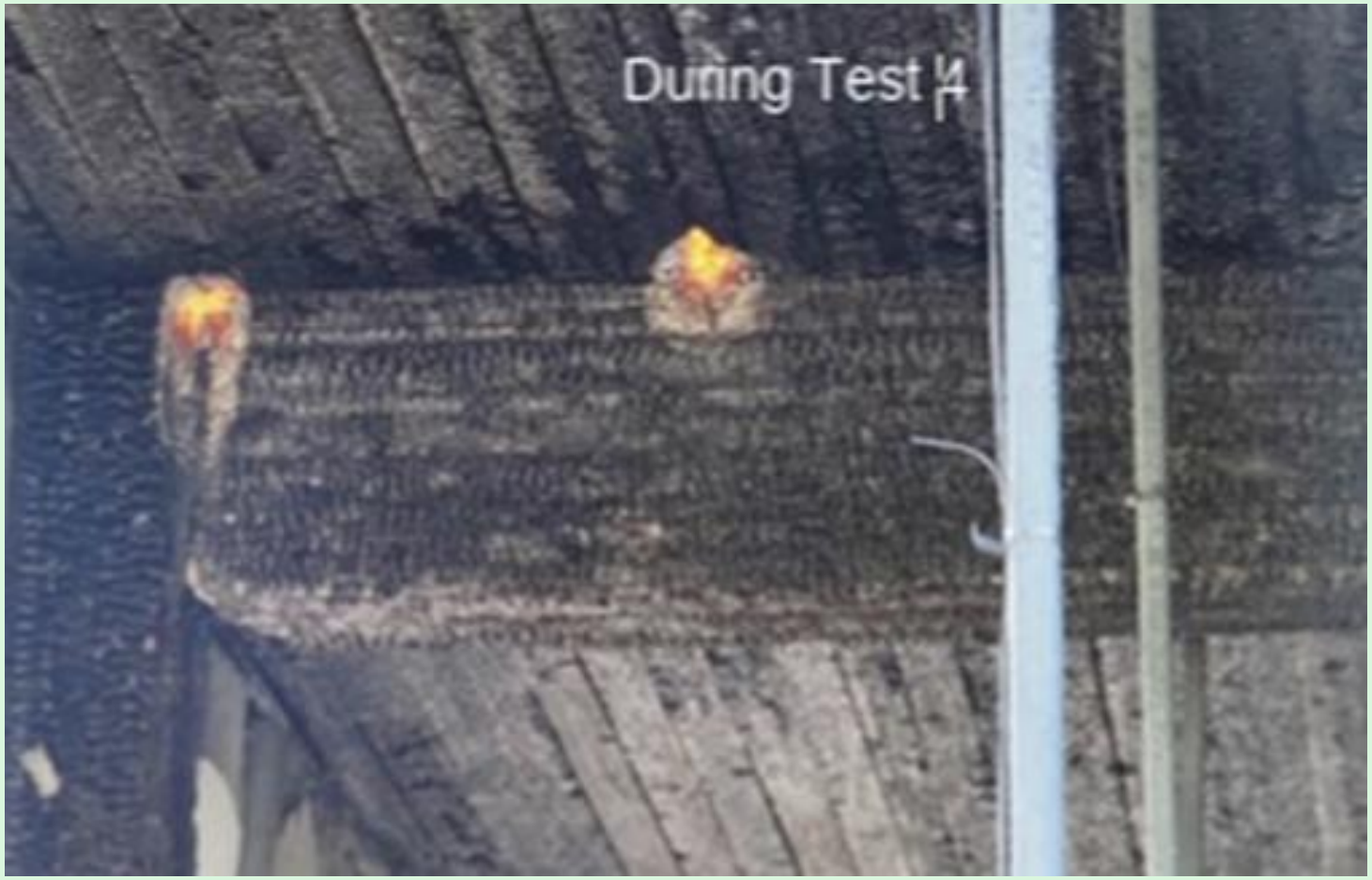
Fire Testing

Fire Testing

- A full size 2 story building was made with mass timber in Ottawa
- Multiple fire tests were performed on the building starting June 2022
- Tests included worst case scenario with no sprinklers or drywall

