Exploring Wood Buildings: Innovative Products and New Code Provisions

March 14, 2023

Presented by
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Apex Plaza / Courtesy William McDonough + Partner

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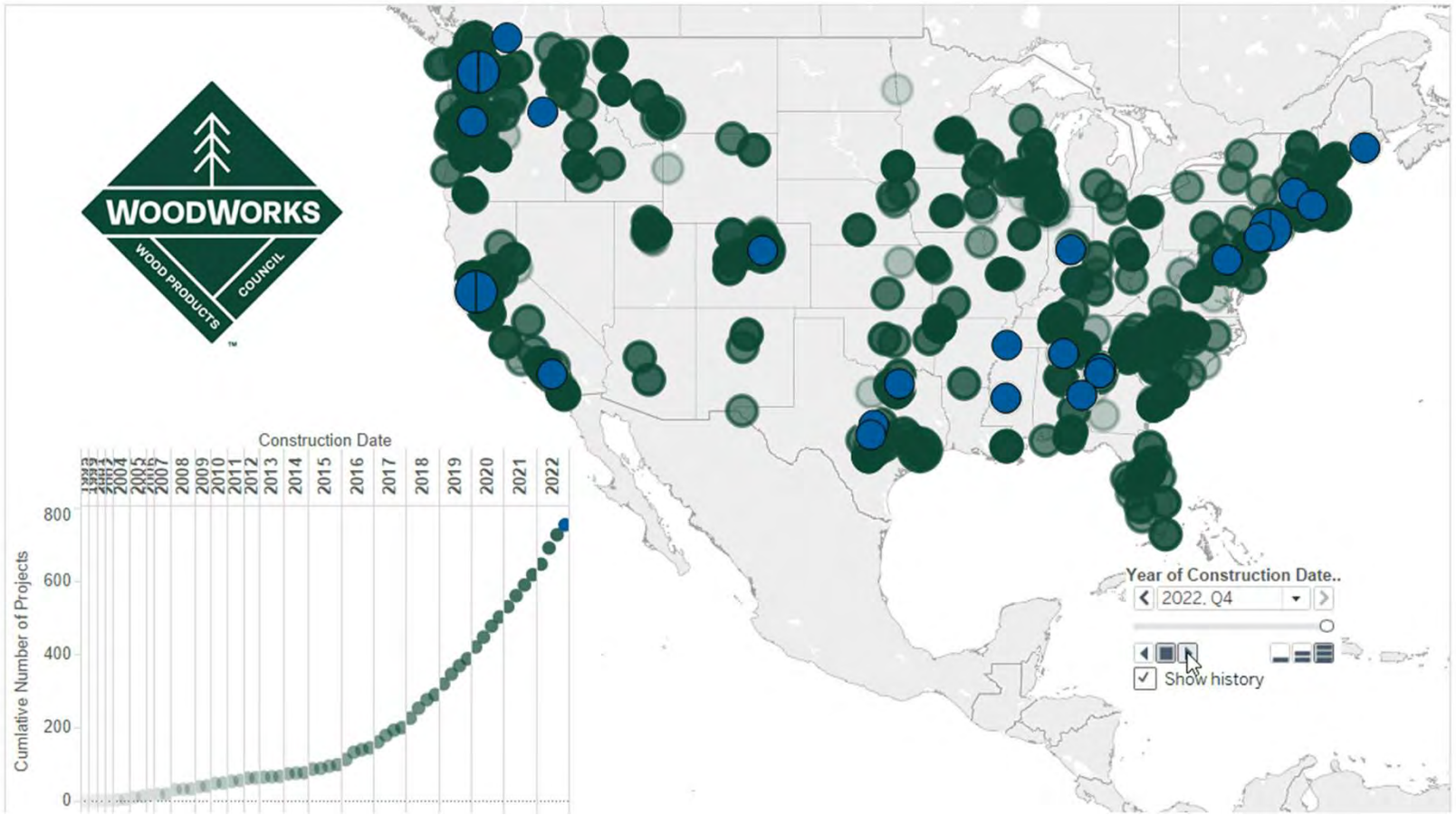
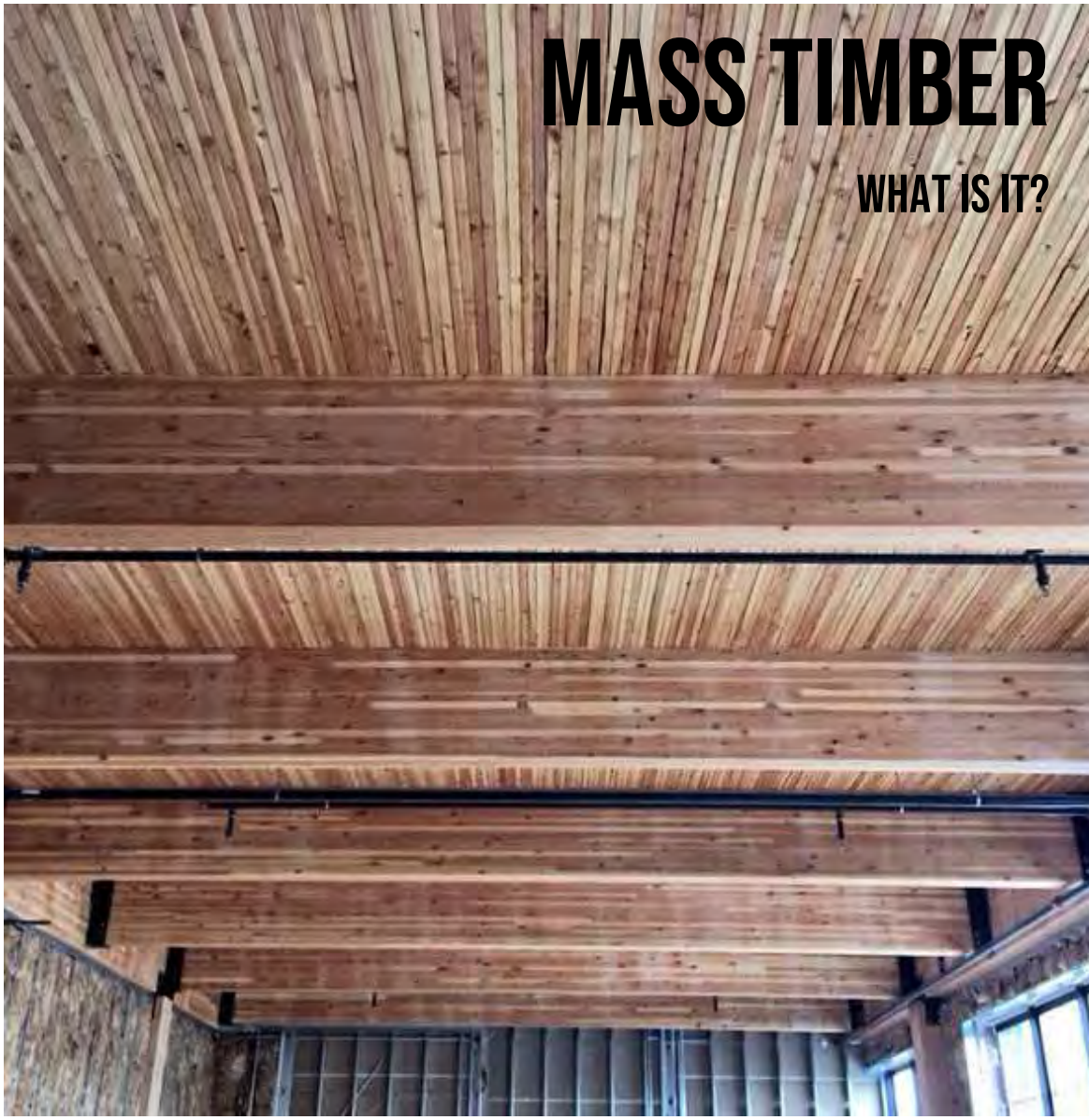
AIA Approved Continuing Education

Current State of Mass Timber Projects

As of December 2022, in the US, **1,667** multi-family, commercial, or institutional projects have been constructed with, or are in design with, mass timber.



MASS TIMBER IS A CATEGORY OF FRAMING STYLES OFTEN USING SMALL WOOD MEMBERS FORMED INTO LARGE PANELIZED SOLID WOOD CONSTRUCTION INCLUDING CLT, NLT OR GLULAM PANELS FOR FLOOR, ROOF AND WALL FRAMING



HEAVY TIMBER

Federal Center South, Seattle, WA
Photo: Benjamin Benschneider

MASS TIMBER

Bullitt Center, Seattle, WA
Photo: John Stamets

Glue Laminated Timber (Glulam)
Beams & columns

Cross-Laminated Timber (CLT)
Solid sawn laminations

Cross-Laminated Timber (CLT)
SCL laminations

Photo: Freres Lumber

Photo: StructureCraft

Photo: LendLease

Photo: LEVER Architecture

Dowel-Laminated Timber (DLT)

Photo: StructureCraft

Nail-Laminated Timber (NLT)

Photo: Think Wood

Glue-Laminated Timber (GLT)

