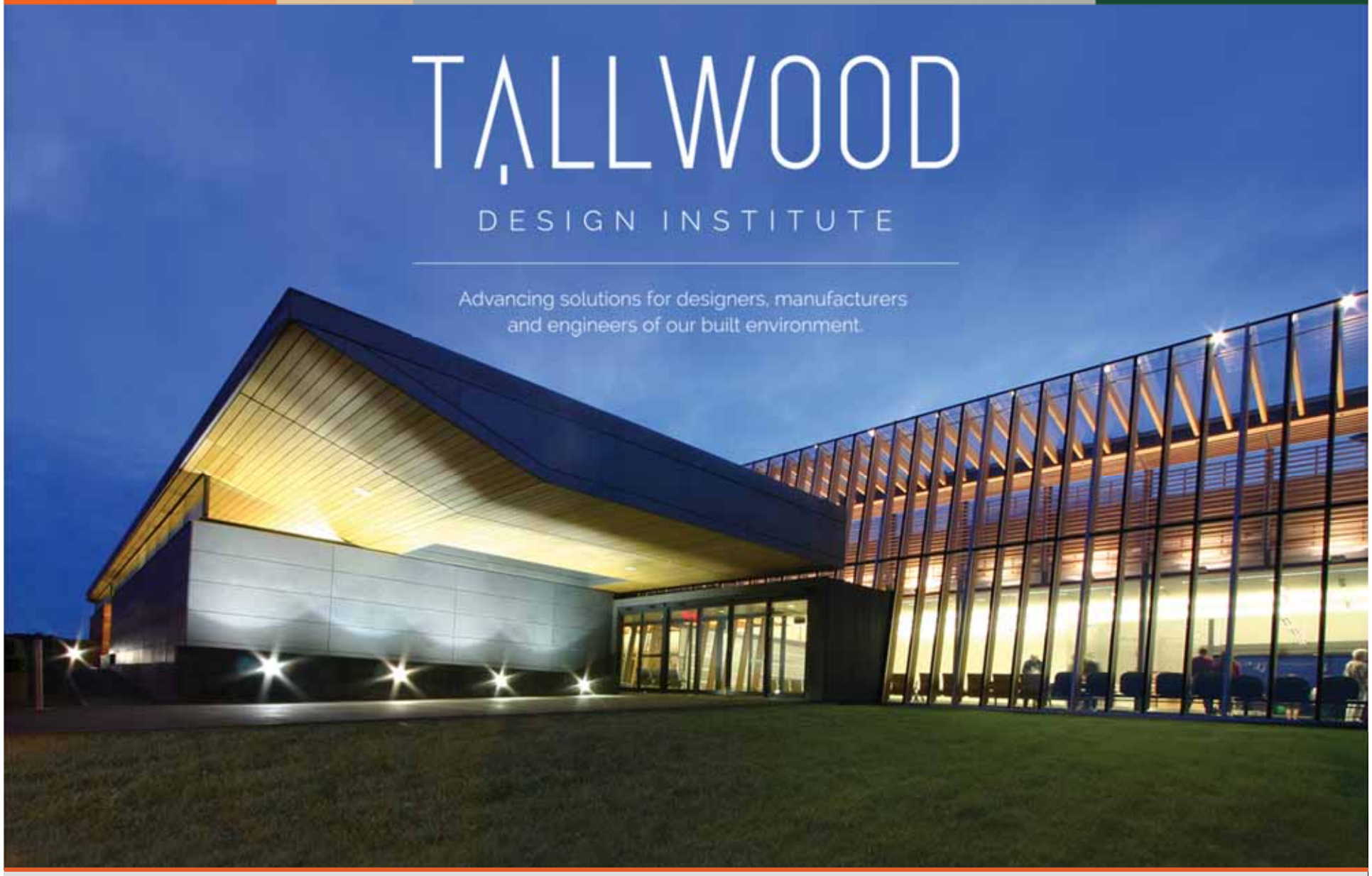
TALLWOOD

DESIGN INSTITUTE

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



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The Mass Timber Opportunity: Jobs and Sustainable Buildings in the USA

