How do contractors answer the ever-growing demand from architects and ownership groups for mass timber buildings? The growth of this budding industry can be slowed by a lack of will and lack of know-how among seasoned construction professionals who know how to build, understand the onus of "architectural intent," and must ultimately take on financial responsibility to deliver the dream of a new building system. This presentation will introduce mass timber products and building systems and then consider why some mass timber projects die at concept, what leads to the resistance, and how the development, architectural, engineering, and construction community can overcome assumptions to achieve success with mass timber projects of various scales and typologies. Particular emphasis will be given to preconstruction coordination, holistic approaches to costing and scheduling studies, project delivery methods, and how to achieve the highest level of cost efficiency.

Course Description

1. Understand the preconstruction manager’s role in material procurement and MEP coordination of code-compliant mass timber projects.
2. Highlight effective methods of early design-phase cost estimation and building official interaction on code compliance topics that keep mass timber options on the table.
3. Discuss potential construction schedule savings and construction fire safety practices realized through the use of prefabricated mass timber elements.
4. Explore best practices for interaction between manufacturer, design team and preconstruction manager that can lead to cost efficiency and safety on site.

Learning Objectives
OVERVIEW | TIMBER METHODOLOGIES

Heavy Timber
Photo: Benjamin Benschneider

Mass Timber
Photo: John Stamets

Light Wood - Frame
Photo: WoodWorks

Glue Laminated Timber (Glulam)
Beams & Columns

Cross-Laminated Timber (CLT)
Solid sawn laminations

Cross-Laminated Timber (CLT)
SG laminations

Dowel-Laminated Timber (DLT)

Nail-Laminated Timber (NLT)

Photo: StructureCraft
Photo: LEVER Architecture
Photo: Freres Lumber
Photo: Ema Peter
Photo: Think Wood
Photo: StructureCraft
Photo: Manasc Isaac Architects/Fast + Epp

OVERVIEW | MANUFACTURING

Structural Solutions | Post, Beam + Plates

Structural Solutions | Post, Beam + Plates

OVERVIEW | MANUFACTURING

Structural Solutions | Post, Beam + Plates

Structural Solutions | Post, Beam + Plates
CURRENT STATE OF MASS TIMBER PROJECTS

As of July 2019, 599 multi-family, commercial, or institutional projects have been constructed out of mass timber across the U.S., or they’re currently in design.


PRECEDENT PROJECTS

<table>
<thead>
<tr>
<th>UMASS AMHERST DESIGN BUILDING</th>
</tr>
</thead>
</table>

Stage
Construction Started / Built
In Design

PRECEDENT PROJECTS | DALSTON WORKS
Photos: Daniel Shearin | Waugh Thistleton Architects

PRECEDENT PROJECTS | Midthamstet Norway
Photos: Espen Mester | Voll Arkitekter

MASS TIMBER PRODUCTS

Glue Laminated Timber (GLT)

Glue Laminated Timber (GLT)

Cross-Laminated Timber (CLT)
Cross-Laminated Timber (CLT)  
With solid sawn laminations

General Panel thicknesses*  
4 1/8" to 19 1/2"  
*Consult with manufacturers for available panel sizes

General Panel dimensions*  
4 to 12 ft wide  
24 to 64 ft long

Nail-Laminated Timber (NLT)  
Photo: StructureCraft

Dowel-Laminated Timber (DLT)  
Photo: StructureCraft

Other Mass Timber Product Options  
Photos: StructureCraft

Decking
Mass Timber in Low- to Mid-Rise: 1-6 Stories in Construction Types III, IV or V

Credit: Susan Jones, atelierjones

Source: AWC's TR 10

Mass Timber's Fire-Resistive Performance is Well-Tested, Documented and Recognized via Code Acceptance

Credit: David Barber, ARUP

Mass Timber Fire Design Resource
- Code compliance options for demonstrating FRR
- Updated as new tests are completed
- Free download at woodworks.org

Source: AWC's NDS
THREE KEY POINTS:
1. Mass timber is a custom building system, not a commodity.
2. Select the right partners for your project.
3. Assess projects holistically when estimating costs.
Procurement Strategy is Key to Success

Risk: Perception of a Commoditized Material

Risk Mitigation: Embrace the Prefab Advantage

Risk: Lack of Supply Chain Understanding

Risk Mitigation: Complementary Procurement

Schedule Savings for Rough-In Trades
Anatomy of a Turnkey Mass Timber Package

- Project Overhead: 7%
- Labor: 15%
- Material: 14%
- Equipment: 64%

Material (Direct Cost)