Plank orientation

Photo: StructureCraft

Photo: StructureCraft

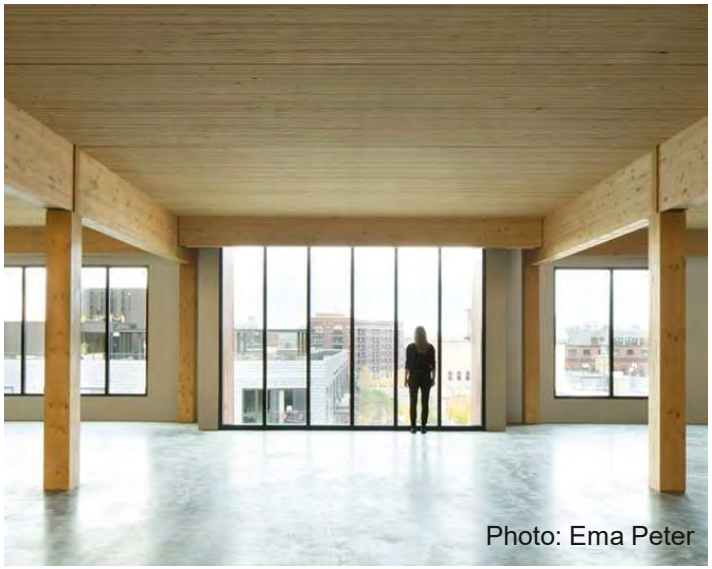


Photo: Ema Peter

Photo: Manasc Isaac Architects/Fast + Epp

Mass Timber Building Options


Photo: Blaine Brownell

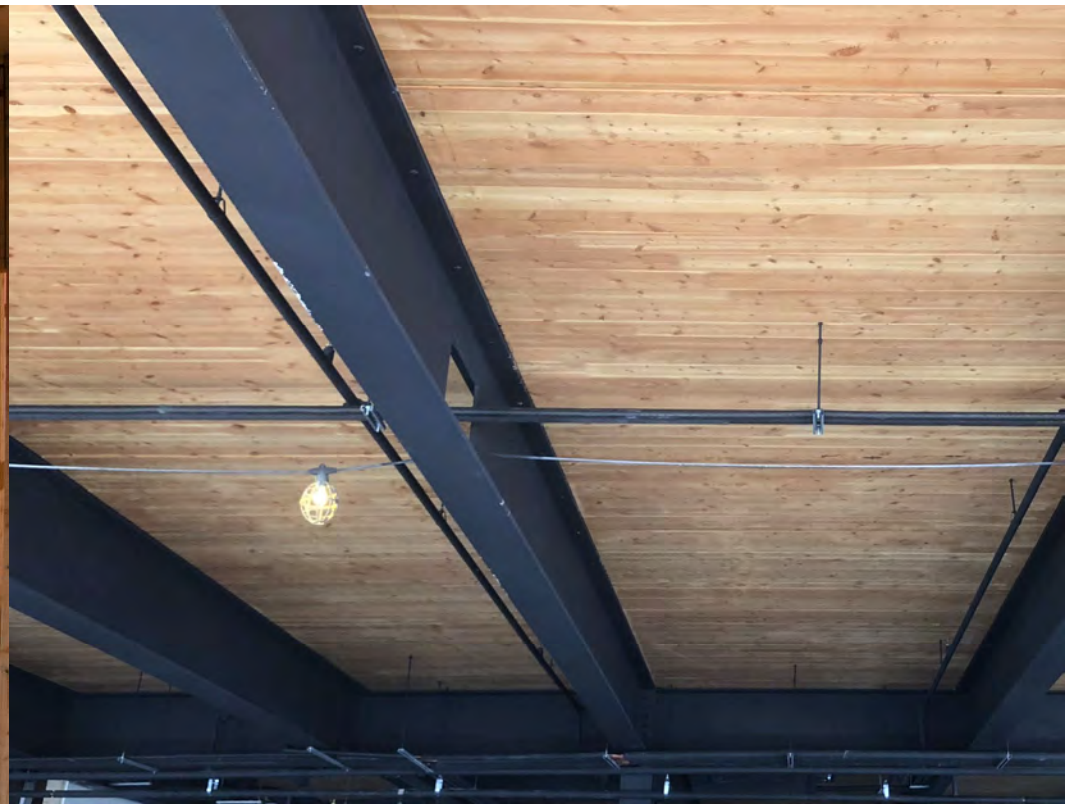

Photo: acton ostry architects


Photo: : LendLease

Post and Beam **Flat Plate** **Honeycomb**

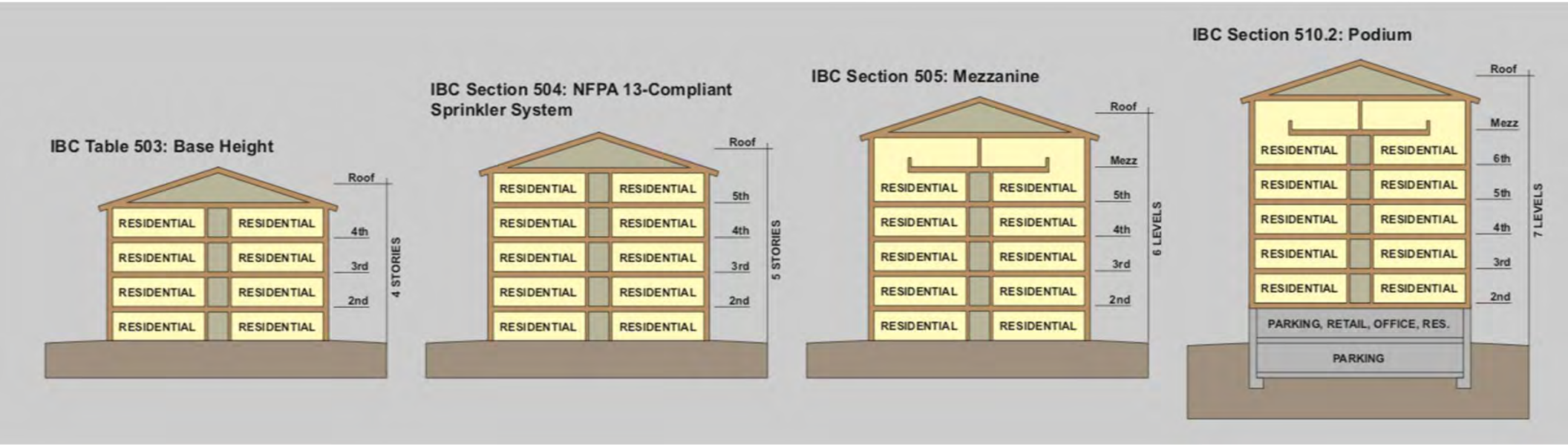
Mass Timber Building Options

Hybrid: Light-frame



Hybrid: Steel framing

Evolution of Mid-Rise Wood Structures in the US



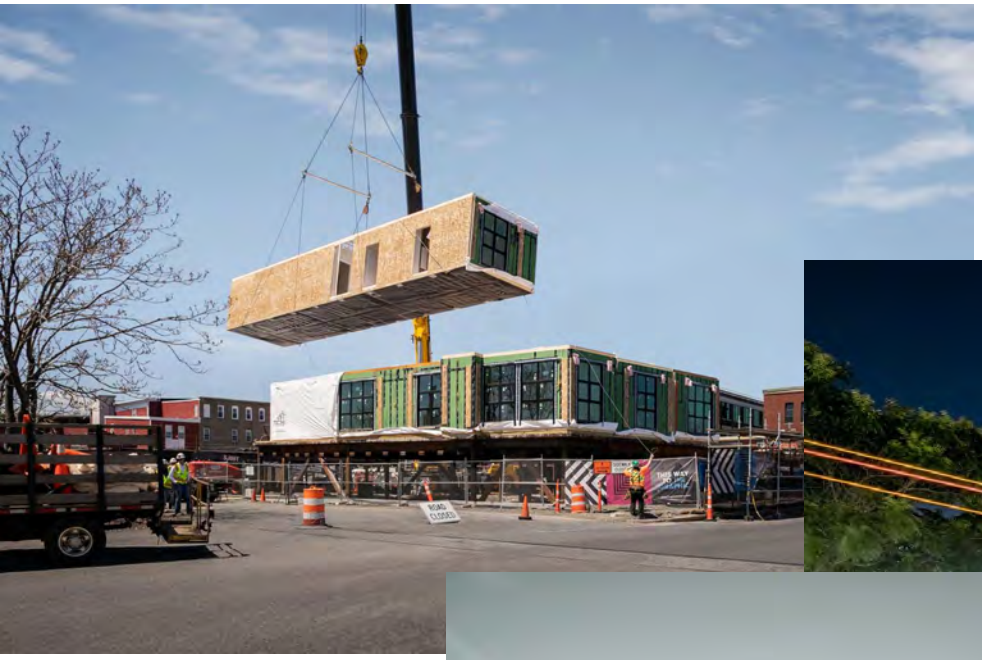
Type V → Type III → + Mezzanines → + Podiums

Source: WoodWorks

Off-Site Construction

Image: Ecocor

Modular Construction



The Graphic
Cambridge, MA

Credit: ICON Architecture

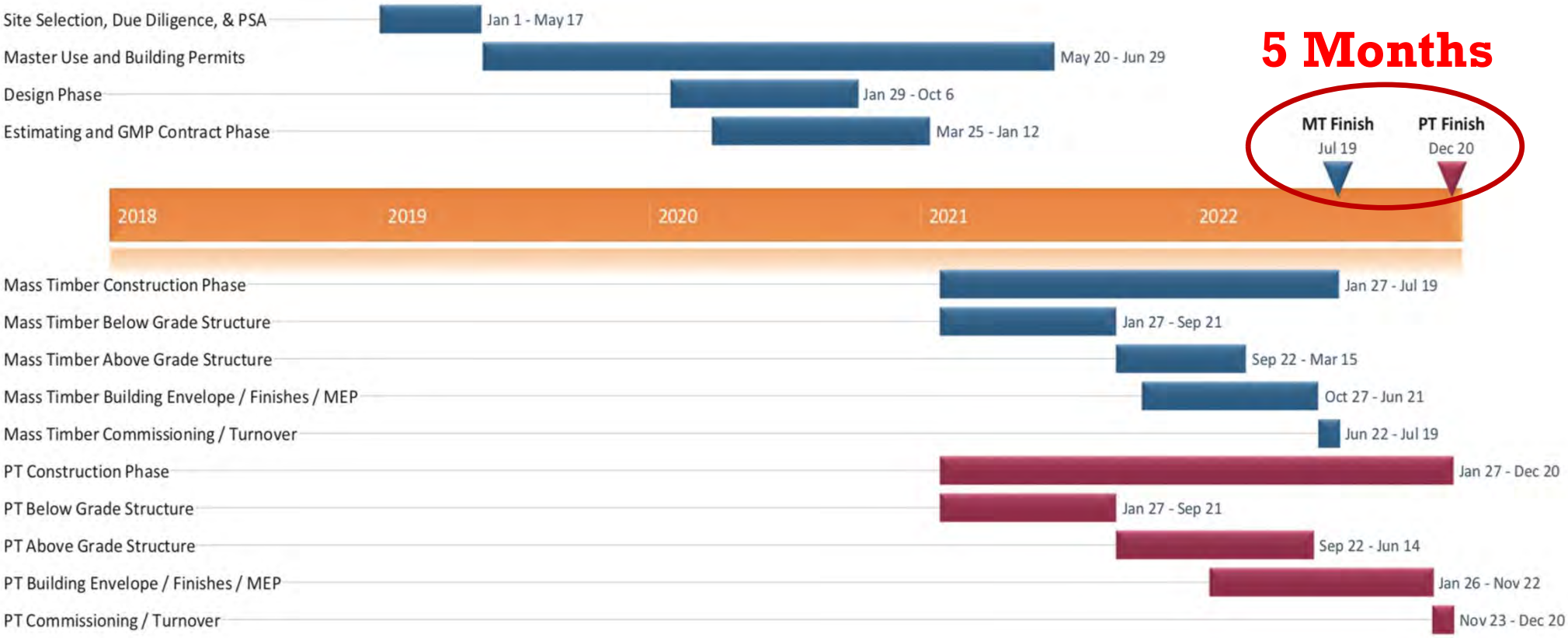

INNOVATIVE TIMBER CONSTRUCTION
UNDERSTANDING THE WHY

Biophilia - Structural Warmth is a Value-Add

TMBR (unbuilt) Minneapolis, MN | Images: D/O Architects

Construction Impacts: Labor Availability

Construction Impacts: Schedule



Seattle Mass Timber Tower Study, Source: DLR Group | Fast + Epp | Swinerton Builders