Fire Testing

- Once the office furniture and other fire load was burned up, the room would enter the decay stage
- Tests have shown that with the main fire load burned up, the mass timber can self extinguish
- There can be some localized hotspots that need further manual extinguishing



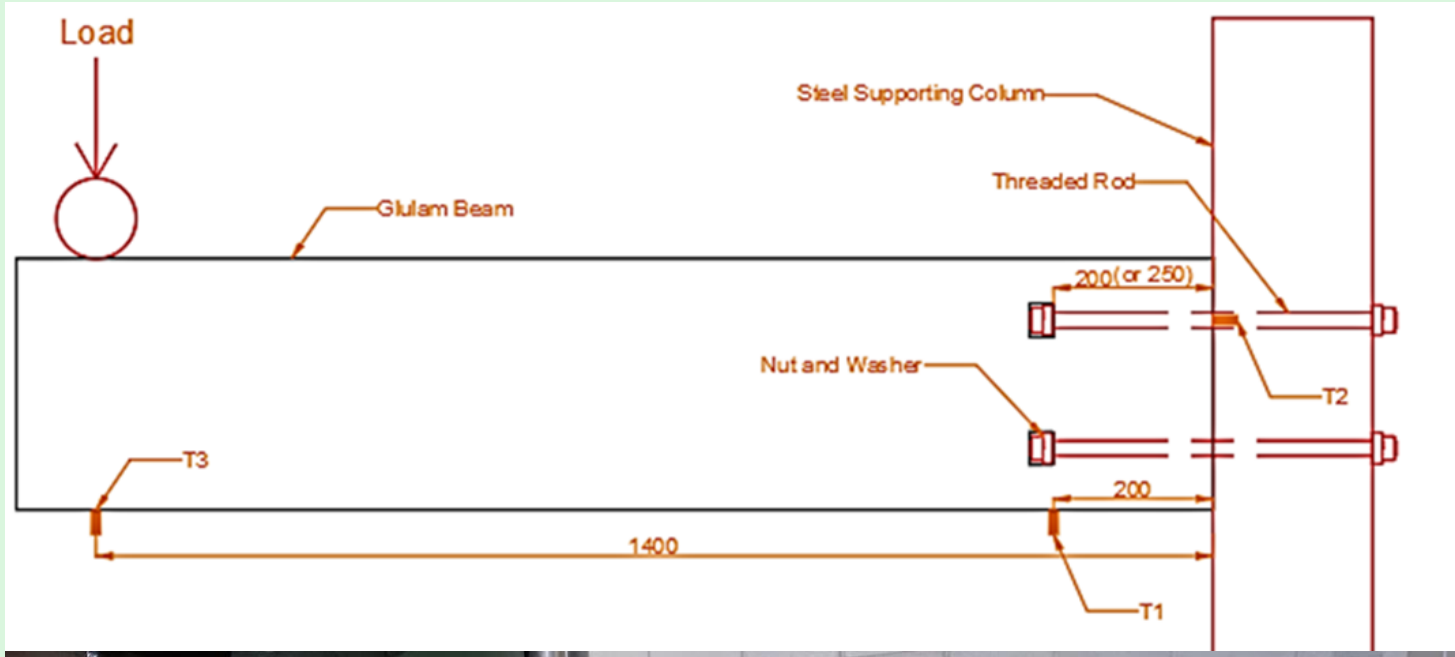
Connections

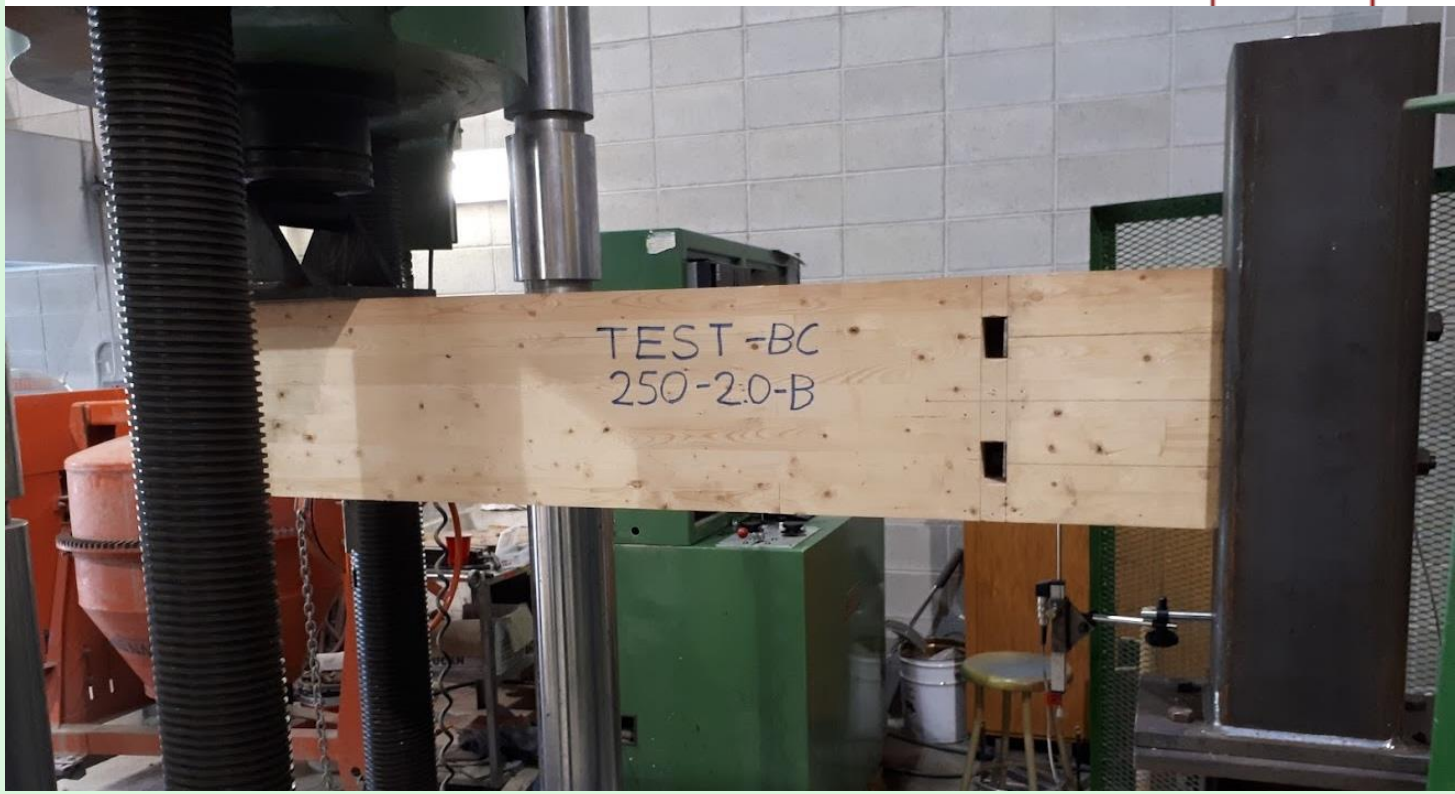
Connection Failure

- Without proper consideration for connection design, mass timber can fail prematurely in fire
- The steel bolts brought the heat into the interior cross-section of the wood causing interior charring

Connection Testing

- Use the wood to protect the connection
- Connection designed and tested at Lakehead University using common threaded steel rod, nuts, and washers



