Mass Timber Construction Management: Design through Project Close Out

Mass Timber Overview:
Systems, Products & Codes
Learning Objectives

1. Understand the preconstruction manager’s role in material procurement and coordination of trades for 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.
MASS TIMBER OVERVIEW
OVERVIEW

STRUCTURAL SOLUTIONS

POST, BEAM + PLATE

Photo: Ema Peter
STRUCTURAL SOLUTIONS | HYBRID LIGHT-FRAME + MASS TIMBER
STRUCTURAL SOLUTIONS | HYBRID CONCRETE + MASS TIMBER

Photo: Structurlam
OVERVIEW | CONNECTIONS

Concealed Connectors

Self Tapping Screws

Photos: Rothoblaas
Panel to Panel & Supports

Photo: Charles Judd

Photo: Alex Schreyer
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.

OVERVIEW

PRECEDENT PROJECTS

CARBON 12 | PORTLAND, OR

Photos: Baumberger Studio/PATH Architecture
PRECEDENT PROJECTS | 360 WYTHE BROOKLYN, NY
PRECEDE NT PROJE C T S  |  F IRST  T ECH  CREDIT  U NION  H ILLSBORO,  OR
Glue Laminated Timber (GLT)
Glue Laminated Timber (GLT)

Photo: Manasc Isaac Architects/Fast + Epp
Cross-Laminated Timber (CLT)
Cross-Laminated Timber (CLT)

- Major Axis
- Minor Axis

- 4 1/8” to 19 1/2”
- 10’X40’
- 8’X64’
Nail-Laminated Timber (NLT)
Nail-Laminated Timber (NLT)

[Images of Nail-Laminated Timber structures and wood paneling with credits to StructureCraft and Think Wood.]
Dowel-Laminated Timber (NLT)

Photo: StructureCraft
Mass Plywood Panels (MPP)

Photos: Freres Lumber
Other Mass Timber Product Options

- Glue Laminated Timber (GLT)
- Laminated Veneer Lumber (LVL)
- Parallel Strand Lumber (PSL)
- Laminated Strand Lumber (LSL)
- Timber-Concrete Composite (TCC)
- Decking

Photos: StructureCraft
MASS TIMBER IN THE CODE
Mass Timber in Low- to Mid-Rise: 1-6 Stories in Construction Types III, IV or V
Tall Mass Timber: Up to 18 Stories in Construction Types IV-A, IV-B or IV-C

<table>
<thead>
<tr>
<th>TYPE IV-A</th>
<th>TYPE IV-B</th>
<th>TYPE IV-C</th>
</tr>
</thead>
<tbody>
<tr>
<td>IBC 2021</td>
<td>IBC 2021</td>
<td>IBC 2015</td>
</tr>
</tbody>
</table>

**BUSINESS OCCUPANCY [GROUP B]**

*Building floor-to-floor heights are shown at 12'-0" for all examples for clarity in comparison between 2015 to 2021 IBC codes.*

Credit: Susan Jones, atelierjones
Mass Timber’s Fire-Resistive Performance is Well-Tested, Documented and Recognized via Code Acceptance

<table>
<thead>
<tr>
<th>Required Fire Resistance (hr.)</th>
<th>Char Depth, ( a_{\text{char}} ) (in.)</th>
<th>Effective Char Depth, ( a_{\text{eff}} ) (in.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-Hour</td>
<td>1.5</td>
<td>1.8</td>
</tr>
<tr>
<td>1½-Hour</td>
<td>2.1</td>
<td>2.5</td>
</tr>
<tr>
<td>2-Hour</td>
<td>2.6</td>
<td>3.2</td>
</tr>
</tbody>
</table>

Source: AWC’s NDS

Credit: David Barber, ARUP
Fire-Resistive Design of Mass Timber Members

Code Applications, Construction Types and Fire Ratings

For many years,accorded heavy timber framing elements have been permitted in U.S. buildings due to their inherent fire-resistance properties.The predictability of wood’s char rate has been well-established for decades, and has long been recognized in building codes and standards.

Today, one of the most exciting trends in building design is the growing use of mass timber—i.e., large solid wood panel products such as cross-laminated timber (CLT) and tall-laminated timber (H-lam) for floor, wall and roof construction. Like heavy timber, mass timber products have inherent fire resistance that allows them to be left exposed and still achieve a fire-resistance rating. Because of their strength and dimensional stability, these products also offer a renovation alternative to steel, concrete, and masonry for many applications. It is this combination of exposed structures and strength that developers and designers across the country are leveraging to create innovative designs with a warm, natural aesthetic, often for projects that go beyond traditional norms of wood design.

This paper has been written to support architects and engineers exploring the use of mass timber for commercial and multi-family construction. It focuses on how to meet fire-resistance requirements in the International Building Code (IBC), including calculation and testing based methods. Unless otherwise noted, references refer to the 2021 IBC.

Mass Timber & Construction Type

Before demonstrating fire-resistance ratings of exposed mass timber elements, it’s important to understand under what circumstances the code currently allows the use of mass timber in commercial and multi-family construction.

A building’s assigned construction type is the main indicator of what and when all wood systems can be used. IBC Section 502 defines five construction Types I through V with all but Type IV framing in categories A and B. Types I and II permit the use of wood framing throughout most of the structure and both are used extensively for modern mass timber buildings.

Type I (IBC 502.3) – Timber elements can be used in floors, roofs and interior walls. All mass timber exposed wood (MTEW) framing is permitted in exterior walls with a fire-resistance rating of 2 hours or less.

Type II (IBC 502.4) – Timber elements can be used throughout the structure, including floors, roofs and both interior and exterior walls.

Type IV (IBC 502.4) – Commonly referred to as “Heavy Timber” construction, this option...
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