MODERN TALL WOOD BUILDINGS: OPPORTUNITIES FOR INNOVATION

Brian Brashaw, Program Manager
Forest Products Marketing Unit
US Forest Service
As a youth growing up in the Nicolet National Forest, I understood the connection between the forest and Connor Forest Products where my Dad worked. Despite moving from Laona in 5th grade, I accomplished my youth goal of being a forester with a career in forest products. After 25 years as a wood specialist in Minnesota, I joined the Forest Service’s FPL in 2015 to fulfill a career goal and work to strengthen the connection between our forests, research, and markets. I am proud to work alongside my Forest Service colleagues and partners to support resilient forests and communities.
National Forest Products Week


…The health and well-being of our forests and our communities go hand in hand. With the Department of Agriculture, we are working to strengthen markets for forest products. By allocating millions of dollars to help expand technologies that encourage the use of wood in innovative ways, we are also striving to improve forest health and generate rural jobs…
USDA Forest Service
Forest Products Laboratory

- Established 1910
- 144 Permanent Employees (42 Scientists)
- Federal Funding $26.6 million
- 150 Cooperative R&D agreements
- Program Leverage $4 - $5 million
A key element in maintaining healthy, resilient forests is our ability to provide value-added products from the full complement of forest biomass.
Population Growth / Urbanization
Climate Change / Carbon
Information Technology
Forest Fire
Wildland Urban Interface
Rural Economies

GLOBAL TRENDS
Overview

• What is mass timber and why is it important?
• What is a tall timber building and why is this a market?
• What is being done to grow this market?
• What opportunities are available?
Mass Timber Strategy

Education
- WoodWorks
- Mass Timber Conference
- Softwood Lumber Board
- Media

Technical Assistance
- WoodWorks
- Forest Products Marketing Unit (FPL)
- Regional Biomass Coordinators

Research
- Forest Products Laboratory (FPL) and University and other Research Partners

Initiatives
- U.S. Tall Wood Building Competition
- National Building Museum
- Film with Choose Outdoors
- Wood Innovation Grants
- Cooperative Agreements

Agency Lead:
Washington Office - Cooperative Forestry
Mass Timber Framing Options

- Nail Laminated Timber (NLT)
- Glue Laminated Timber (GLT)
- Glulam Beams & Columns
- Laminated Veneer Lumber (LVL)
- Cross Laminated Timber (CLT)

Images Source: Structurecraft

Source: FPL-GTR-241 @fpl.fed.fs.us
Cross-laminated Timber (CLT)
Nail-laminated Timber
• Defines CLT
  – How it can be made
  – Basic qualification tests
  – Expected minimum performance

• 7 Performance Grades

• No nail laminations

• Requires 3rd Party Certification
CLT Production (Per PRG 320-2012)

- Machine Stress Rated or Visually Graded Dimensional Lumber (Douglas-fir, southern yellow pine, SPF, SPF_{south}) or Structural Composite Lumber – often #2, #3 visual
- 2 by 4, 6, 8, 10 common in NA
- Dried to 12% moisture content before layup
- Glulam adhesive standard (AITC 405)
  - Phenol-resorcinol formaldehyde (PRF), Emulsion polymer isocyanate (EPI), One-component polyurethane (PUR)
North American Manufacturing

United States
- DR Johnson (OR) - ANSI/APA certified
- Smartlam (MT) – ANSI/APA certified
- Sterling (IL)

Canadian
- Nordic Structures (Quebec)
- StructureCraft (BC)
- Structurlam (BC)
Global output by operation scale*

*based on combined sources
Opportunity - Tall Wood

Incremental Volume: 5.0 BBF/Year

<table>
<thead>
<tr>
<th></th>
<th>5-6 Stories</th>
<th>7-10 Stories</th>
<th>11-15 Stories</th>
<th>16-20 Stories</th>
<th>21-30 Stories</th>
</tr>
</thead>
<tbody>
<tr>
<td>Non-Res</td>
<td>2.035 bbf</td>
<td>1.229 bbf</td>
<td>.425 bbf</td>
<td>.195 bbf</td>
<td>.113 bbf</td>
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<tr>
<td>Residential</td>
<td>.958 bbf</td>
<td>.420 bbf</td>
<td>.318 bbf</td>
<td>.192 bbf</td>
<td>.129 bbf</td>
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<tr>
<td>Total</td>
<td>2.003 bbf</td>
<td>1.649 bbf</td>
<td>.743 bbf</td>
<td>.387 bbf</td>
<td>.242 bbf</td>
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</tbody>
</table>

Source: Softwood Lumber Board in FPL-GTR-241 @fpl.fed.fs.us
Why should we care about mass timber?

- Contributes to healthy, sustainable forests
- Increase public awareness of forestry
- Reduce global CO$_2$ emissions
- More globally competitive forest products sector
- Creates manufacturing jobs in rural communities
MASS TIMBER PROJECT EXAMPLES
Market Trends

What about in the US?