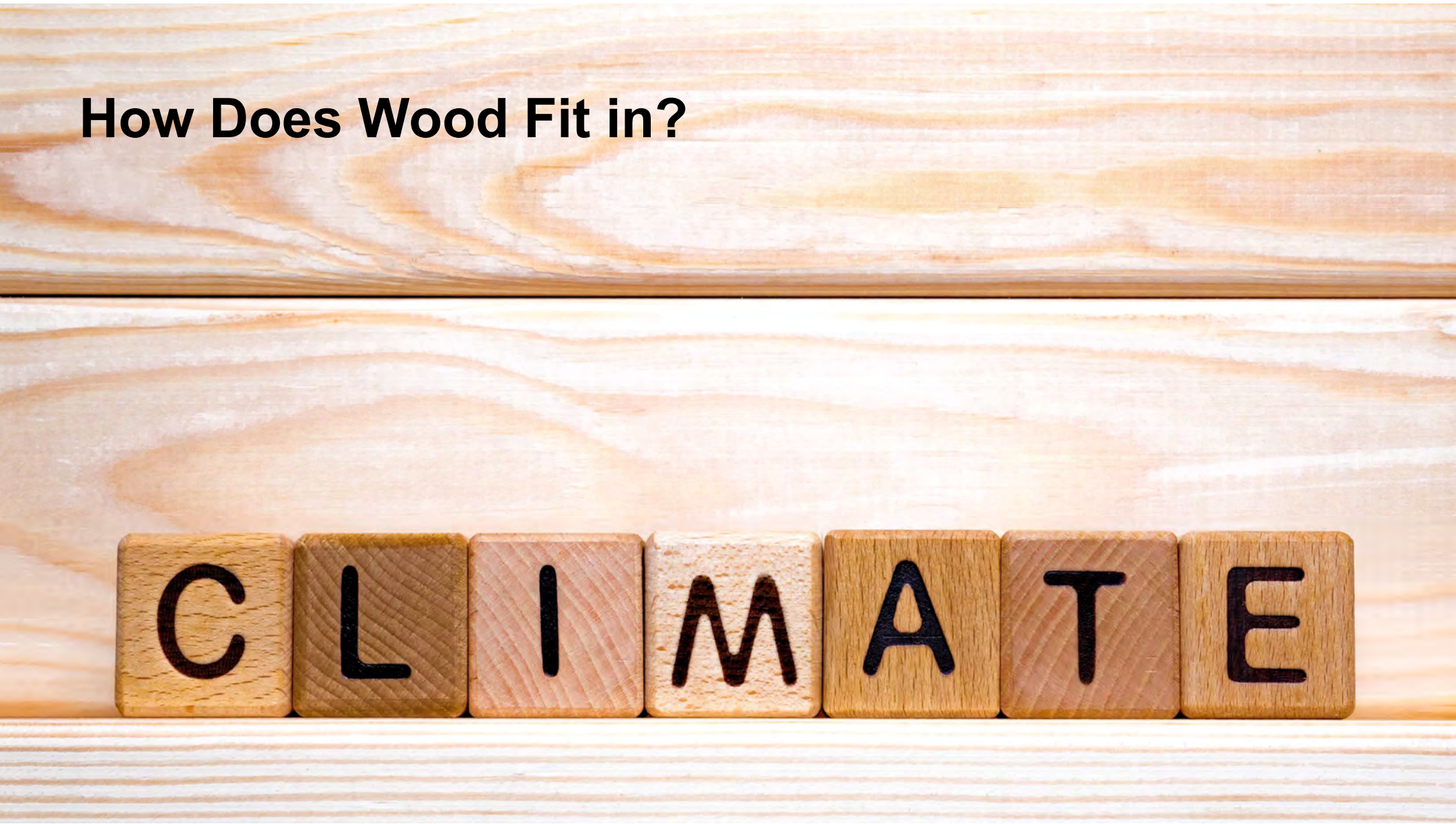
INNOVATIVE WOOD APPEAL

MATERIAL MASS

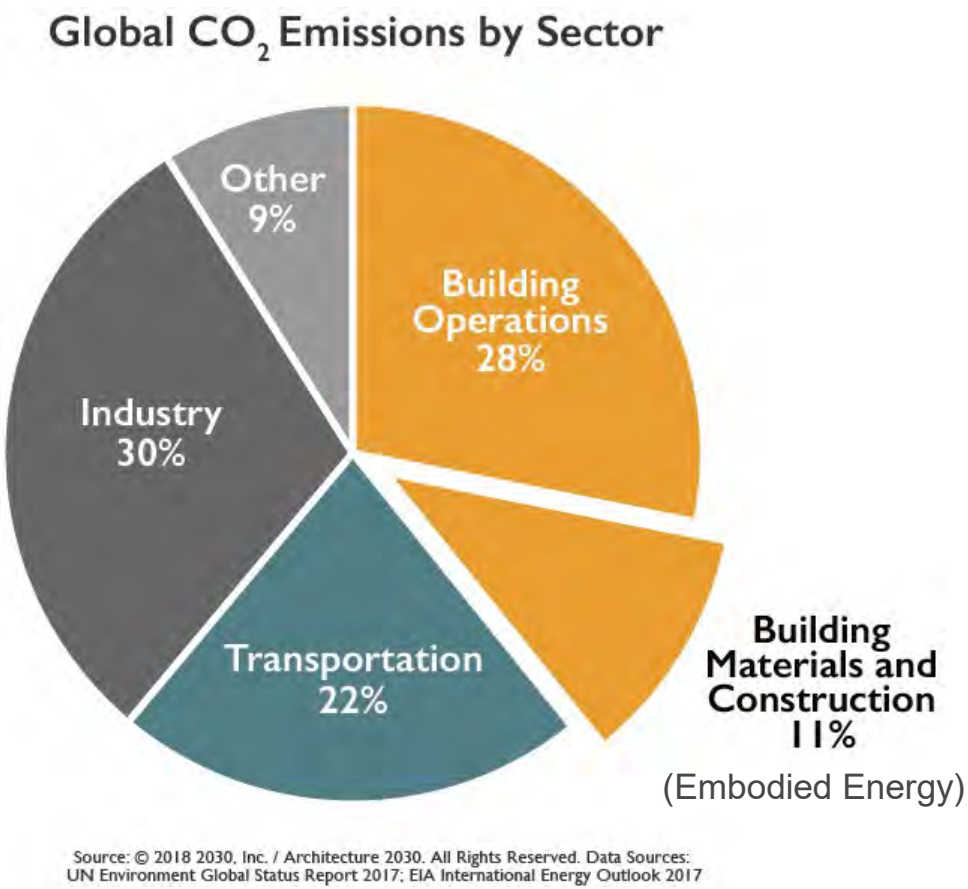
75% LIGHTER WEIGHT THAN CONCRETE

SOURCE: STRUCTURLAM[7]

How Does Wood Fit in?



New Buildings & Greenhouse Gases



Buildings generate nearly **40%** of annual global greenhouse gas emissions (*building operations + embodied energy*)

Embodied energy: **11%**

Concrete, iron, steel **~9%**

Image: Architecture 2030

Carbon vs CO_2

1 ton Carbon ≠ 1 ton CO_2

1 ton Carbon = (44/12=) **3.67 tons CO_2**

Carbon Terms

- **Embodied Carbon**: Carbon emissions associated with the entire life cycle of the building including harvesting, mining, manufacturing, transporting, installing, maintaining, decommissioning, and disposing/reuse of a material or product
- **Operational Carbon**: Carbon emissions associated with operating a building including power, heat, and cooling

Image: Boston Society for Architecture

Embodied Carbon

- Primarily related to **manufacturing of materials**
- More significant than many people realize, has been **historically overlooked**
- Big upfront GHG “cost” - which makes it a **good near-term target** for climate change mitigation

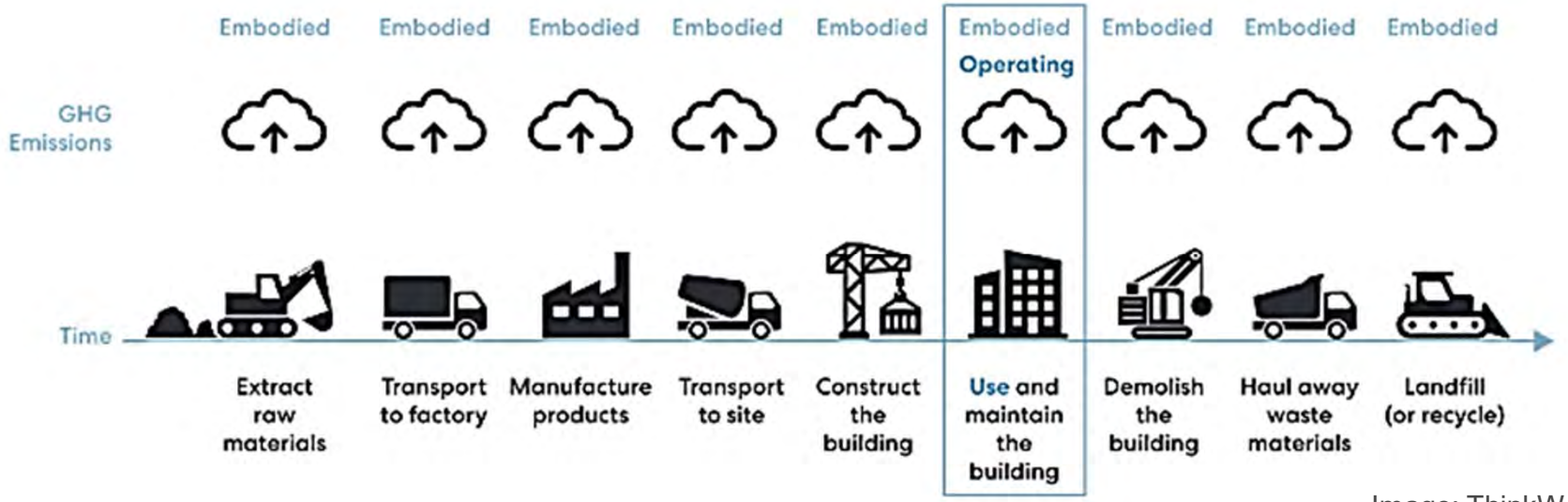


Image: ThinkWood

More Carbon Terms

Carbon Sequestration: The process by which CO_2 is **removed** from the atmosphere and deposited in solid or liquid form in oceans, living organisms, or land.

Carbon Storage: Carbon is **stored as a solid** in the form of plant material: roots, trunks, branches, stems, and leaves. It can continue to be stored in **wood building materials**.

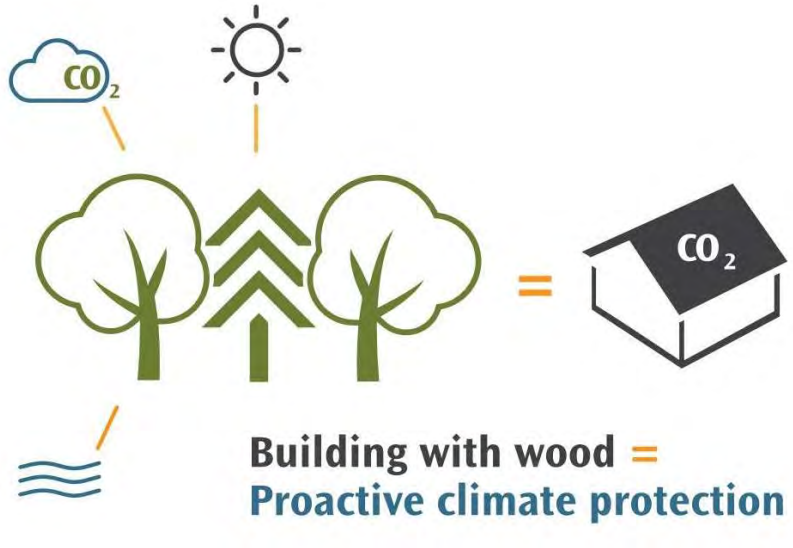


Image: Dovetail Partners, Inc.