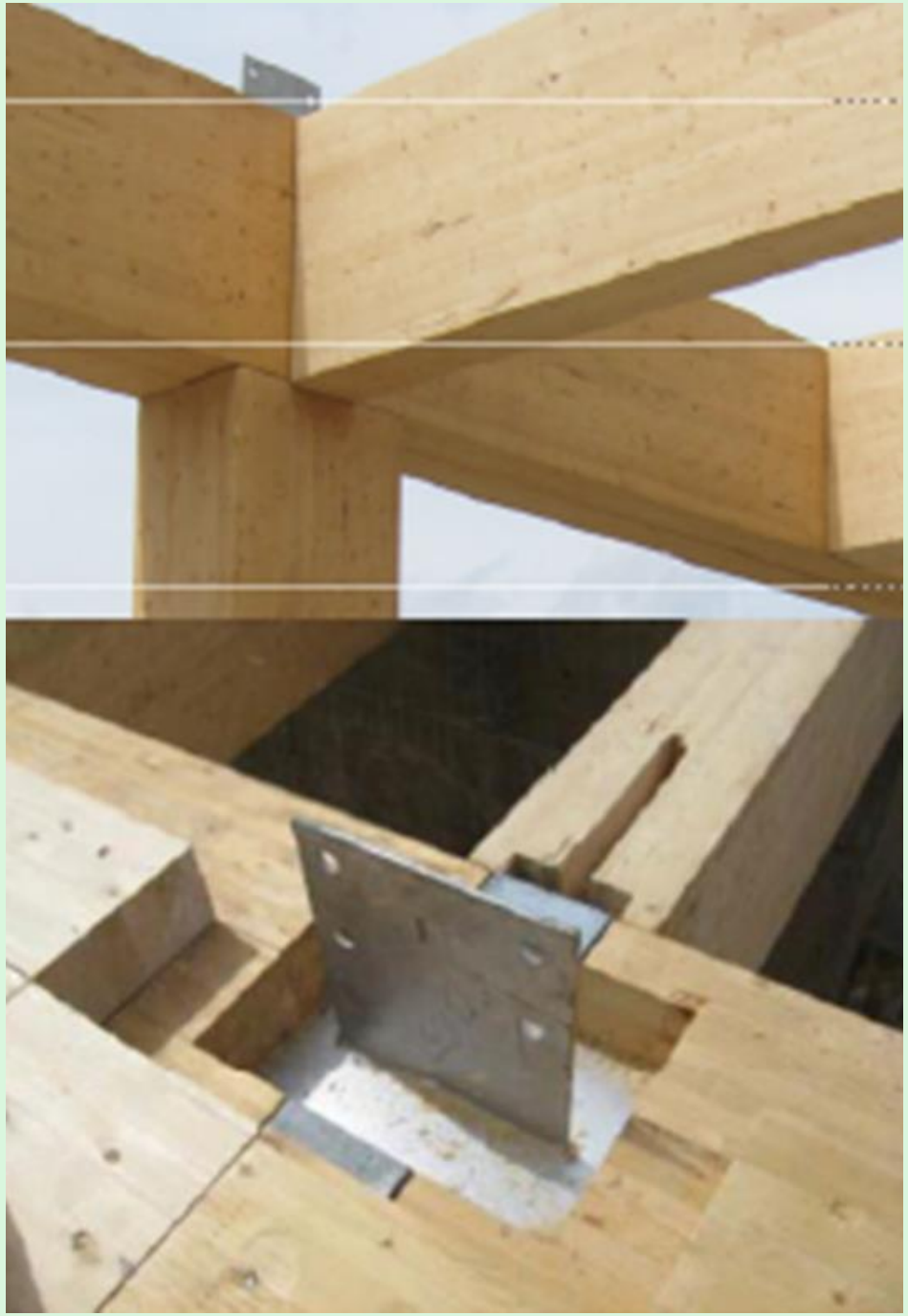


Connection Testing

- With the connection protected by the wood, the connection was able to achieve a one-hour fire rating without any added fire protection

