
Joe Mayo

Disclaimer: This presentation was developed by a third party and is not funded by WoodWorks or the Softwood Lumber Board.
Course Description

Through the rise of mass timber, one of the world’s oldest building materials has been reimagined as a sustainable alternative to concrete and steel. Innovations in solid wood building systems, which include large engineered wood members such as glue-laminated timber (GLT), laminated veneer lumber (LVL) and cross-laminated timber (CLT), have created new opportunities for wood, whether that means going taller, spanning farther, or building faster. Driven by wood’s light environmental footprint, large-scale wood buildings around the world are helping to spur building code changes, improve wood-based economies and demonstrate the untapped potential of this versatile material. This presentation will provide insight into these new, exciting architectural developments through detailed case studies that will expand your perception of wood’s possibilities.
Learning Objectives

1. Apply principles of carbon accounting for sustainable material selection.
2. Identify challenges and opportunities with using wood as both structure and finish to reduce material use.
3. Consider mass timber material options and how to choose between them for material efficiency and optimization in design.
4. Evaluate different mass timber building systems in order to choose the most appropriate system for specific project needs.
Agenda

- Carbon Impacts of Material Selection
- Timber in the City
- Case Studies
- What the Future Holds
<table>
<thead>
<tr>
<th>Material</th>
<th>Net Carbon Emissions (kg C/metric ton)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Framing lumber</td>
<td>33 (-457 with carbon stored in product)</td>
</tr>
<tr>
<td>Medium density fiberboard (virgin fiber)</td>
<td>60 (-382 with carbon stored in product)</td>
</tr>
<tr>
<td>Brick</td>
<td>88</td>
</tr>
<tr>
<td>Glass</td>
<td>154</td>
</tr>
<tr>
<td>Recycled steel (100% from scrap)</td>
<td>220</td>
</tr>
<tr>
<td>Concrete</td>
<td>265</td>
</tr>
<tr>
<td>Concrete block</td>
<td>291</td>
</tr>
<tr>
<td>Recycled aluminum (100% recycled content)</td>
<td>309</td>
</tr>
<tr>
<td>Steel (virgin)</td>
<td>694</td>
</tr>
<tr>
<td>Plastic</td>
<td>2,502</td>
</tr>
<tr>
<td>Aluminum (virgin)</td>
<td>4,532</td>
</tr>
</tbody>
</table>

1. Values are based on life cycle assessment and include gathering and processing of raw materials, primary and secondary transportation
3. A carbon content of 49% is assumed for wood
Data: CORRIM
It’s 2009
What does timber in the city look like

Photo: Benjamin Benschneider

Photo: Bernd Bochardt
University of Washington Student Housing
Mahlum
Seattle, 2009

E3
Kaden + Partner
Berlin, 2009

Photo: WG Clark

Photo: Bernd Bochardt / Kaden + Partner
Jurisdictional requirements:

1. Feasibility research
2. Approval from the fire department
3. Approval from the building authority
4. Approval of fire protection concept
5. Acquisition of multiple permits
6. Approval for not using a sprinkler system
7. A withdraw of responsibility from the building authority
8. Use of outside engineer for verification of the fire protection system
9. Test of structural components at the Technical University of (TU) Munich
10. Fire testing and expert statement of façade safety from testing facility MFPA Leipzig
11. Certification by experts of HBV timber, concrete floor / ceiling system
12. Proof by test that the floor system could support 6.5 tons of weight

Source: Kaden + Partner
Photo: Bernd Bochardt / Kaden + Partner
Graphite Apartments
Waugh Thistleton
London, 2009

Photos: Will Pryce
**Exterior Wall:**
- Eternit Tile
- 50mm Air Gap
- 70mm Insulation
- 128mm CLT Wall Panel
- 2 Layers Gypsum Wall Board

**Floor:**
- 15mm Wood Flooring
- 55mm Screed
- 25mm Insulation
- 146mm CLT Floor Panel
- 75mm Void
- 50mm Insulation
- 1 Layer Gypsum Board

Detail: Waugh Thistleton Architects

Photo: KLH UK
Brideport House
Karakusevic Carson Architects (KCA)
London, 2012

Building Section: KCA
Photo: Ioana Marinescu
Images: Eurban

Photo: Ioana Marinescu
Forté
Lend Lease
Melbourne, 2013

Photos: Lend Lease
Photo: Lend Lease
Woodcube
achitekturagentur
Hamburg, 2013

Photos: IBA/Martin Kunze
Images: Thoma Holz100

Photo: IBA/Martin Kunze
Photo: IBA/Martin Kunze

Building Section: achitekturagentur
City Academy
Sheppard Robson
Norwich, 2012

Photo: Hufton + Crow
Photos: Hufton + Crow
Photos: Hufton + Crow
Alpenhotel
OLK / Rüf
Austria, 2010

Photos: OLK / Rüf
Photos and Drawing: OLK / Rüf

Photo: Merz Kley
Photos: Merz Kley
The Hive
FCB Studios
Worcester, 2012

Photo: Hufton + Crow
Drawings: FCB Studios
Photos: KLH UK
Vennesla Library
Helen & Hard
Vennesla, 2011

Photos: Emile Ashley
Drawing: Helen & Hard

Photo: Emile Ashley
BRDF
McFarland Marceau Architects
Vancouver, 2012

Photo: Don Erhardt
Images: McFarland Marceau Architects
Detail: Equilibrium

Photo: Don Erhardt
Photo: McFarland Marceau Architects

Detail: Equilibrium
NMIT
Irving Smith Jack Architects
Nelson, 2011

Photos: Patrick Reynolds
Building Frames and Walls

Potius panel stressed skin floor
Short span double LVL beam
LVL column notched for beam support
Long span double LVL beam composite action with floor topping

Beam Column Joint
Post tensioned cable through wall
UPF seismic energy dissipators between walls
LVL solid panel wall 200mm thick
75mm concrete topping
Wall / floor shear connectors
Potius panel stressed skin floor
Minimum 90mm joist thickness for fire rating

LVL Post Tensioned Shear Wall

Roof Beams:
Long span 2 / 400x126 LVL
Large cantilever roof beams:
Long span 2 / 400x126 LVL

Columns:
406x300 LVL continuous columns

Upper Floors:
75mm reinforced concrete topping
360x45 LVL Potius Panels
36mm LVL panel top
2 / 610x171 long span LVL beams (continuous at columns)
Simple pin joint splice to
2 / 400x126 LVL short span beams

Ground floor slab on grade

Portal / Floor Junction

Images: ISJ Architects
What’s Next?
Questions?

This concludes The American Institute of Architects Continuing Education Systems Course

Joe Mayo
Mahlum Architects
jmayo@mahlum.com