Iain Macdonald
Associate Director,
TallWood Design Institute

Oregon State University OSU

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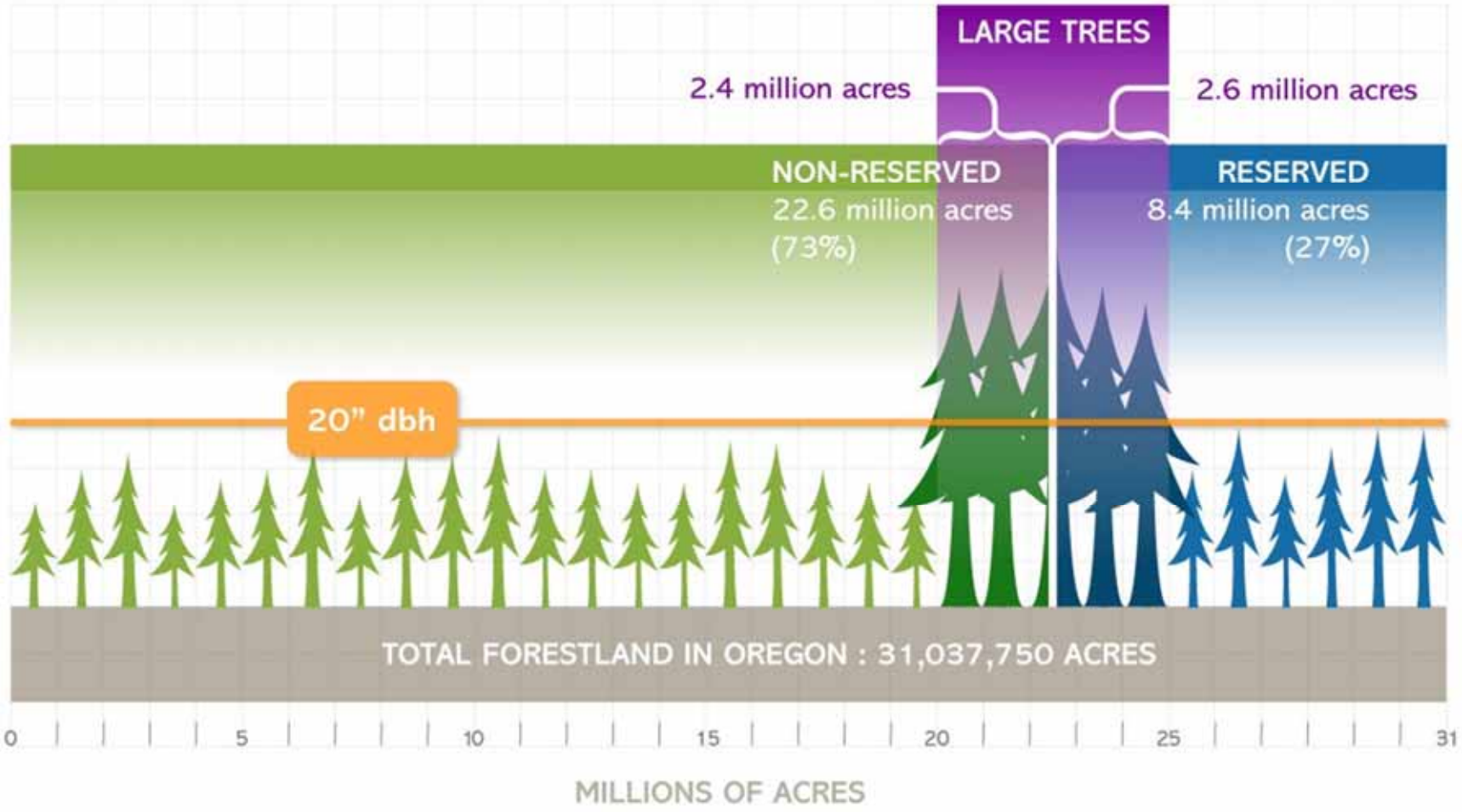
What is Mass Timber?