CNC machine

CNC connections



Catalogue connections

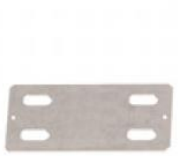
Simpson Strong-Tie

Rothoblaas

VGU PLATE T TIMBER

PLATE FOR TENSILE LOADS

CE



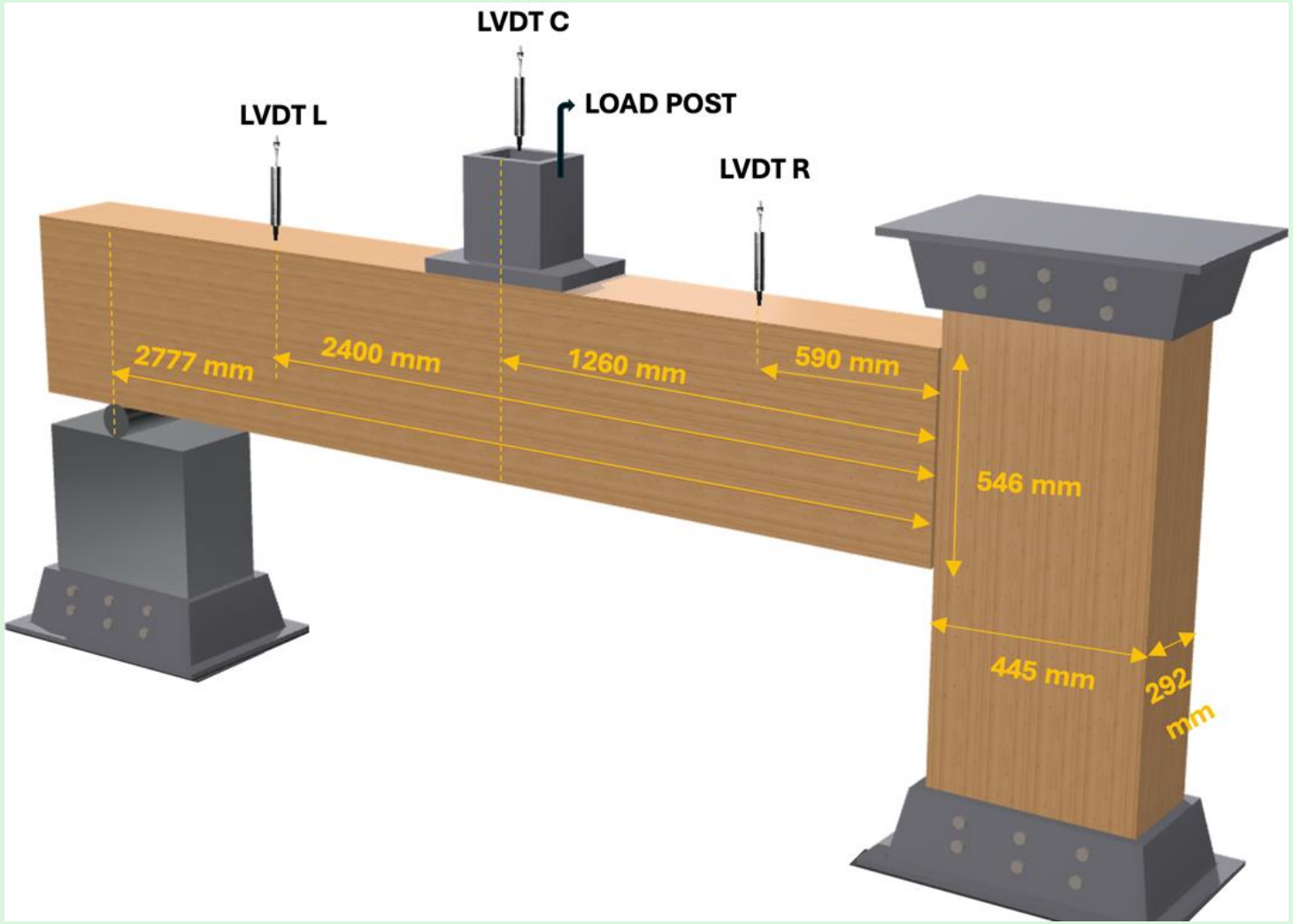
FOCUS	beam-column moment joints
TIMBER SECTIONS	from 120 x 120 mm to 280 x 400 mm
MOMENT STRENGTH	M_k up to 20 kNm
FASTENERS	VGU, VGS