WoodWorks is currently assisting on 19 projects 7-stories or more.
Brock Commons

University of British Columbia

18-Storey Hybrid Mass Timber Student Residence

Wood Construction:

Start: June 6, 2016
Finish: August 10, 2016

Brock Commons YouTube Time Lapse
USDA Tall Wood Competition

T3 - Hines
Minneapolis, MN

- 7 stories – 85’
- High end office space
- 220,000 square feet
- Post & beam with NLT
- Under Construction
- **$0 funding**
- Next project planned for Atlanta, GA

Source: Softwood Lumber Board in FPL-GTR-241 @fpl.fed.us
USDA Tall Wood Building Prize Competition - $3.0 M

Framework
Portland, OR
12 stories / 130 feet tall
Retail/office/apartments

475 West 18th Street
Manhattan, NY
10 stories / 120 feet tall
Commercial / condominiums

Source: Softwood Lumber Board in FPL-GTR-241 @fpl.fed.us
More with Less – An Overview of the 1st CLT Hotel in the U.S.

Timber Innovations Group
2016 Mass Timber Research Workshop
November 3, 2016
# The Case for CLT / Modular Construction

<table>
<thead>
<tr>
<th>PAL PORTFOLIO</th>
<th>TYPICAL NEW PAL HOTEL (ACTUAL*)</th>
<th>REDSTONE ARSENAL (ACTUAL)</th>
<th>DIFFERENCE</th>
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<tbody>
<tr>
<td>Gross SF</td>
<td>54,891</td>
<td>62,688</td>
<td>+14%</td>
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<tr>
<td>Average # of Employees</td>
<td>18 (Peak 26)</td>
<td>10 (Peak 11)</td>
<td>-43%</td>
</tr>
<tr>
<td>Structural Duration</td>
<td>123</td>
<td>78</td>
<td>-37%</td>
</tr>
<tr>
<td>(Days)</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Structural Man Hours</td>
<td>14,735</td>
<td>8,203</td>
<td>-44%</td>
</tr>
<tr>
<td>Structural Production</td>
<td>460 SF/day</td>
<td>803 SF/day</td>
<td>+75%</td>
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<tr>
<td>Rate/Day (SF)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Overall Schedule</td>
<td>15 months</td>
<td>11 months**</td>
<td>-27%**</td>
</tr>
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</table>

* PAL New Build Hotel Historical Average  
** Forecasted completion 10/26/15
Mass Timber Construction Benefits

- Light/strong
- Versatile
- Small environmental footprint
- Design flexibility
- Rapid assembly
- Cost-competitive
Expanding the Use of Wood Products

Wood Project Assistance
help@woodworks.org

WoodWorks Website
www.woodworks.org

2016 Wood Design Award Winner:
Commercial Wood Design Framework
Works Partnership Architecture,
TM Rippey Consulting Engineers
Photo: Joshua Jay Elliot
Free design and engineering support for wood buildings

Nationwide support for the code-compliant design, engineering and construction of non-residential and multi-family wood buildings.

- Allowable Heights/Areas
- Construction Types
- Structural Detailing
- Wood-Framed & Hybrid Systems
- Fire/Acoustic Assemblies
- Lateral System Design
- Alternate Means of Compliance
- Energy-Efficient Detailing
- Building Systems & Technologies

woodworks.org/help  •  help@woodworks.org
2015 PROGRAM HIGHLIGHTS

- Technical support for 220 projects that went to construction this year
- Technical support on an additional 488 projects that are still in design phase
- 43,300 practitioner education hours through Wood Solutions Fairs, workshops, webinars and other education events

Growth in Number of Direct Projects Supported

EDUCATIONAL OUTREACH TO SUPPORT PROJECT ASSISTANCE

- 31,895 education hours delivered to 17,465 specifiers through 262 WoodWorks-hosted events
- 5 Wood Solution Fairs for 1,919 design and building professionals
- 24 workshops for 1,259 attendees
- 67 two- or three-hour lunch seminars for 1,807 attendees
- 92,000 specifiers added to the database—a total of 242,000 have opted-in to receive info
- 62 third-party event presentations: including the AIA National Conference and Architectural Record Innovations Conference
- 12 webinars presented to 10,557 practitioners, with an average of 880 attendees per month
- 152 lunch & learn for 1,797 design and building professionals
- 2-day mass timber research workshop attended by 116 people


2015 PROGRAM HIGHLIGHTS

Supporting a Full Range of Projects

In 2015, 55 percent of the projects supported were taller than 3 stories, compared to 50 percent in 2014. The average height of a supported project was 3.3 stories, up from 2.7 in 2014.
FPL Research Needs Workshop

Key Topics

1. Resistance to lateral loads
2. Building performance
   a) Durability
   b) Sound
   c) Vibration
   d) Life cycle assessment
3. Fire safety
4. Material resources

FPL-GTR-241 is available @fpl.fed.fs.us
• Portland, Oregon
  – Building Tour
  – Conference and Expo Hall
  – 500+ attendees from 14+ countries
Photo by Yassine al Mansouri, courtesy National Building Museum.
Mass Timber Resources

- USDA Forest Service Wood Innovation
- USDA Forest Products Laboratory
- Waugh Thistleton Architects Ltd.
- reThink Wood
- WoodWorks
- APA–The Engineered Wood Association
Changing the Way America Builds

• Mass Timber building is being embraced
  – Expanding CLT manufacturing capacity
  – Surge of initial projects

• Code acceptance and standardized design methods still the pressing need
  – Alternative means and methods for seismic design
  – Height and area limits
  – International efforts for fire, durability, seismic design

• Significant resources to support market opportunities and pushback from steel and concrete
Thank you!

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