Carbon Storage

Wood ≈ 50% Carbon (dry weight)

Image: Kaiser + Path

Image: Lever Architecture

Carbon Benefits of Wood

- **Less energy intensive** to manufacture than steel or concrete
- **Less fossil fuel consumed** during manufacture
- **Avoid process emissions**
- Carbon **storage in forests** and **promote forest health**
- Extended carbon **storage in products**

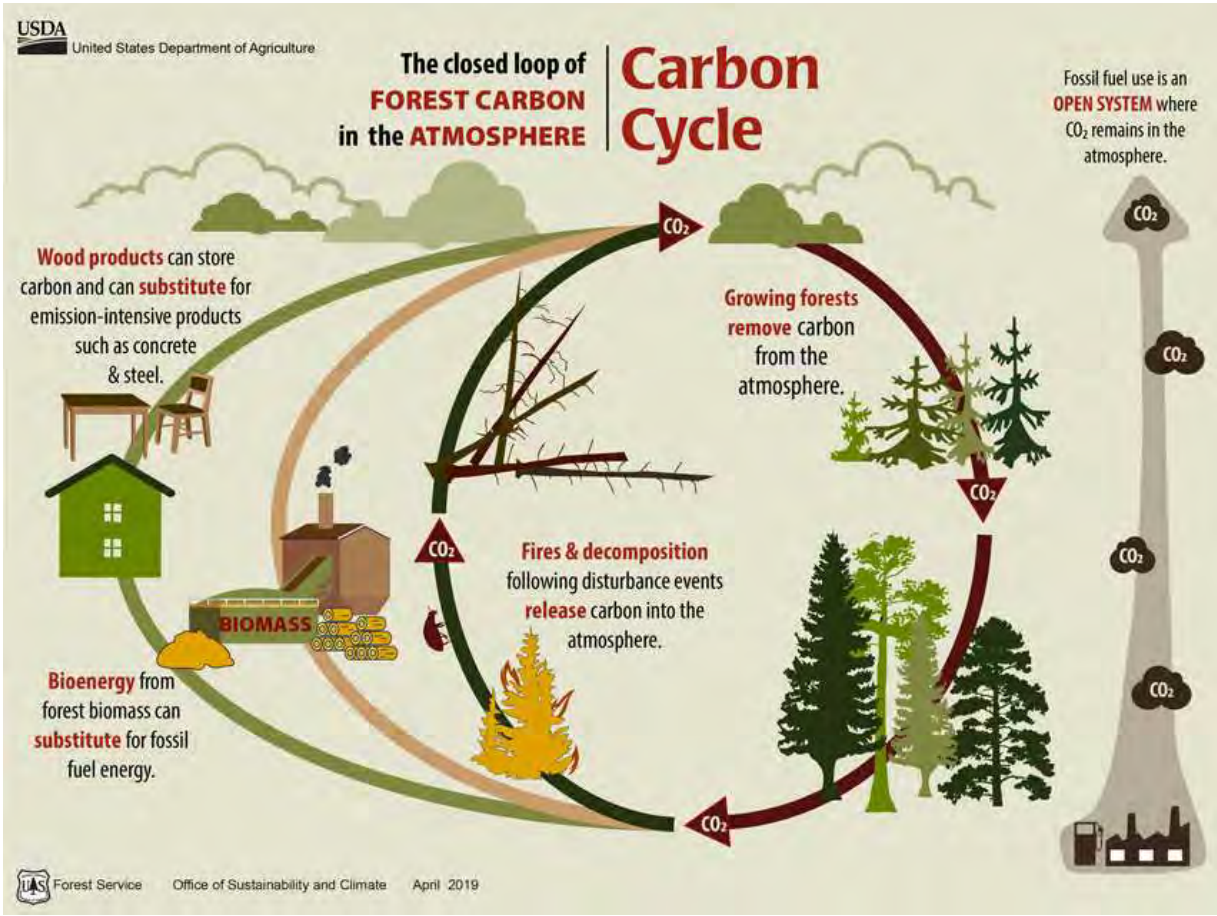
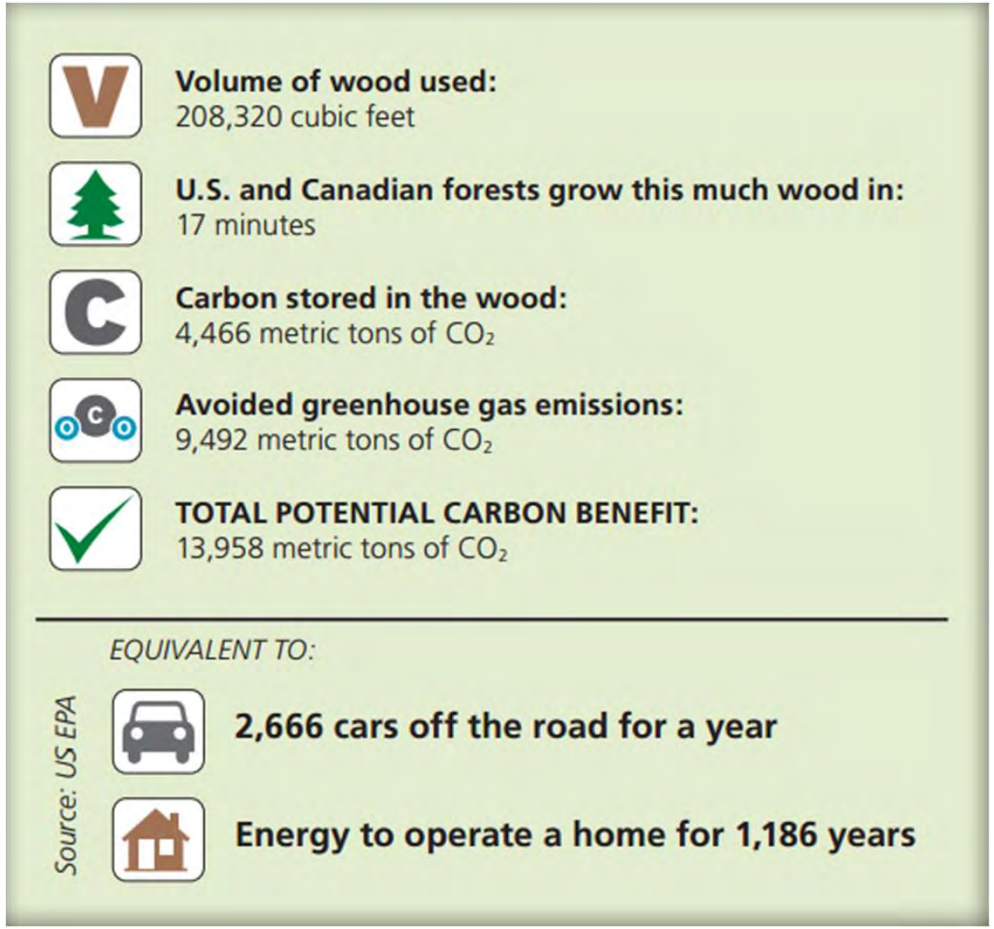


Image: USDA US Forest Service

WoodWorks Carbon Calculator

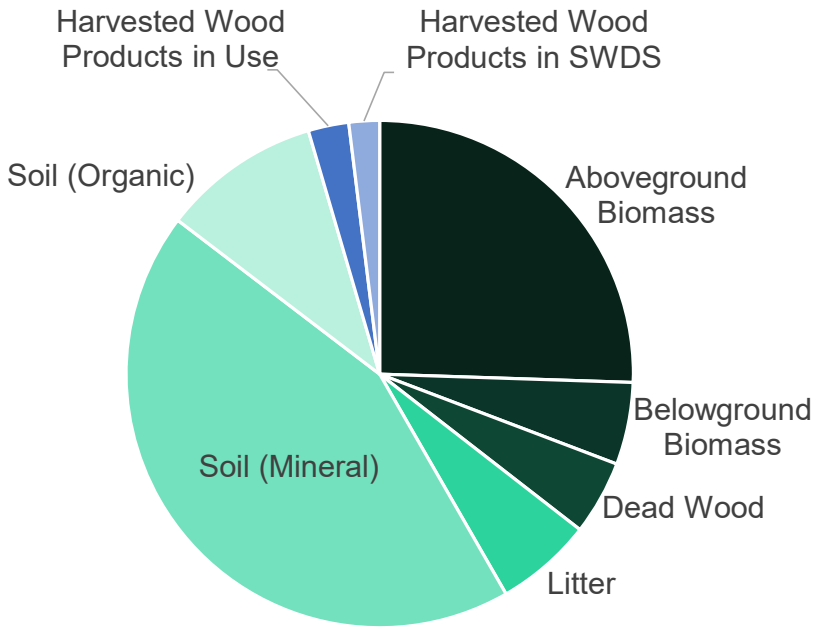
- Available at **woodworks.org**
- Estimates total wood mass in a building
- Relays **estimated** carbon impacts:
  - Amount of **carbon stored** in wood
  - Amount of **greenhouse gas emissions avoided** by choosing wood over a non-wood material



http://www.woodworks.org/carbon-calculator-download-form/

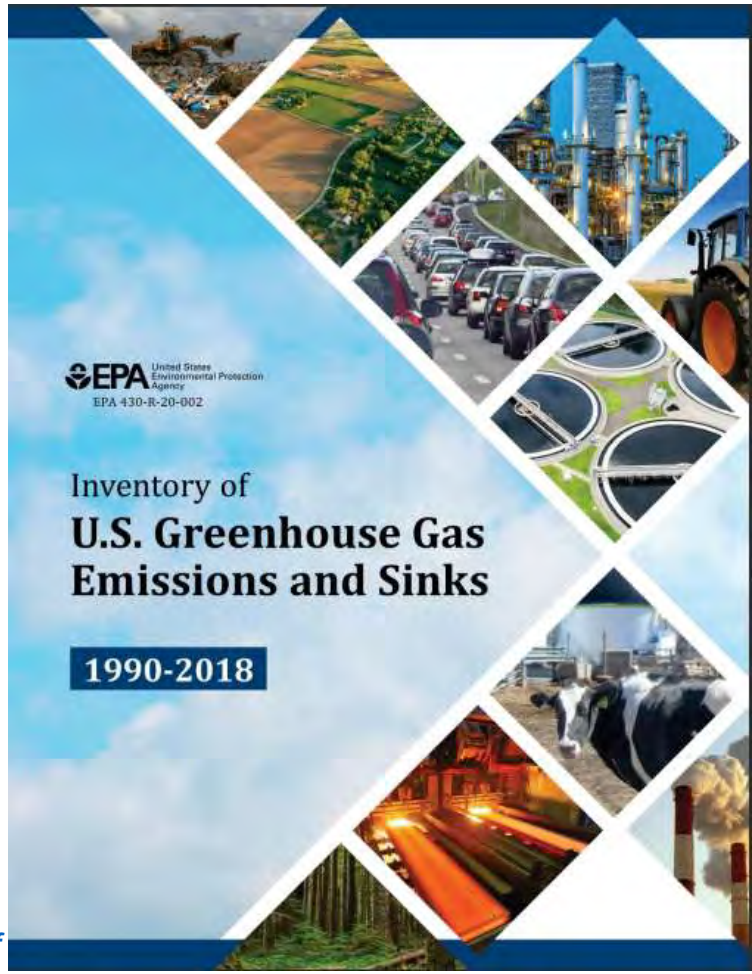
Carbon Storage in Harvested Wood Products

As of 2019, the carbon stock for Harvested **Wood Products in Use** in the conterminous 48 states is estimated at **1,521 Million Metric Tons**.