Simpson Strong-Tie (SCBH) interlocking beam-to-column mass timber connectors

(Courtesy of Prof. Sam Salem, Founder and Director of LU FTRL)

Testing Tolerances

- Exposed to fire on 3 sides
- Testing various beam-column gaps from 1mm-6mm



Testing Tolerances

- Full-scale fully-concealed, interlocking beam-to-column mass timber connection underwent 2-hour standard fire exposure at LUFTRL (*Courtesy of Prof. Sam Salem, Founder and Director of LUFTRL*)

Residential Use

- Traditionally, mass timber has been used for large public structures such as arenas, schools, etc.
- With advances in the building codes and a further understanding of the capacity of mass timber, it is seeing a growing adoption in residential use

Glulam Use

- 9 housing units built for Shoal Lake #39
- (Courtesy of Cornerstone Timberframes)

CLT Use

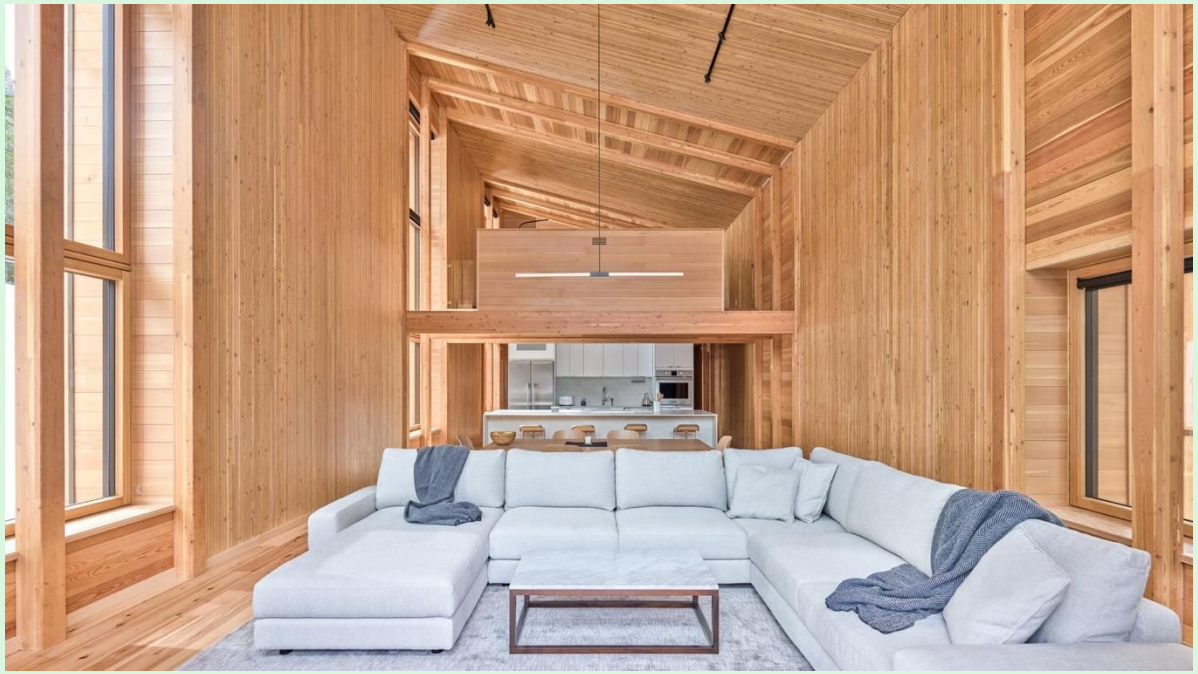
- CLT modular housing kits
- (Courtesy of Kalesnikoff)