USNR
DANGER

Current interest in mass timber in Oregon is based on a confluence of factors…

OREGON FORESTED AREA - RESERVED LANDS & LARGE TREES

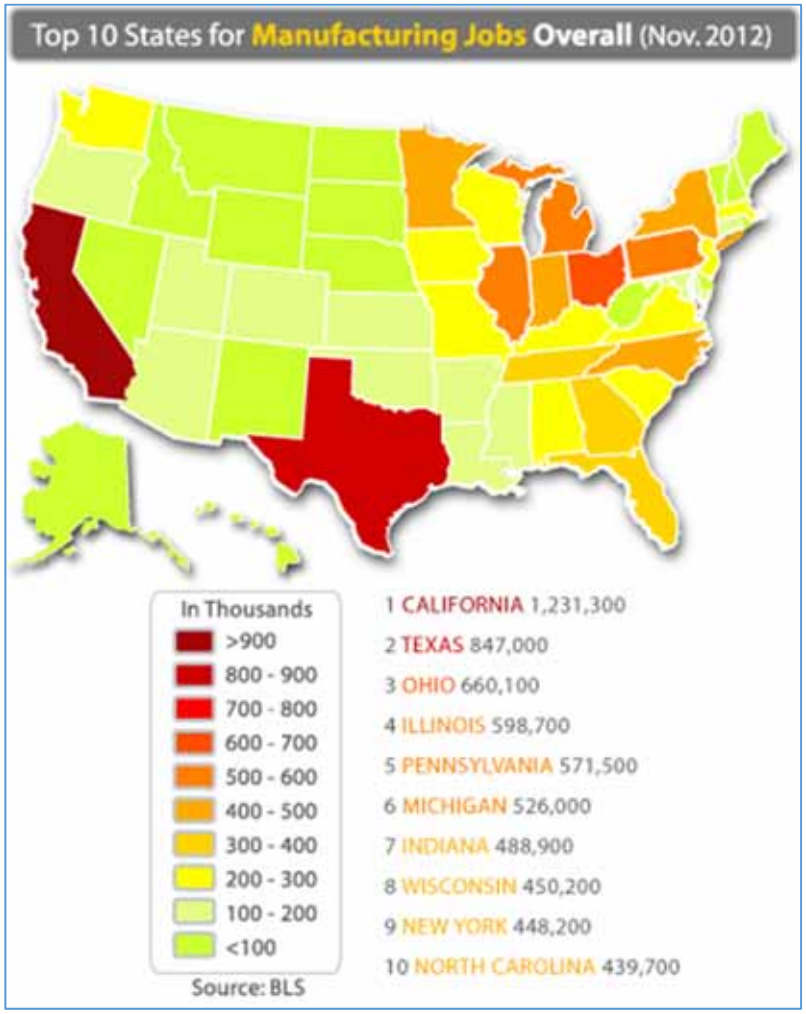


LEADING
LUMBER PRODUCER
IN USA

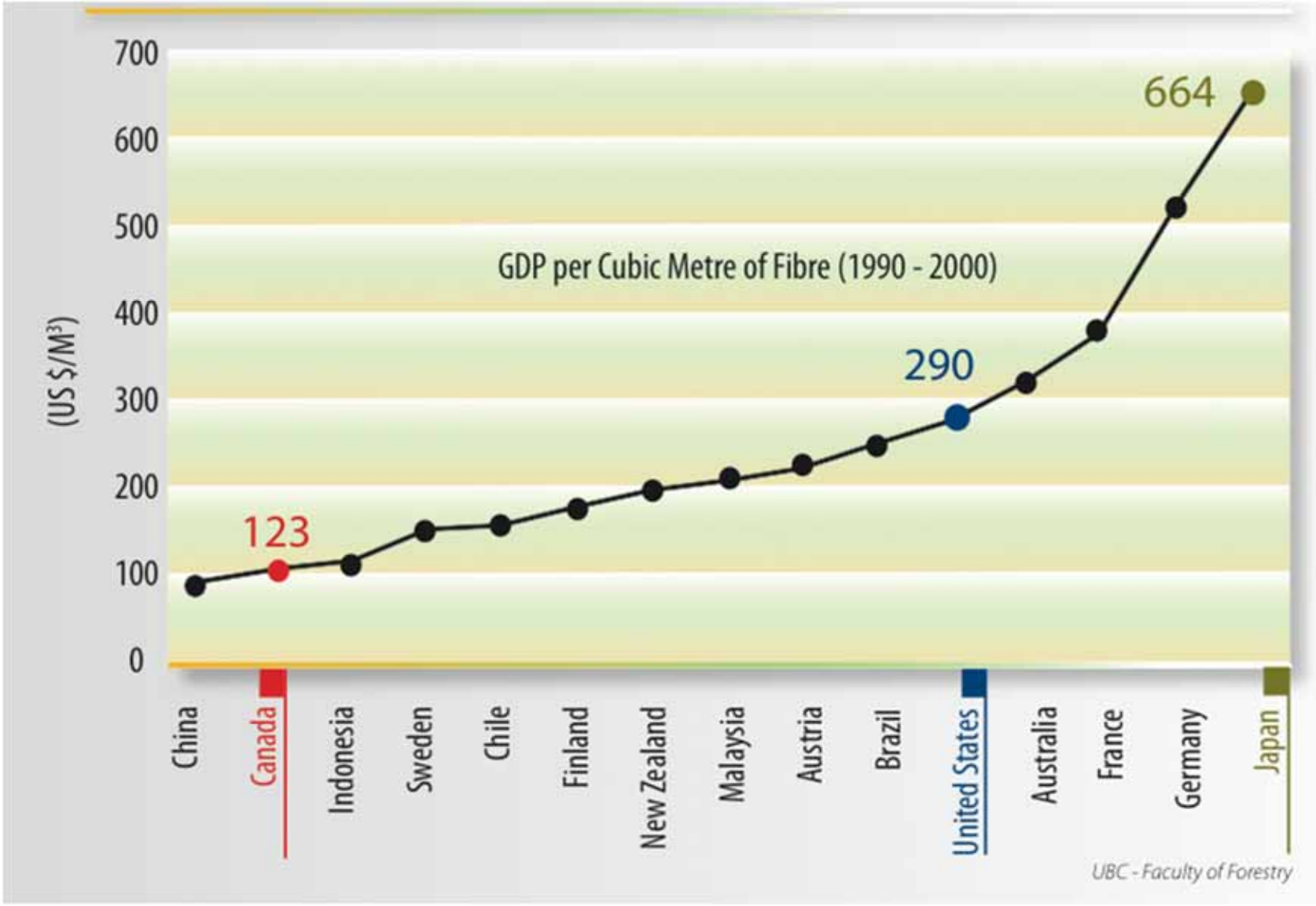
+76,000 JOBS

$12.7 BILLION
IN OREGON'S ECONOMY
IN 2011

IN 2011 **NEARLY 16%**
OF TOTAL U.S.
PRODUCTION

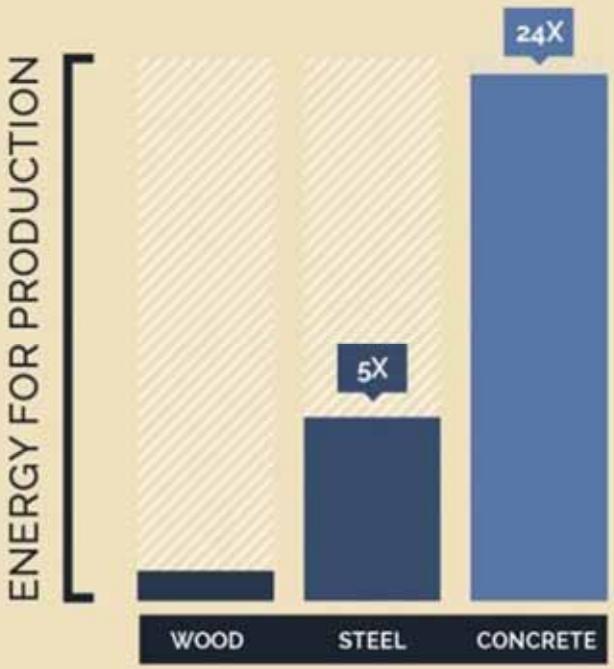

Top 10 States for Manufacturing Jobs Overall (Nov. 2012)
In Thousands
>900
800 - 900
700 - 800
600 - 700
500 - 600
400 - 500
300 - 400
200 - 300
100 - 200
<100
Source: BLS
1 CALIFORNIA 1,231,300
2 TEXAS 847,000
3 OHIO 660,100
4 ILLINOIS 598,700
5 PENNSYLVANIA 571,500
6 MICHIGAN 526,000
7 INDIANA 488,900
8 WISCONSIN 450,200
9 NEW YORK 448,200
10 NORTH CAROLINA 439,700


Oregon Wood Products Employment, 1950-2014
100,000
90,000
80,000
70,000
60,000
50,000
40,000
30,000
20,000
10,000
0
Jan-50
Jan-60
Jan-70
Jan-80
Jan-90
Jan-00
Jan-10
Lumber and Wood Products (SIC)
Wood Products, Logging and Adjustments (NAICS)


GDP per Cubic Metre of Fibre (1990 - 2000)
(US $/M³)
700
600
500
400
300
200
100
0
123
290
664
China
Canada
Indonesia
Sweden
Chile
Finland
New Zealand
Malaysia
Austria
Brazil
United States
Australia
France
Germany
Japan
UBC - Faculty of Forestry