Carbon Stocks in Forest Land and Harvested Wood Pools, 2019

https://www.epa.gov/sites/production/files/2020-04/documents/us-ghg-inventory-2020-main-text.pdf



Whole Building Life Cycle Analysis (WBLCA)

"Evaluation of the inputs, outputs, and potential environmental impacts… throughout its life cycle"

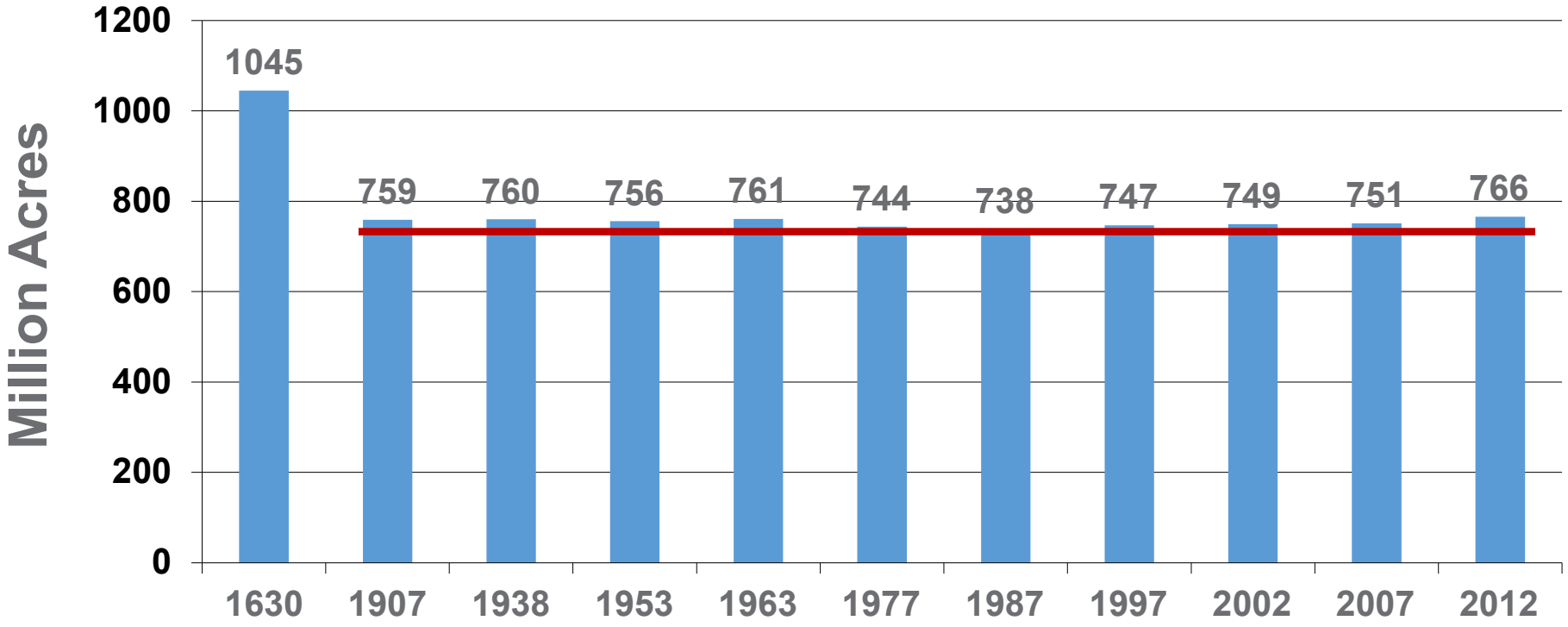
- WBLCA covers all stages in the life cycle of a building and its components
- Several tools available; various methodologies
- https://www.thinkwood.com/education/calculate-wood-carbon-footprint
- https://www.thinkwood.com/blog/understanding-the-role-of-embodied-carbon-in-climate-smart-buildings


State of Our Forests

Common Environmental Concerns About Specifying Wood

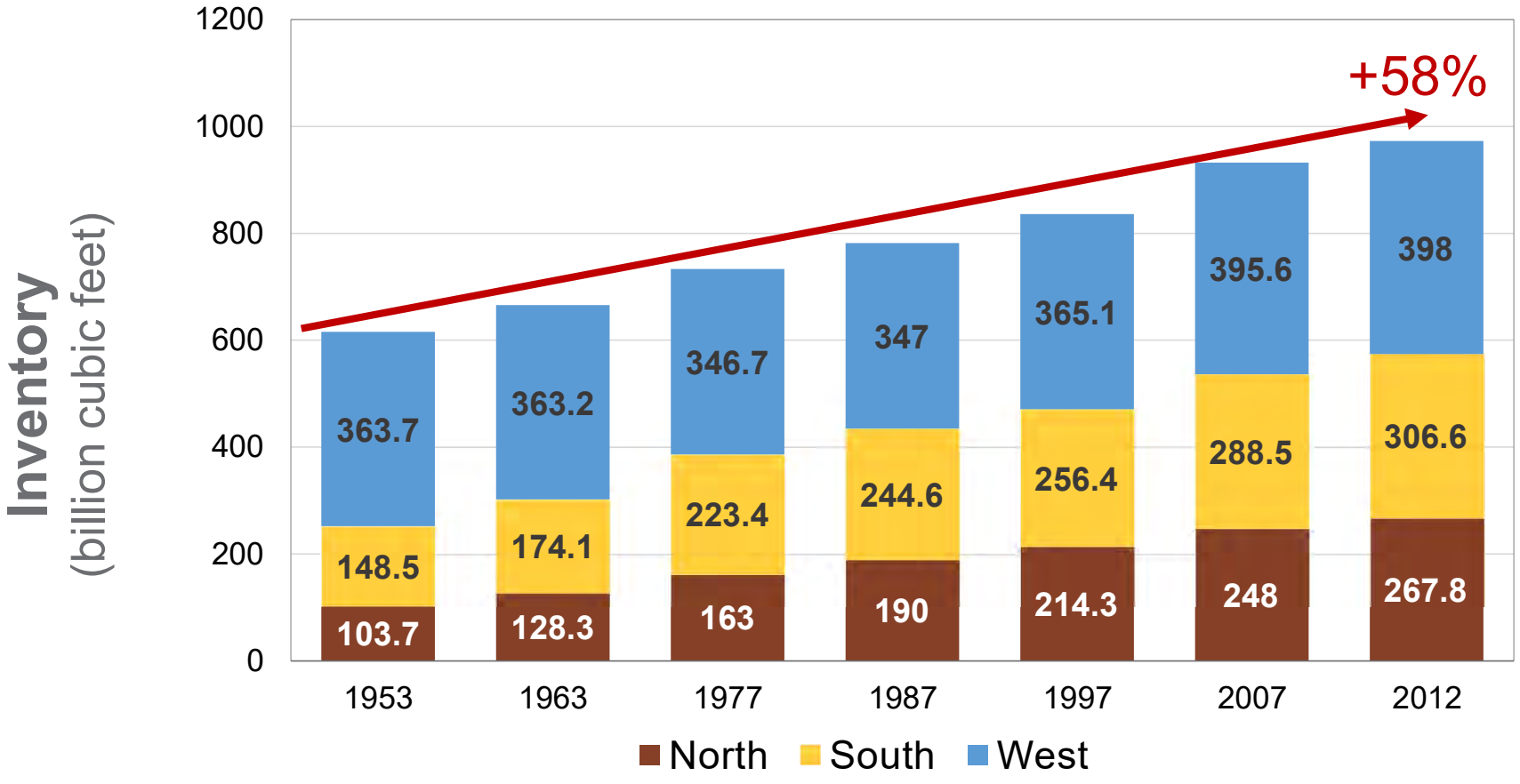
1. Is North America **running out of Forests?**
2. Does specifying wood products contribute to **deforestation?**
3. Is wood is a **renewable resource?**

U.S. Forest Land:
Forest **Area** in the United States 1630 – 2012



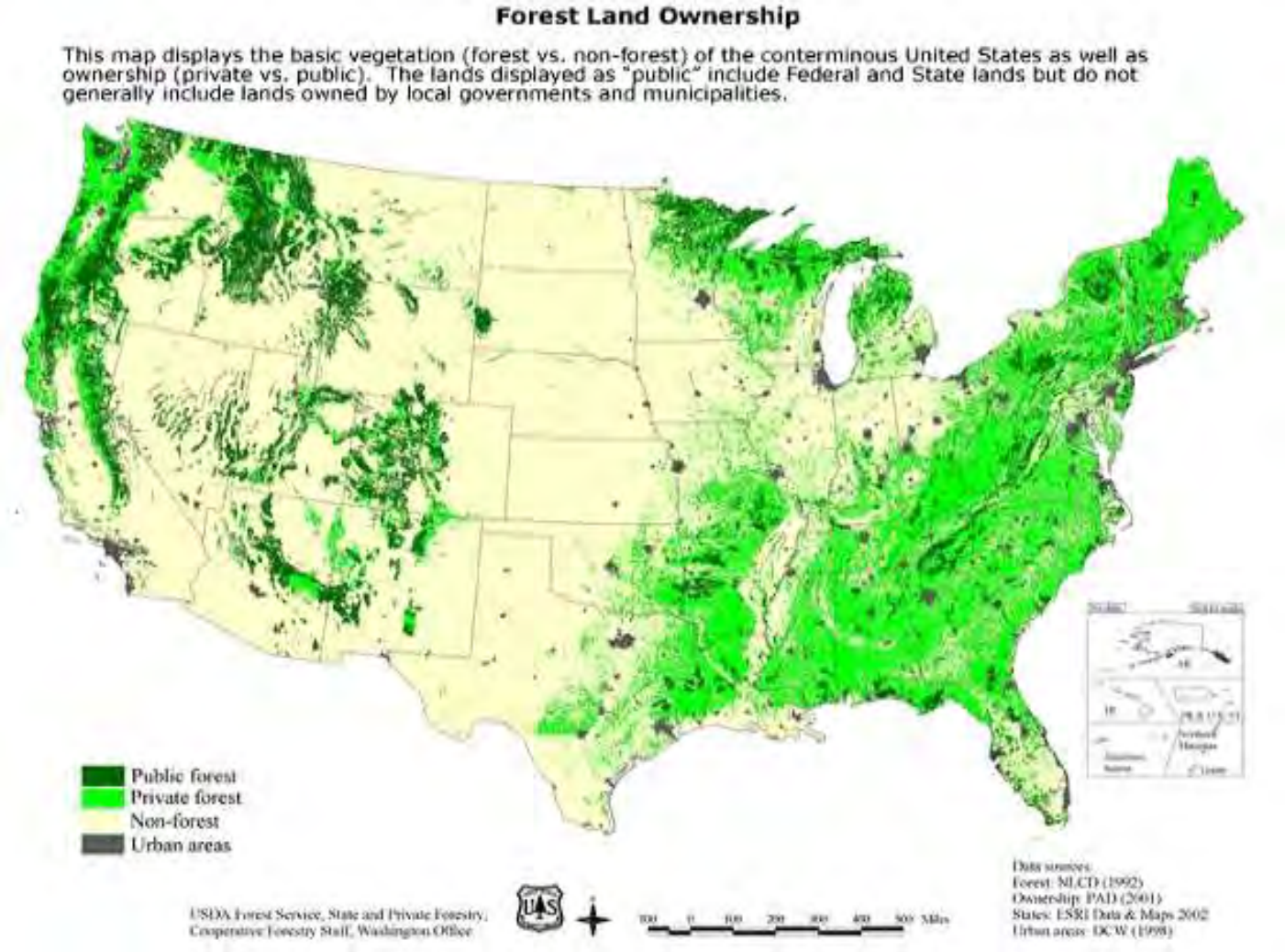
Source: USDA-Forest Service, US Forest Resource Facts and Historical Trends FS-1035. (2014).