- Project Overhead: 7%
- Labor: 15%
- Material: 14%
- Equipment: 64%

Labor (Direct Cost)

- Project Overhead: 7%
- Labor: 15%
- Material: 14%
- Equipment: 64%

Equipment (Direct Cost)

- Project Overhead: 7%
- Labor: 15%
- Material: 14%
- Equipment: 64%

Value Analysis

\[ \text{Value} = \frac{\text{Function} + \text{Aesthetics}}{\text{Cost}} \]
Value Analysis

Value Engineering = \frac{\text{Function} + \text{Aesthetics}}{\text{Cost}}

Cost: Construction Type

<table>
<thead>
<tr>
<th>Building Element</th>
<th>1A</th>
<th>1B</th>
<th>2A</th>
<th>2B</th>
<th>3A</th>
<th>3B</th>
<th>4A</th>
<th>4B</th>
<th>5A</th>
<th>5B</th>
<th>V.A</th>
<th>V.B</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ext. Bearing Walls</td>
<td>3&quot;</td>
<td>2&quot;</td>
<td>2&quot;</td>
<td>2&quot;</td>
<td>2&quot;</td>
<td>2&quot;</td>
<td>2&quot;</td>
<td>1&quot;</td>
<td>0&quot;</td>
<td>0&quot;</td>
<td>1 V.</td>
<td>0 V.</td>
</tr>
<tr>
<td>Int. Bearing Walls</td>
<td>2&quot;</td>
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<td>1&quot;</td>
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<td>0&quot;</td>
<td>1&quot;</td>
<td>0&quot;</td>
<td>0&quot;</td>
<td>1 V.</td>
<td>0 V.</td>
</tr>
<tr>
<td>Floor Construction</td>
<td>2&quot;</td>
<td>2&quot;</td>
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<td>2&quot;</td>
<td>0&quot;</td>
<td>1&quot;</td>
<td>0&quot;</td>
<td>0&quot;</td>
<td>1 V.</td>
<td>0 V.</td>
</tr>
</tbody>
</table>

*These values can be reduced based on certain conditions in IBC 403.2.1, which do not apply to Type IV buildings.

TABLE 601

Fire Resistance Rating Requirements for Building Elements (Hours)

Value: Program

Cost: Structural System & Grid
Value: Perimeter Glazing

Tolerances: Interface with Other Structural Materials

Procurement Approach Determines Schedule

Procurement Approach Determines Schedule

Design-Bid-Build Procurement
Procurement Approach Determines Schedule

Example 6 Story Type IIIA Project

Design-Build/Design-Assist Procurement

What are the schedule drivers on a mass timber project?

Schedule Impacts: Translating 2D to 3D

Schedule Impacts: Hybrid Structures

Is there a schedule savings with a mass timber structure compared to other structural systems?
Overall Project Cost Analysis: 12 Story Type IV-B

<table>
<thead>
<tr>
<th></th>
<th>MASS TIMBER</th>
<th>PT CONCRETE</th>
<th>MASS TIMBER vs. PT CONCRETE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Direct Cost of Work</td>
<td>86,997,136</td>
<td>85,105,091</td>
<td>2.2%</td>
</tr>
<tr>
<td>Project Overhead</td>
<td>9,393,750</td>
<td>11,768,750</td>
<td>-20.2%</td>
</tr>
<tr>
<td>Add-Ons</td>
<td>8,387,345</td>
<td>8,429,368</td>
<td>-0.5%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>104,778,231</td>
<td>105,303,209</td>
<td>-0.5%</td>
</tr>
</tbody>
</table>

*S* Includes 2 layers of gyp on 80% of interior surfaces.

Overall Project Schedule Analysis: 12 Story Type IV-B

5 Months

Schedule Impact on Cost | Value of Time

A large scale MT project can be up to 2% higher in direct costs, but a minimum of 20% lower in project overhead costs. The net result is cost-neutrality and higher value.

Embracing BIM for Fabrication

Holistic Schedule Analysis

Shorter Schedule = Lower General Conditions Costs
Sequencing

Material Protection
- Painting steel
- Taping joints
- Protect end cuts of timber

Questions?

This concludes The American Institute of Architects Continuing Education Systems Course.

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archie@woodworks.org

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