BENEFITS OF BUILDING WITH **WOOD**

Wood and wood products need the least amount of energy to manufacture and has the lowest impact on air and water quality.




KENTUCKY
CARBON STORAGE MODULE
PLANT TREES
HARVEST
the
BENEFITS

PHOTOGRAPH BY WILL PRYCE

THE BUILDING BLOCKS

The panels, made of three or five layers, are up to 6 inches thick and 30 feet long. But thicker and bigger panels can be made.

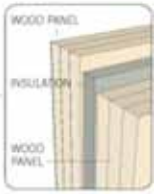
Cross section of a cross-laminated timber panel

IN CASE OF FIRE

When massive solid-wood panels burn, their surface becomes charred. Charring can slow the fire and protect the inner core from heating, keeping it structurally sound. Panels with more layers of wood last longer in a fire. Typically walls and ceilings are covered with plasterboard to further reduce risk of the fire.

A CLOSER LOOK

INSTALLING ELEMENTS
Floors and walls can be lifted in place with a mobile crane. Metal brackets and screws are used to join panels together.



ELEVATOR SHAFT
For fire safety and soundproofing, the elevator shafts and stairwells have double walls with an insulating layer between.

ADDING STRENGTH
In areas of high stress where walls press into the floor, additional screws or nails can be driven into the floor to distribute the surface load deeper into the panel.