State of our Forests: US Timber Volume on Timber Land

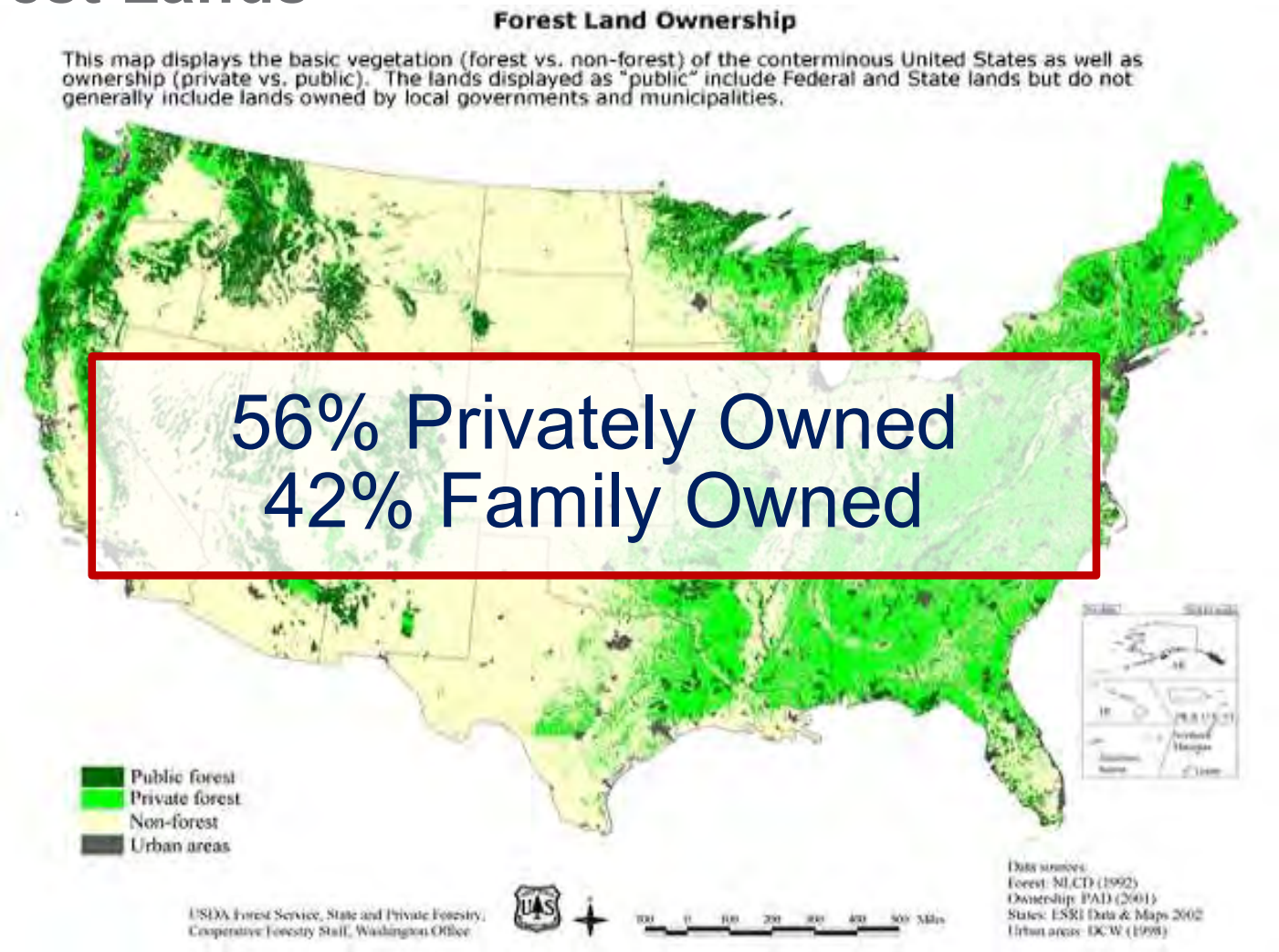


Source: USDA-Forest Service, US Forest Resource Facts and Historical Trends FS-1035. (2014).

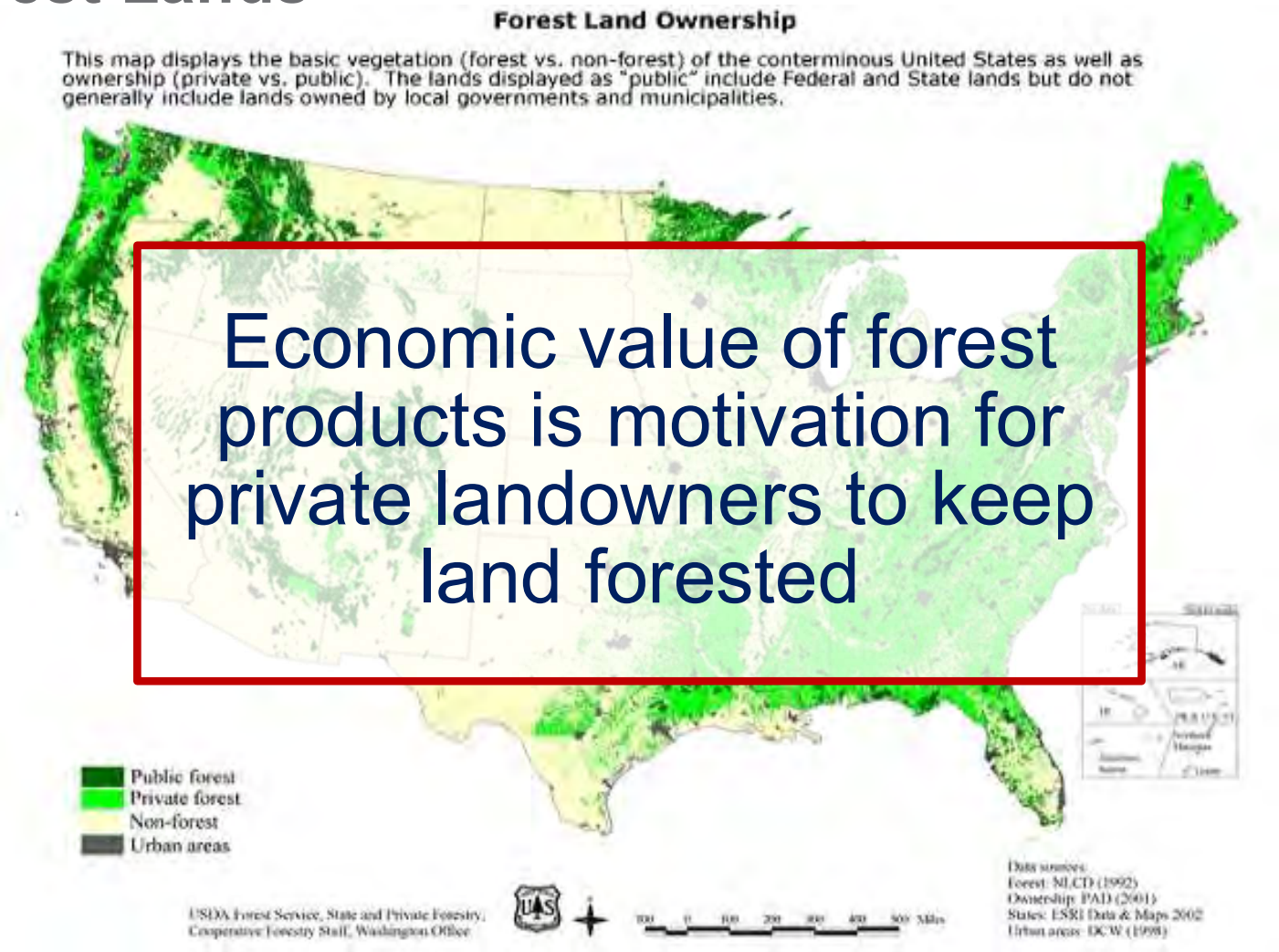
US Forest Lands



US Forest Lands



US Forest Lands



Economic value of forest products is motivation for private landowners to keep land forested

Regeneration vs. Deforestation

Deforestation is the permanent conversion of forest land to non-forest land uses. Worldwide, agricultural expansion is the main driver of deforestation, but in the U.S., the rate of deforestation has been virtually zero for decades.

Source: State of the World's Forests—2020– FAO and UNEP, USDA Forest Service, US Forest Resource Facts and Historical Trends FS-1034 (2014)

Good Forestry = Sustainable Forestry

"Forestry is the art and science of creating, using and conserving forests. The forestry profession was a pioneer in developing techniques for sustainable management and, later, techniques for the multiple use of forests. [...] The term sustainable forest management is synonymous with good forestry".

