MASS TIMBER OVERVIEW What Is It, Applications, & Limitations



HOFFMAN CONSTRUCTION COMPANY

MASS TIMBER EXPERIENCE









HAYWARD FIELD







TCORE





LAKEVIEW OFFICE BUILDING



LMU

© LMN Architects

UC BERKELEY ACADEMIC BUILDING



LMN

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MUKILTEO MULTIMODAL FERRY TERMINAL







© Benjamin Benschneider

UW FOUNDERS HALL





© Tim Griffith



Mass Timber Definition Product Types Construction Types Benefits Challenges **Project Types Resources**

WHAT IS MASS TIMBER?



Heavy timber construction uses large, rustic, heavy sawn timbers joined together with traditional-mortise and tenon joinery or modern metal joinery.

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Image: Masin Building, Pioneer Square, Seattle (hstconstruction.com) Text: Adapted from Buildipedia (buildipedia.com)

Mass timber uses state-of-the-art technology to glue, nail, or dowel wood products together in layers. The results are large structural panels, posts, and beams

Image: First Tech Credit Union, Hacker Architects (hackerarchitects.com) Text: Adapted from naturally:wood (naturallywood.com)





Image: Wood Works (woodworks.com) Text: Adapted from naturally:wood (naturallywood.com

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Image: Portland International Airport, ZGF Architects (timberlab.com) Text: Adapted from naturally:wood (naturallywood.com)

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PRODUCT TYPES

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LAMINATED STRAND LUMBER (LSL)

To make LSL, thin strands of wood are aligned parallel to the length of the member and glued together.



PARALLEL STRAND LUMBER (PSL)

PSL is manufactured from veneers that are clipped into long strands, laid in a parallel formation, and then bonded together with an adhesive. The difference between PSL and LSL is the higher lengthto-thickness ratio of the strands in PSL.

PRODUCT TYPES | GLUE-LAMINATED TIMBER



To form a **glulam** component, wood laminations (dimensional lumber) are positioned according to their stress-rated performance characteristics. The laminations are jointed end to end, allowing for long spans, and are bonded with a durable, moisture-resistant adhesive.

PRODUCT TYPES | NAIL-LAMINATED TIMBER



laminations mechanically fastened together with nails or screws.

To create **NLT**, dimension lumber is placed on edge with individual

from ThinkWood (thinkwood.com)

PRODUCT TYPES | DOWEL-LAMINATED TIMBER



lumber panels are stacked like NLT and friction-fit together with hardwood dowels.

To form **DLT** members, softwood

from ThinkWood (thinkwood.com)

PRODUCT TYPES | CROSS-LAMINATED TIMBER



CLT panels consist of layered lumber boards (usually three, at 90-degree angles and glued into place. Finger joints and structural adhesive connect the boards.

five, or seven) stacked crosswise

from ThinkWood (thinkwood.com)

CONSTRUCTION TYPES

CONSTRUCTION TYPES | IBC 2000-2015



- Fire Rating: N/A (~1-hour)
- 0% covered MT Walls:
- MT Ceilings: 0% covered

CONSTRUCTION TYPES | IBC 2018



MT Ceilings: 80% covered

MT Ceilings: 100% covered

MT Ceilings: 0% covered



- Fire Rating: N/A (~1-hour)
- MT Walls: 0% covered
- MT Ceilings: 0% covered

CONSTRUCTION TYPES | IBC 2021





- Fire Rating: N/A (~1-hour)
- MT Walls: 0% covered
- MT Ceilings: 0% covered

CONSTRUCTION TYPES | OTHER PROVISIONS

 Combustible construction forming concealed spaces shall be protected with noncombustible protection or sprinklers.



EMBODIED CARBON REDUCTION

Over the next 40 years, the world's building stock is expected to double an increase of >2.5 trillion square feet. This explosion of growth is equivalent to adding an entire New York City to the planet every 35 days for the next four decades.

Without intervention, business-as-usual construction would alone consume 60% of the remaining global carbon budget (500 GtCO2e) if humanity is to limit global temperature rise to 1.5 °C.





from Aureus Earth (aureusearth.com)

EMBODIED CARBON REDUCTION

Using life cycle analysis, researchers found that substituting wood for concrete and steel in commercial buildings cut GHG emissions by an average of 60%.



Concrete + Steel

Wood

BIOPHILIC BENEFITS

Biophilia: Relating to, showing, or being the human tendency to interact or be closely associated with other forms of life in nature.