Arbora
Montréal, Canada
8 Stories
2016

Moholt 50/50
Trondheim, Norway
9 Stories
2016

Banyan Wharf
London, UK
10 Stories
2015

Hypérion
Bordeaux, France
18 Stories
2020

Silva
Bordeaux, France
18 Stories
Under Construction

5 King
Australia
10 Stories
Under Construction

Puukuokka
Jyväskylä, Finland
8 Stories
2015

TREET
Bergen, Norway
14 Stories
2015

Strandparken
Stockholm, Sweden
8 Stories
2014

Mjøstårnet
Norway
18 Stories
Under Construction

HoHo Vienna
Vienna, Austria
24 Stories
Proposed

Haut
Amsterdam, Netherlands
21 Stories
Proposed

Contralaminada
Lleida, Spain
8 Stories
2014

Wood Innovation & Design Centre
British Columbia, Canada
8 Stories
2014

St. Dié-des-Vosges
St. Dié-des-Vosges
8 Stories
2014

Framework
Portland, United States
12 Stories
Design Phase

Santuary
Glasgow, Scotland
7 Stories
2018

Sida Vid Sida
Skelleftea, Sweden
19 Stories
Announced

Cenni di Cambiamento
Milan, Italy
9 Stories
2013

Wagramerstrasse
Vienna, Austria
7 Stories
2013

Panorama Giustinelli
Triste, Italy
7 Stories
2013

Brock Commons Tallwood House
Vancouver, Canada
18 Stories
2017

Origine Condos
Quebec City, Canada
13 Stories
2017

T3
Minnesota, United States
7 Stories
2016

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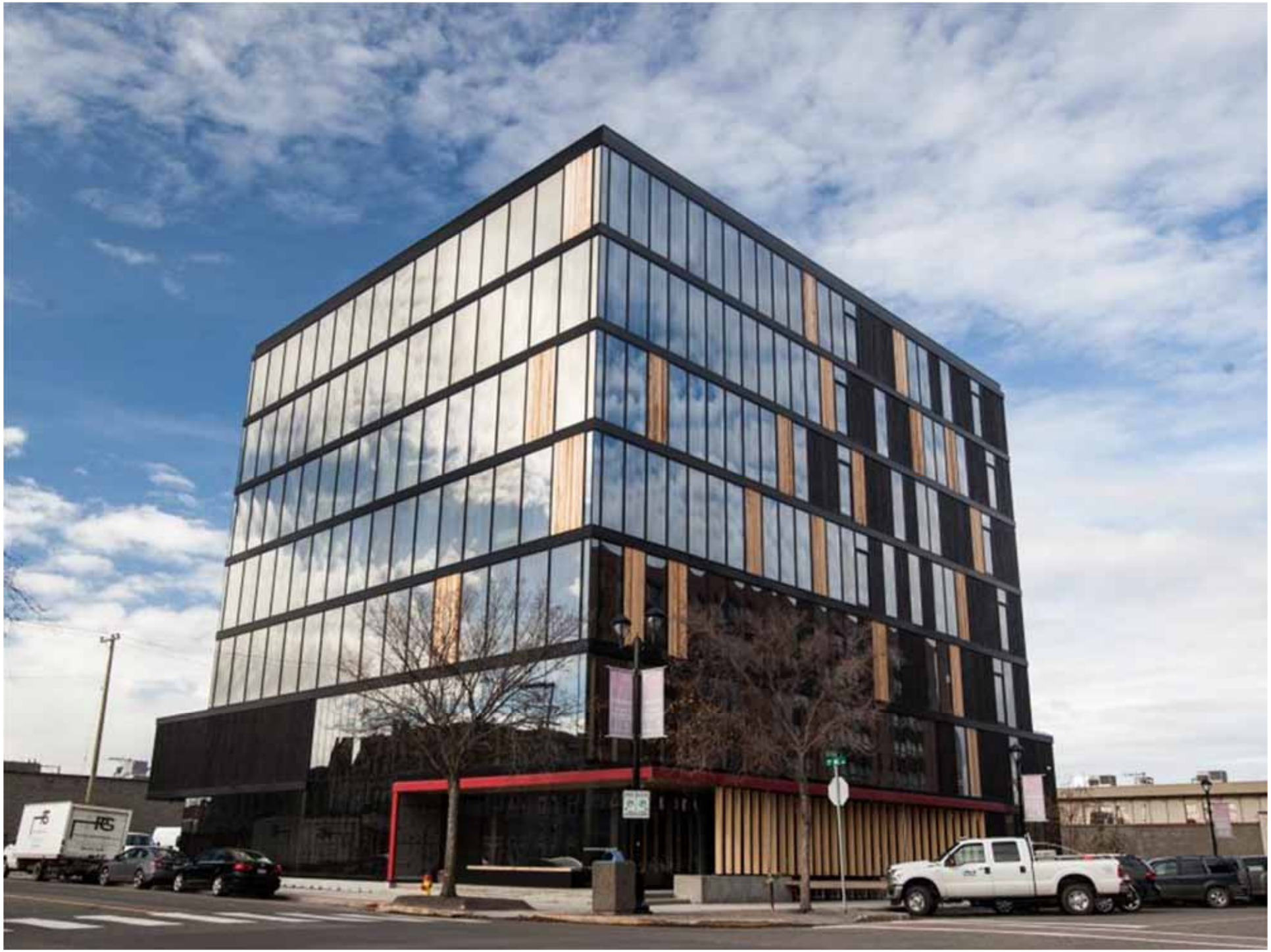
British Columbia and mass timber

- Wood First Act – 2009 - required wood to be considered as the primary building material in all new publicly-funded buildings, in a manner consistent with the British Columbia Building Code. In an average year, the Province funds almost $3 billion worth of capital investments in buildings such as hospitals, schools, and social housing.
- 6-storey 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