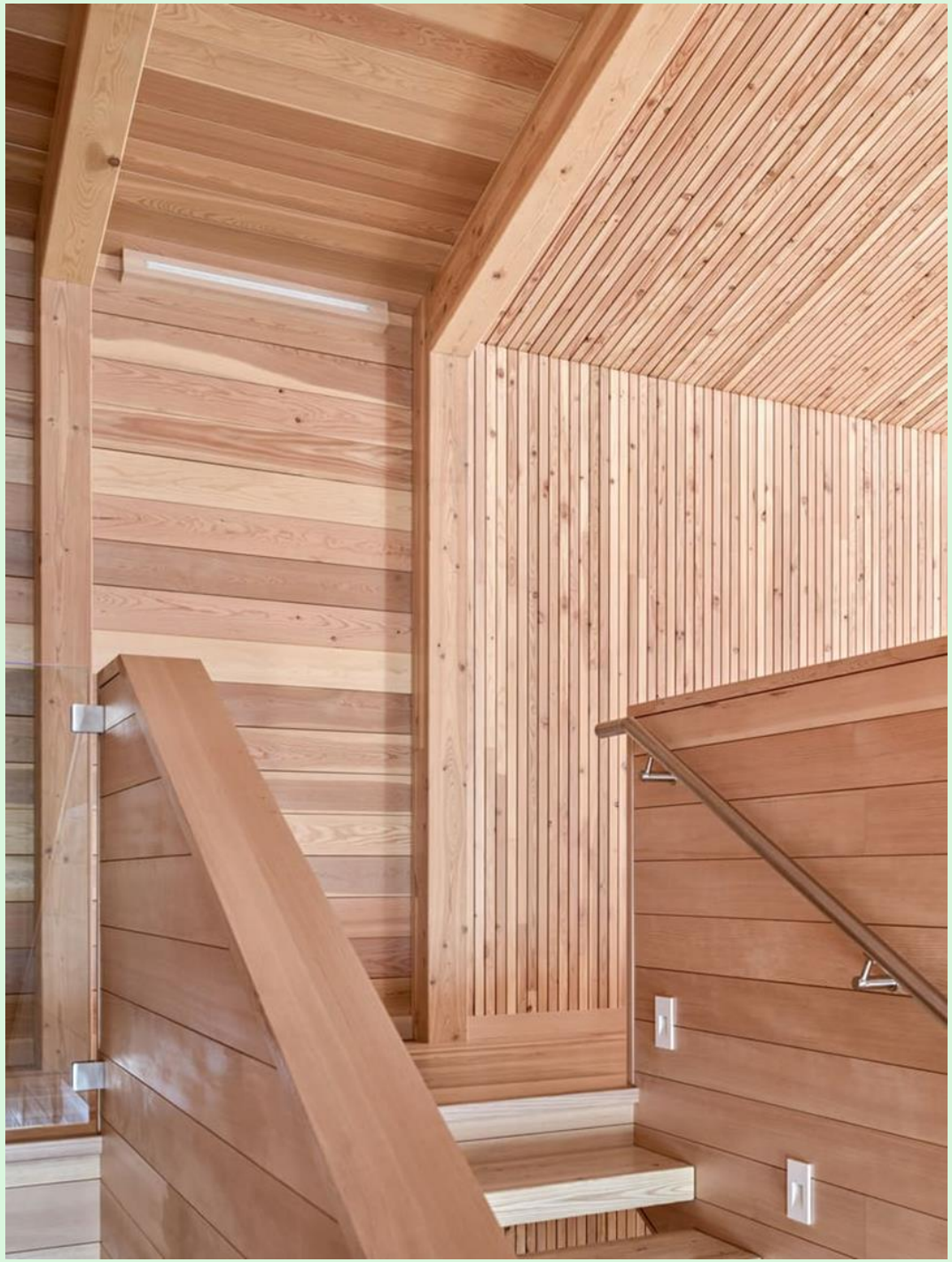
NLT Use

- NLT panelized housing kits made from stud grade lumber built in the Nak'azdli Whut’en community
- (Courtesy of Nak’azdli Development Corporation)

DLT Use

- DLT panelized house built in Soo Valley, BC
- (Courtesy of DowelLam)





Hybrid Use

- Built with light wood frame walls and CLT floor slabs

Thank You