BIOPHILIC BENEFITS | STRESS REDUCTION



Image: Minskoff Pavilion, LMN Architects © Adam Hunter. Text: adapted from Think Wood (thinkwood.com), based on Wood in the human environment: restorative properties of wood in the built indoor environment, David Robert Fell, UBC

A 2010 study conducted by the University of **British Columbia** demonstrated the stressreducing effects of wood and plants on the autonomic nervous system.

BIOPHILIC BENEFITS | PRODUCTIVITY

A 2018 study commisioned by Forest and Wood Products Australia found a correlation between the presence of wood lower absenteeism, higher levels of concentration, and improved productivity.



Workplaces: Wellness + Wood = Productivity, Polinate (planetark.org)

BIOPHILIC BENEFITS | ENVIRONMENTAL



Wood is hypoallergenic and promotes good air quality.

Wood helps absorb sound.

Wood helps regulate temperature and humidity.

BIOPHILIC BENEFITS | NATURE, PLACE, & HISTORY

Along with daylight and views, wood helps promote a connection to nature, place, and history - especially in the Pacific Northwest.



Image: Mukilteo Multimodal Ferry Terminal, LMN Architects and artist Joe Gobin © 2021 Benjamin Benschneider

BIOPHILIC BENEFITS | DELIGHT



Wood creates spaces where people want to be.

Image: PACCAR Hall, LMN Architects © LaCasse Photography

CONSTRUCTION BENEFITS | SCHEDULE IMPROVEMENTS

Get on decks faster.

MEP easier, installs direct to wood ceiling in lieu of inserts in concrete deck.

No reshoring required.



Image: Founders Hall, LMN Architects © Adam Hunter

CONSTRUCTION BENEFITS | SEQUENCING



Materials are delivered Just In Time, very little laydown required.

Build core, then decks.

Approximately 10 days per floor.

CONSTRUCTION BENEFITS | EXPERIENCE

Fun to build, simple process.

Easy to modify and adjust.



Image: Founders Hall, LMN Architects © Adam Hunter

FUNDING BENEFITS | CARBON OFFSETS



Aureus Earth created an offset program to monetize the carbon storage or reduction potential in building or infrastructure projects. This new revenue stream subsidizes the purchase of carbon-storing and low-carbon building

materials.

CHALLENGES

DESIGN AND PERMITTING CHALLENGES

Panel types (CLT, DLT, NLT, etc.) are manufacturerspecific, not universal.

Deeper beams (typically).

Mass timber lateral systems are not codified (requires brace frames or sheer walls in steel or concrete).





0'-7" CLT Floor Deck 1'-8" Glulam Beams 1'-8" Max HVAC Duct 0'-10" Ligting and Ele 9'-0" Clear

0'-3" Concrete Topping Slab

DESIGN AND PERMITTING CHALLENGES



gypsum sheathing,

industry.



Additional protection for concealed spaces (requires sprinklers, or mineral wool).

Unfamiliarity within AEC

Unfamiliarity with AHJs.

CONSTRUCTION CHALLENGES



Sequence

- Critical to get it right
- handling if not

More equipment • Two cranes if concrete

• Just in time deliveries • Requires substantial laydown and double

CONSTRUCTION CHALLENGES

Screw replacement

Sun exposure

- Wood may look different if placed together from separate deliveries
- Mechanical, Electrical, & Plumbing (MEP) surface mounted
 - Takes time to make it look intentional/clean



CONSTRUCTION CHALLENGES



New to commercial projects Less familiar

- Industry still getting comfortable

difficult to protect from staining

- deck

Weather protection more

• Metal shavings or dust • Water leaching through

PROJECT TYPES

PROJECT TYPES

Better for Mass Timber

- Buildings with a uniform grid/repeatable floor patterns
- Office
- Residential
- Schools
- Cultural spaces
- Light commercial

Better for Concrete or Steel

- MEP-heavy buildings
- Laboratories or fabrication plants with vibration limitations
- Prisons
- codes
- require steel (wood span limitations)

Hospitals and sterile spaces

Spaces with specialized fire

Large span spaces that may



RESOURCES

Think Wood

- Mass timber website (US)
- Mass Timber Design Manual
- Wood in the human environment: restorative properties of wood in the built indoor environment
- Workplaces: Wellness + Wood = **Productivity**

Wood Works

• Mass timber website (US)

naturally:wood

• Mass timber website (BC)



Mass Timber

Design Manual



naturally:wood®

vol.2

RESOURCES

LMN Architects

• Path to Zero Carbon: Embodied Carbon 101

Aureus Earth

• Carbon offset program website

International Mass Timber Conference

<u>Conference website</u>





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