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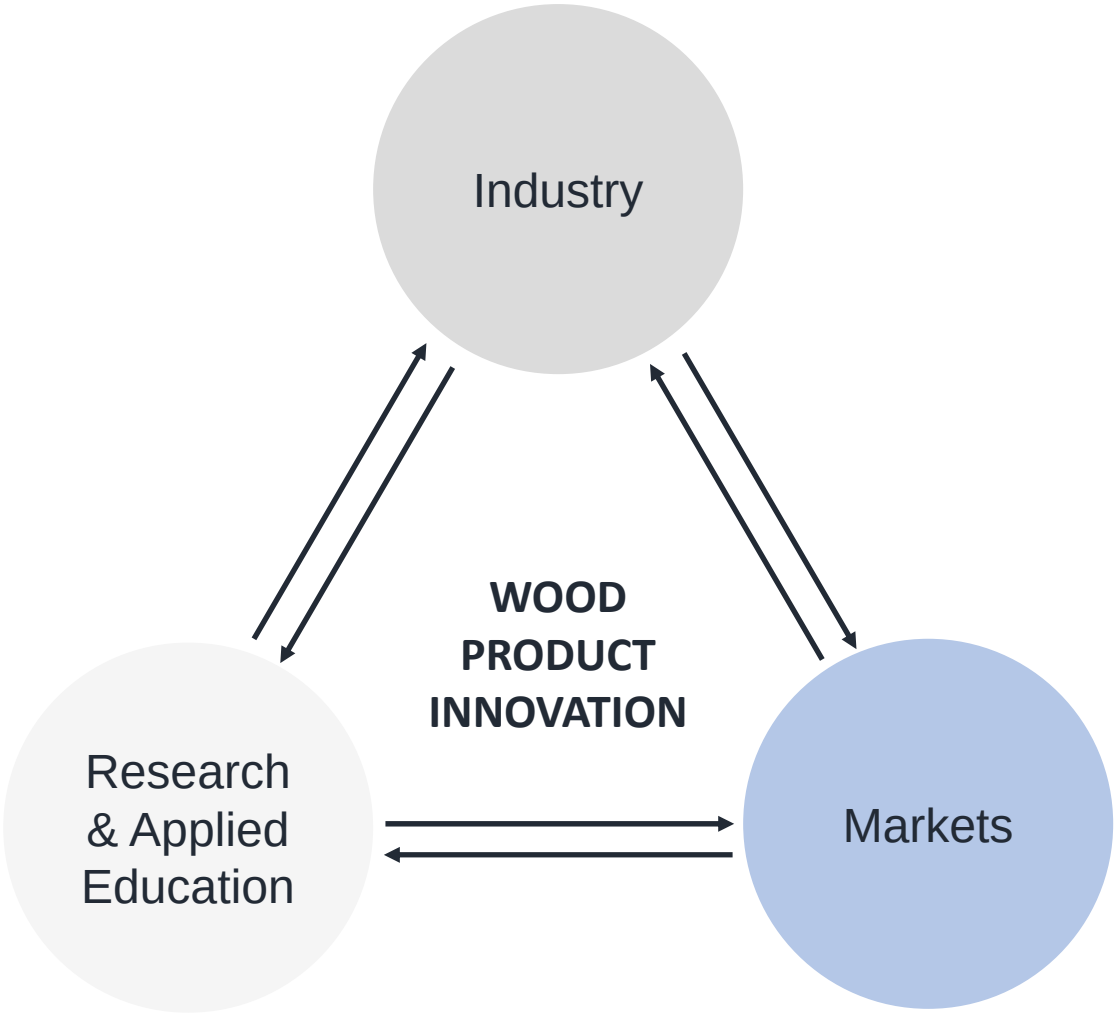
What role does TallWood Design Institute play?

Building successful industry clusters

Porter 2001: Regional Foundations of US Competitiveness – Clusters:

- "Strong and competitive clusters are a critical component of a good business environment and are the driving force behind regional innovation and rising productivity"
- "Each region must craft a distinctive approach based on its unique and inherited assets"
- "Build on traditional industries: Established and already emerging clusters offer the greatest prospects for near term growth".
- "Universities and specialized research centers are the driving force behind innovation in nearly every region: Although companies and individuals do create a large number of innovations, universities and research centers institutionalize entrepreneurship and ensure a steady flow of new ideas".

The innovation triangle



TallWood Design Institute: The Vision

1. Grow the mass timber manufacturing base in Oregon
2. Eliminate barriers and stimulate demand for mass timber products and building systems in Oregon and beyond

What are the barriers?

