Building Bigger, Taller and Smarter with Wood

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TallWood Design Institute
Outline

• Mass timber – what and why?
• European origins
• Worldwide growth
• Mass timber in the US
• The future
TallWood Design Institute

An industry-driven partnership between:

- College of Forestry, Oregon State University
- College of Design, University of Oregon
- College of Engineering, Oregon State University
Our Purpose

1. Grow the manufacturing base for structural wood products – especially mass timber - in Oregon and the Northwest US

2. Eliminate barriers and stimulate demand for structural wood products and building systems throughout the US
CLT – “plywood on steroids”?
Origins of CLT

• Developed as a high-value use for side lumber from sawmilling processes
• Intensive Austrian research at University of Graz by Gerhard Schickhofer and others – mid to late 1990s
• First CLT buildings – 1993-95 – Germany & Switzerland
• KLH founded in 1997 – now worldwide market leader
CLT Production in Europe Today

Courtesy of Lech Muszynski, OSU
Estimated Global Output

- Austria 54%
- Germany 14%
- Italy 5%
- Switzerland 3%
- Other EU 6%
- France** 5%
- Japan** 5%
- USA 3%
- Canada 5%

Muszynski 2017
Market Growth


35.3 M CFT
OR
424 M BF
Mass timber is not just CLT
Why Build Bigger with Wood?

- 50% of the world’s population live in cities today
- 75% will be urban dwellers by 2040
- 3 billion people will need a new home in next 20 years
Urban Growth vs Climate Change

- 47% of GHGs come from buildings
- 33% from transportation
- 19% from industry
Wood and wood products need the least amount of energy to manufacture and has the lowest impact on air and water quality.
Environmental Benefits During Service

- 50% of the dry weight of wood is carbon
- 1m$^3$ of wood stores 1 ton of carbon
- Carbon is sequestered throughout the lifetime of the building
- Can be reclaimed at end of building life
Economic Benefits

- Offsite prefabrication saves jobsite labor
- Up to 75% lighter than a concrete building = reduced foundation sizes and easier material handling
- Less deliveries, simplified jobsite logistics
- Less jobsite waste
THE BUILDING BLOCKS
The panels, made of three or five layers, are up to 6 inches thick and 30 feet long. Full thickness and bigger panels can be made.

Class section of a closed sandwich timber panel

IN CASE OF FIRE
White masswood's wood panels turn, their surface becomes charred. Charred can slow the fire and protect the inner core from burning, keeping it structurally sound. Panels with more layers of wood last longer in a fire. Typically walls and ceilings are covered with polystyrene to further reduce risk of the fire.

A CLOSER LOOK
Wood panels
Metalized elements
Floors and walls can be lifted in place with a mobile crane. Metal bracings and anchors are used to join panels together.

ELEVATOR SHED
For fire safety and soundproofing, the elevator shafts and skylights have double walls with an insulating layer between.
Canada – Pioneering Steps

- Wood First Act – 2009 - required wood to be considered as the primary building material in all new publicly-funded buildings

- In an average year, BC funds almost $3 billion in capital investments in hospitals, schools, social housing, etc.

- 2010 Winter Olympics used as springboard

- 6-storey light frame wood buildings allowed under code since 2009 in BC and Quebec first, now more broadly

- 53 BC municipalities representing 1.1M people passed similar Wood First bylaws/resolutions
Brock Commons, Vancouver, BC
Mass Timber in the US
Oregon has become the US mass timber hub due to several factors...
OREGON FORESTED AREA - RESERVED LANDS & LARGE TREES

2.4 million acres

NON-RESERVED
22.6 million acres
(73%)

LARGE TREES
2.6 million acres

RESERVED
8.4 million acres
(27%)

TOTAL FORESTLAND IN OREGON: 31,037,750 ACRES

20” dbh
LEADING LUMBER PRODUCER IN USA

+76,000 JOBS

$12.7 BILLION IN OREGON’S ECONOMY IN 2011

IN 2011 NEARLY 16% OF TOTAL U.S. PRODUCTION
T3 Building, Minneapolis

Image courtesy of Michael Green Architects
Integrated Design Building, UMass
Barriers to Growth

• Cost uncertainties and lack of familiarity

• Design: seismic, fire, durability (moisture), lack of standardized connector systems, etc.

• Manufacturing: computer aided design skills, computer numerical control fabrication machinery skills, digital integration from screen to machine and jobsite; aversion to capital investment risk; drying capacity

• Construction: different installation skills required than typical general contractors possess
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*These span across disciplines and must be addressed through a coordinated approach*
TallWood Design Institute - response

• Industry-focused applied research
• Product development and testing
• Training and education
Seismic-resilient Design
Redstone Arsenal, Huntsville, AL
TRANSPARENCY-V

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MASS TIMBER WEST GRANDSTANDS

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Mass timber in the USA: the future?
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DESIGN INSTITUTE

Advancing solutions for designers, manufacturers and engineers of our built environment.

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