Source: State of the World's Forests 2012. United Nations Food and Agriculture Organization

Photos: Oregon Forest Resources Institute

Sustainable Forestry Management Systems

- Wood from well-managed forests is sustainable over the long term.
- Forest certification shows that the wood comes from well-managed forests
- The major North American programs are:

FSC

SFI

CSA

ATFS

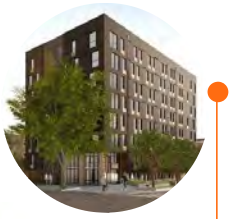
The What, Why and How of Tall Mass Timber

Photo: Michael Green Architecture

TALL WOOD

= 20 in-design tall wood projects

= tall wood project in construction or completed



Heartwood
Seattle, WA
8 stories mass timber

Carbon 12
Portland, OR
8 stories
mass timber

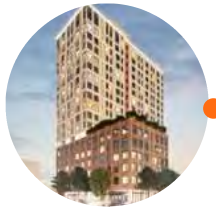
INTRO Cleveland
Cleveland, OH
9 stories –
8 mass timber

11 E Lenox
Boston, MA
7 stories
mass timber

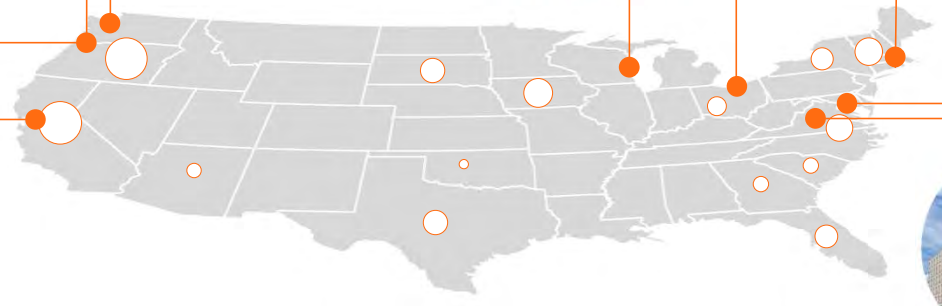
Minnesota Places
Portland, OR
8 stories –
7 mass timber

Ascent
Milwaukee, WI
25 stories –
19 mass timber

80 M Street
Washington DC
10 stories – 3-story
mass timber
vertical addition



1510 Webster
Oakland, CA
18 stories –
16 mass timber



Apex Plaza
Charlottesville, VA
8 stories –
6 mass timber

1510 Webster, rendering oWow Architecture; Minnesota Places, rendering Wright Architecture; Carbon 12, Kaiser+Path, photo Andrew Pogue; Heartwood, rendering Atelier Jones; INTRO Cleveland, Harbor Bay Real Estate Advisors, HPA Architecture; Ascent, Korb + Associates Architects, Thornton Tomasetti; 11 E Lenox, rendering Monte French Design Studio; 80 M Street, Hickok Cole Architects, Columbia Property Trust; Apex Plaza, rendering William McDonough + Partners

TALL MASS TIMBER ASSESSING THE WHAT

Brock Commons, Vancouver, BC | Architect: Acton Ostry| Image Courtesy naturallywood

Photos: Michael Elkan | Naturally Wood | UBC

BROCK COMMONS, BRITISH COLUMBIA

18 STORIES | 174 FT

Photos: Bygg Mesteren | Voll Arkitekter

MJOSTARNET, NORWAY

18 STORIES | 280 FT

Photos: *RLP Rüdiger Lainer + Partner, RWTplus*

HOHO, AUSTRIA

24 STORIES | 275 FT

Photos: Baumberger Studio/PATH Architecture

INTRO, CLEVELAND

Type IV-B
Variance to expose ~50% ceilings

Photo: Harbor Bay Real Estate Advisors, Image Fiction | Architect: Hartshorne Plunkard Architecture

9 Stories | 115 ft
8 Timber Over 1 Podium

ASCENT, MILWAUKEE

25 STORIES

19 TIMBER OVER 6 PODIUM, 284 FT

Tallest Mass Timber Building in the World

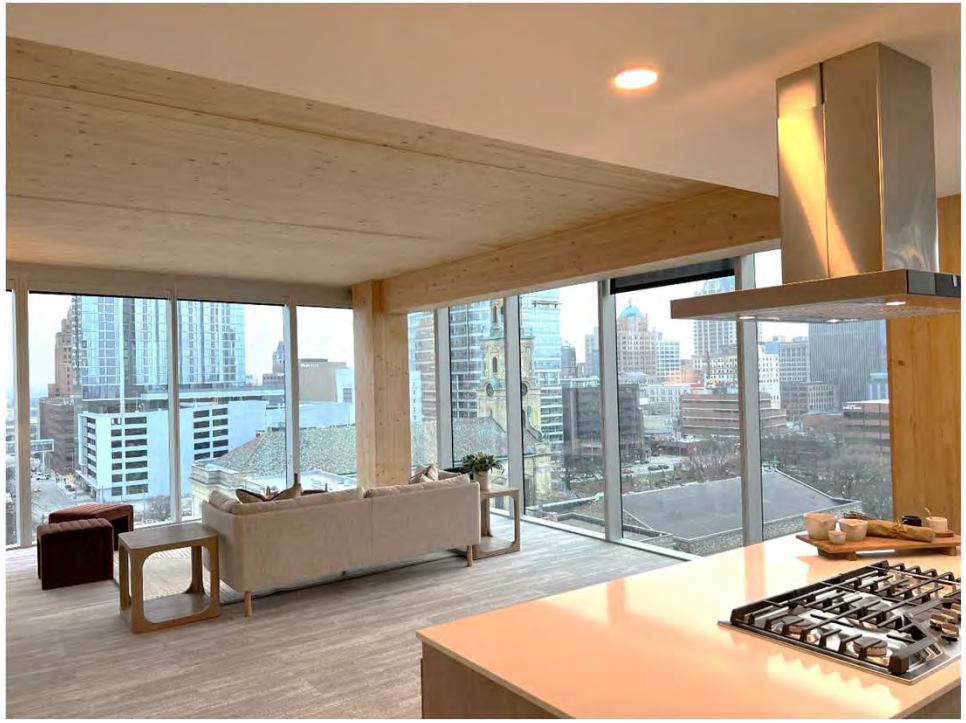


Photo: CD Smith Construction |
Architect: Korb & Associates Architects


APEX PLAZA
CHARLOTTESVILLE, VA
8 STORIES
6 TIMBER OVER 2 PODIUM, 100 FT
Monticello Av
Gleason St
PRIMARILY OFFICE SPACE
Photo: William McDonough + Partners | Architect: William McDonough + Partners

11 E LENOX, BOSTON, MA

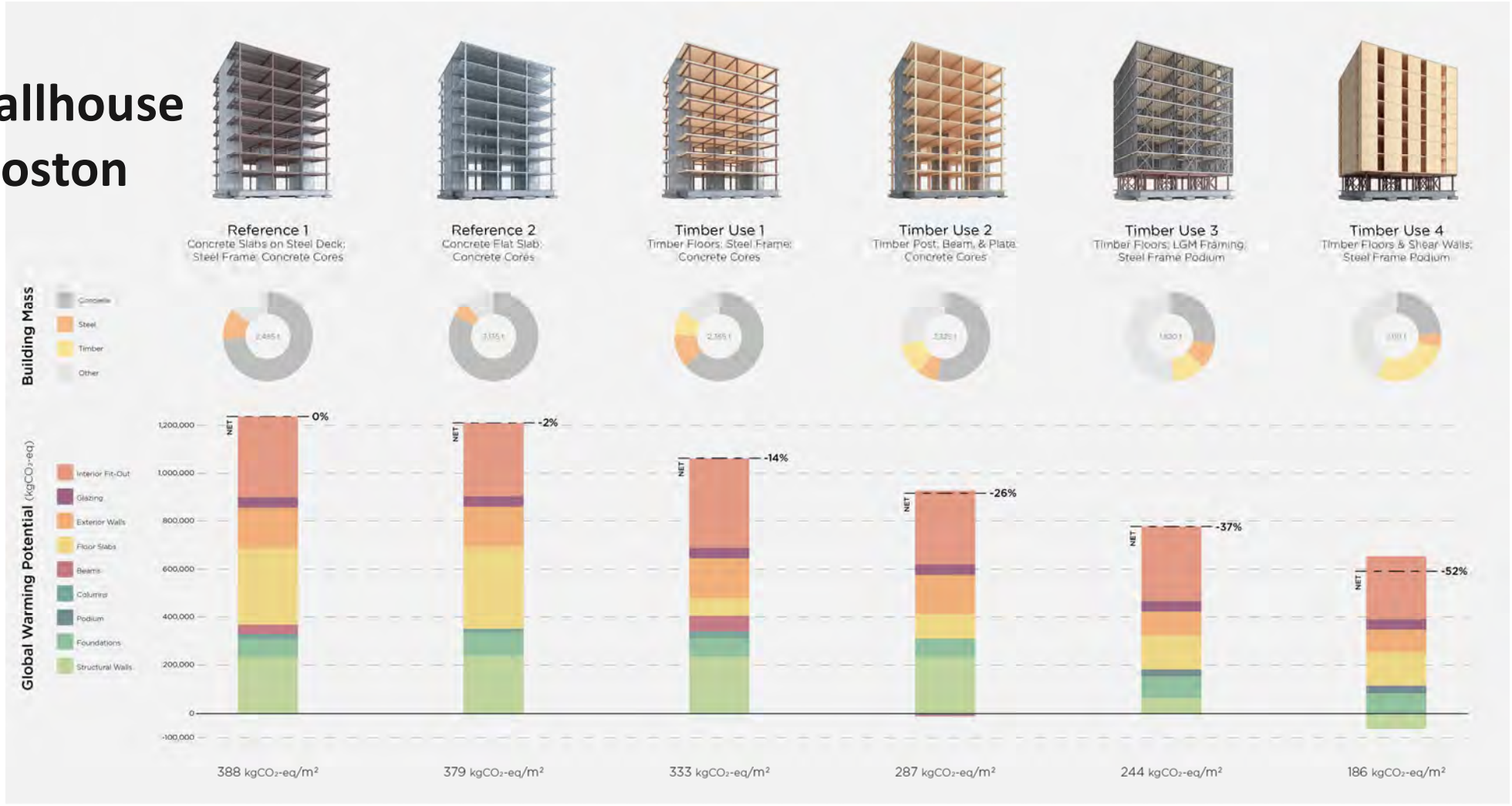
7 STORIES

70 FT, Passive House, Multi-Family

Credit: WoodWorks, Kure Creative


80 M ST, WASHINGTON, DC
3 STORY VERTICAL ADDITION
7 STORY EXISTING BUILDING
Photo: ProPano | Architect: Hickok Cole

Tallhouse Boston



GLOBAL WARMING POTENTIAL & MATERIAL MASS

(PER BUILDING ASSEMBLY)

Source: Generate Architecture

The total global warming potential (GWP) of each option is shown with a breakdown by building assembly. The Concrete With Steel Frame and Concrete Flat Slab options have the highest GWP, with the bulk of the impact embedded in the floor slabs. The Timber Use 1 (Floor Slabs; Steel Frame) option offers a slight reduction in GWP, with the most of the savings also embedded in the floor slabs. The Timber Use 2 (Post, Beam, and Plate) option offers a relatively typical approach to building with timber, showing savings in floor slabs, beams and columns. Since Timber Use 3 and 4 are cellular approaches with load-bearing walls, these options included steel podiums to accommodate the ground floor program. Timber Use 3 shows how a hybrid approach with light gauge metal yields GWP savings in structural walls and exterior walls, despite the addition of the podium. Lastly, Timber Use 4 emphasizes how a completely cellular CLT

TALL WOOD IN THE CODE


2018 IBC and All Previous Editions:
» Prescriptive Code Limit - 6 stories (B occupancy) or 85 feet
» Over 6 Stories - Alternate Means and Methods Request (AMMR) through performance based design
» Based on the 1910 Heights and Areas Act
Photo: Alex Schreyer