- 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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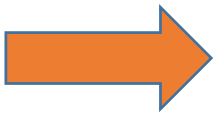
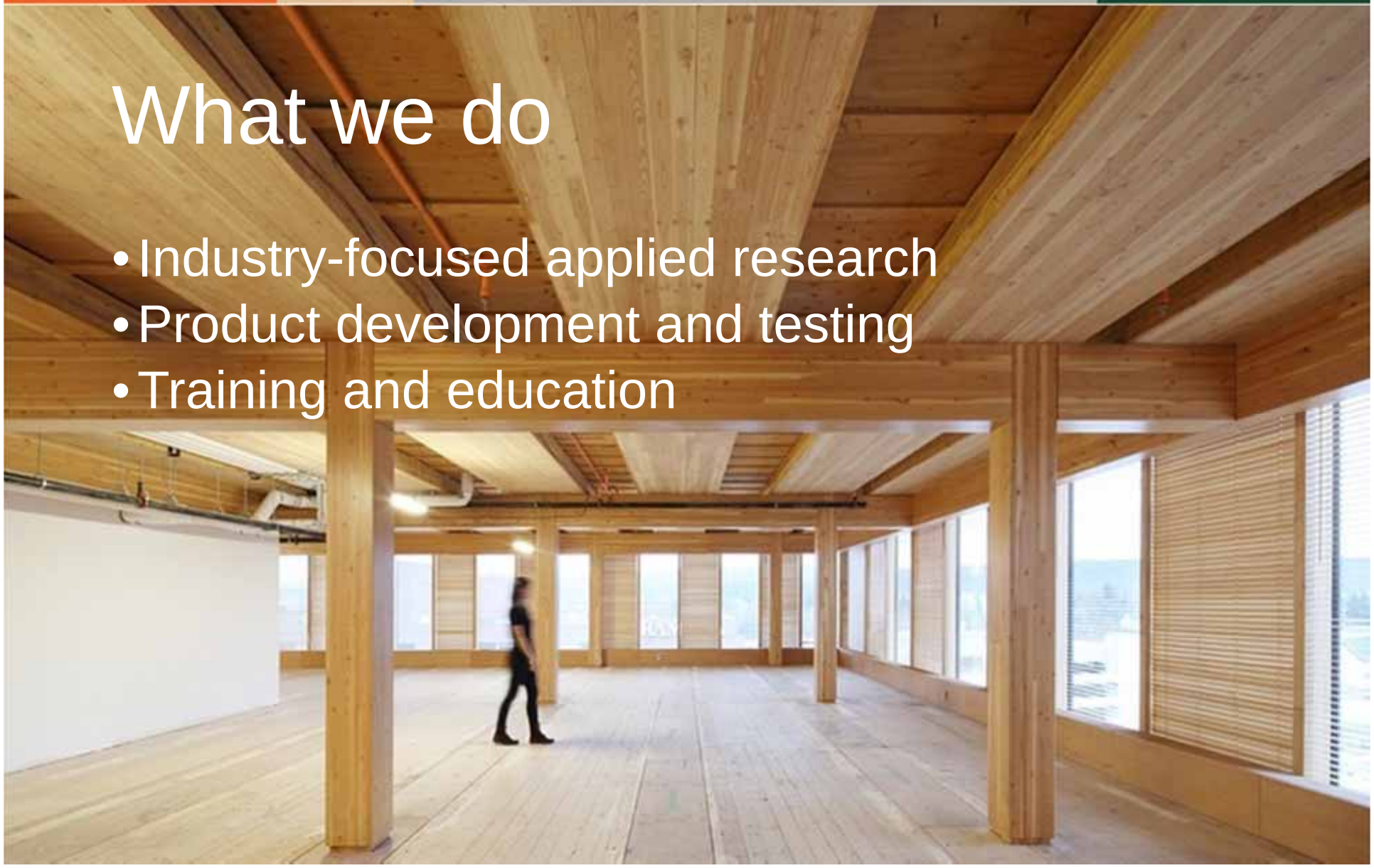


These span across disciplines and must be addressed through a coordinated approach

TallWood Design Institute

- College of Forestry, Oregon State University
- School of Architecture and Allied Arts, University of Oregon
- College of Engineering, Oregon State University

What we do



- Industry-focused applied research
- Product development and testing
- Training and education

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Research

- Fire Performance of Douglas-Fir CLT Wall and Floor Assemblies Made in Oregon
- Behavior of CLT Diaphragm Panel-to-Panel Connections with Self-tapping Screws
- CLT Fastener Solutions for Tall Wood Buildings
- Composite Concrete-CLT Floor Systems for Tall Buildings
- Seismic Performance of Cross-Laminated Timber and Cross-Laminated Timber-Concrete Composite Floor Diaphragms
- Design of the Timber Pile Ground Improvement for Liquefaction Mitigation

- Post-Occupancy Performance Monitoring of Mass Timber Buildings
- Peavy Hall as a Living Lab
- Net-Zero Tall Wood Buildings
- Life Cycle Analysis of Mass Timber Buildings
- Tall Wood Buildings and Indoor Air Quality
- The Pulse of the Global CLT Industry: Launching an Annual Survey as a Continuing Learning Tool

Education & Training

- Certificate program in mass timber manufacturing and construction:
  - Modular program for workplace learners
  - Joint delivery with community colleges
  - Online elements
  - Partnerships with software and machinery vendors
  - Design-fabricate build experiences at TDI's A.A. "Red" Emerson Advanced Wood Products Lab



Education & Training

- Summarize research on wood construction for code officials, designers and other relevant audiences

- Joint studio courses involving U of Oregon and OSU students

Education & Training

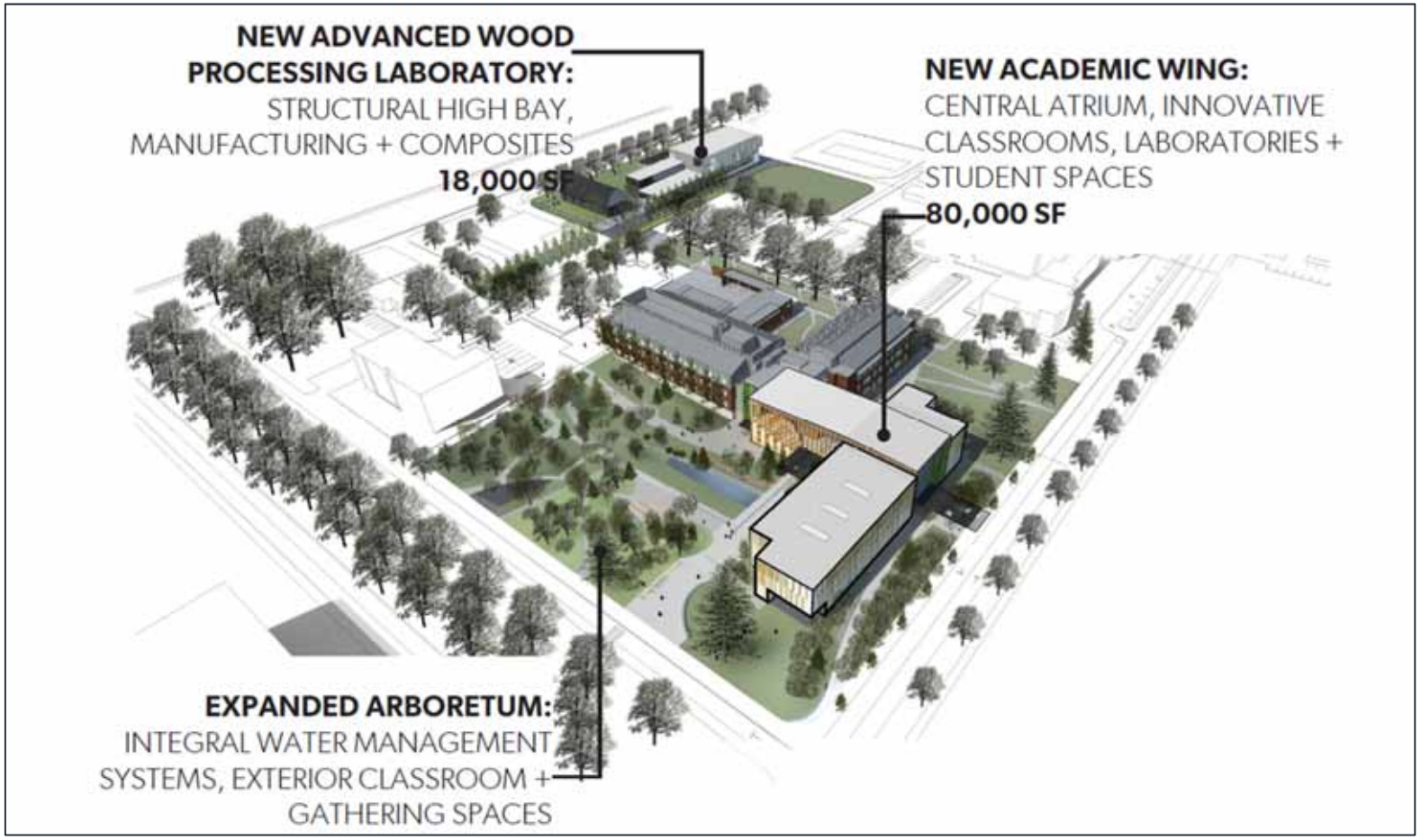
- Affordable Housing Round Table (March 1st)
  - White Paper available at http://tallwoodinstitute.org/news/affordable-housing-round-table

Product Development & Testing

- Helping manufacturers prototype, test and refine new mass timber products
- Providing peer review and testing services for new mass timber projects


MPP

Oregon Forest Science Complex




PEAVY HALL


AWP


ROOF
LEVEL 2
LEVEL 1
STRUCTURES LAB
REACTION WALL
OVERHEAD CRANE
STRONG FLOOR
PANEL SAW
MANUFACTURING
ACCESS
MEZZANINE SPACE
MECHANICAL
ENTRANCE CANOPY
SECTION A
ROOF
LEVEL 2
LEVEL 1
CLT CANOPY
HYDRAULIC TRENCH
REACTION WALL
CORRIDOR
WORKS YARD
SECTION B
AWP
WORKS YARD
ACCESS TO MANUFACTURING
CORRIDOR
LOBBY
OFFICES
CLT CANOPY
SECTION C
AWP SECTIONS
SCALE 3/32" = 1'

Thank You

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