Photo: Blaine Brownell

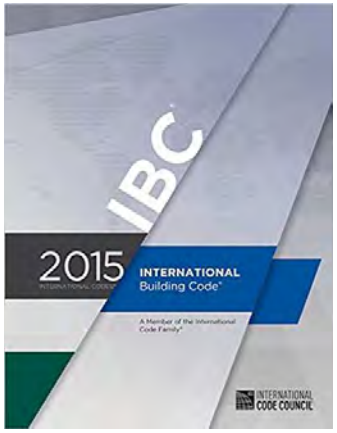
Photo: Christian Columbres

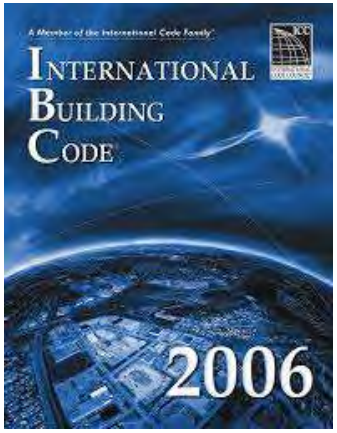
ICE Block I, RMW Architecture & Interiors, Buehler Engineering, Bernard André Photography

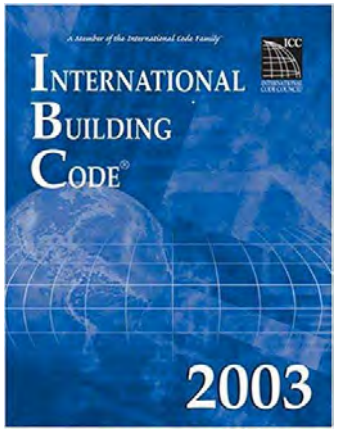
Photo: Swinerton

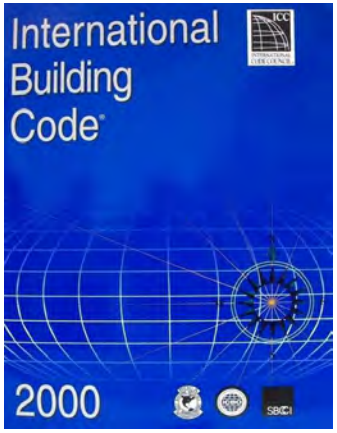
ICC INTERNATIONAL CODE COUNCIL®

3 YEAR CODE CYCLE









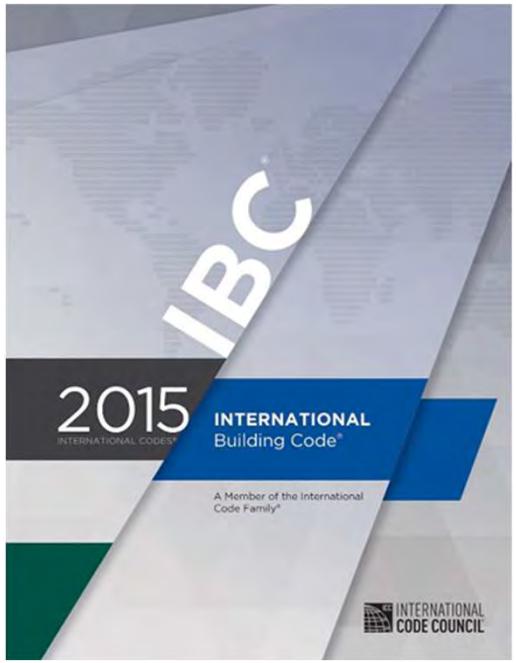
Source: ICC

U.S. TALL WOOD
DEVELOPMENT AND CHANGES

Seen as the catalyst for the mass timber revolution, CLT first recognized in US codes in the 2015 IBC

[BS] CROSS-LAMINATED TIMBER. A prefabricated engineered wood product consisting of not less than three layers of solid-sawn lumber or *structural composite lumber* where the adjacent layers are cross oriented and bonded with structural adhesive to form a solid wood element.

2303.1.4 Structural glued cross-laminated timber. Cross-laminated timbers shall be manufactured and identified in accordance with ANSI/APA PRG 320.



U.S. TALL WOOD
DEVELOPMENT AND CHANGES

Interest in tall wood projects in the US was rapidly increasing. Some building officials were reluctant to approved proposed plans, primarily due to lack of code direction and precedent

Empire State Bulding, New York City, New York, 1931

Photo: Seagate Mass Timber Inc
Pollux Chang photographer

U.S. TALL WOOD
DEVELOPMENT AND CHANGES

In December 2015, the ICC Board established the ICC Ad Hoc Committee on Tall Wood Buildings. Objectives:

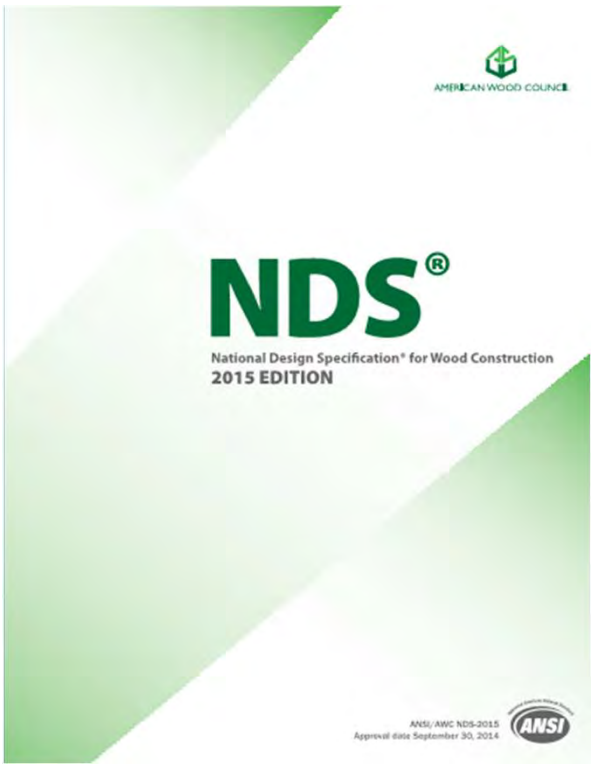
1. Explore the building science of tall wood buildings
2. Investigate the feasibility, and
3. Take action on developing code changes for tall wood buildings.

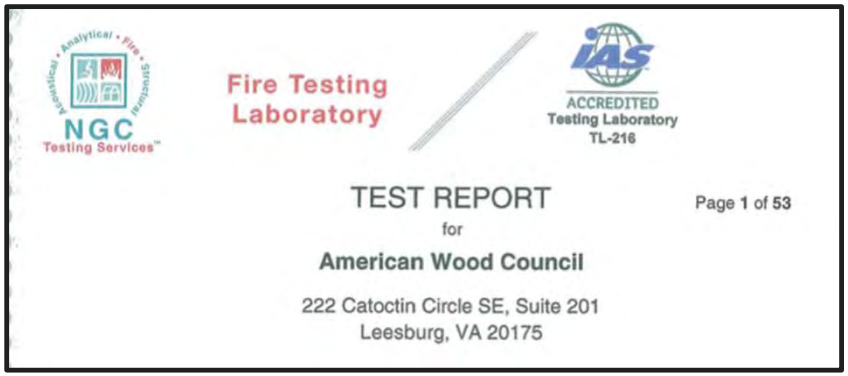
U.S. BUILDING CODES
DEVELOPMENT AND CHANGES

5 Working Groups Created

- July 2016 – November 2017: 5 in-person meetings, numerous conference calls
- 82 issues addressed, one primary topic was **fire performance and life safety**


Photo: FPInnovations




Fire Testing Laboratory

NGC Testing Services

ACCREDITED Testing Laboratory TL-216

TEST REPORT Page 1 of 53

for

American Wood Council

222 Catoctin Circle SE, Suite 201
Leesburg, VA 20175

Fire resistance of mass timber for low- to mid-rise structures well understood, codified

Taller wood buildings create new set of challenges to address:

AHC established 6 performance objectives:

1. No collapse under reasonable scenarios of complete burn-out of fuel without automatic sprinkler protection being considered.
2. Highly reliable fire suppression systems to reduce the risk of failure during reasonably expected fire scenarios. The degree of reliability should be proportional to evacuation time (height) and the risk of collapse.

AHC established 6 performance objectives:

3. No unusually high radiation exposure from the subject building to adjoining properties to present a risk of ignition under reasonably severe fire scenarios.
4. No unusual response from typical radiation exposure from adjacent properties to present a risk of ignition of the subject building under reasonably severe fire scenarios.

AHC established 6 performance objectives:

5. No unusual fire department access issues
6. Egress systems designed to protect building occupants during the design escape time, plus a factor of safety.

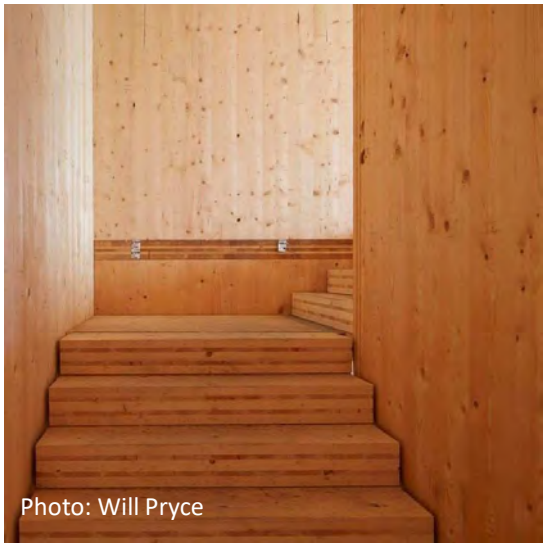


Photo: Will Pryce

U.S. BUILDING CODES
Tall Wood Ad Hoc Committee

Commissioned series of 5 full-scale tests on 2-story mass timber structure at ATF lab in MD, May-June 2017

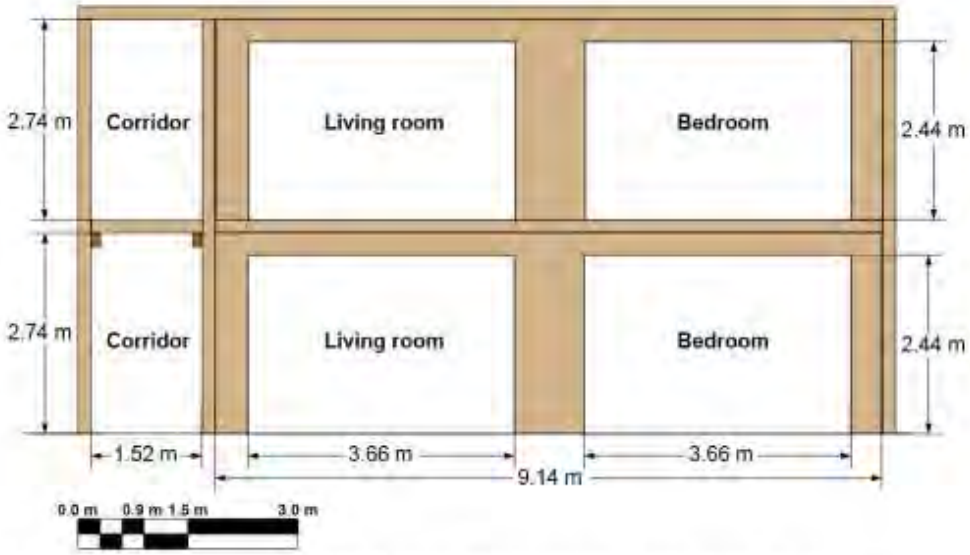


Figure 2. Elevation view of the front of the cross-laminated timber test structure.

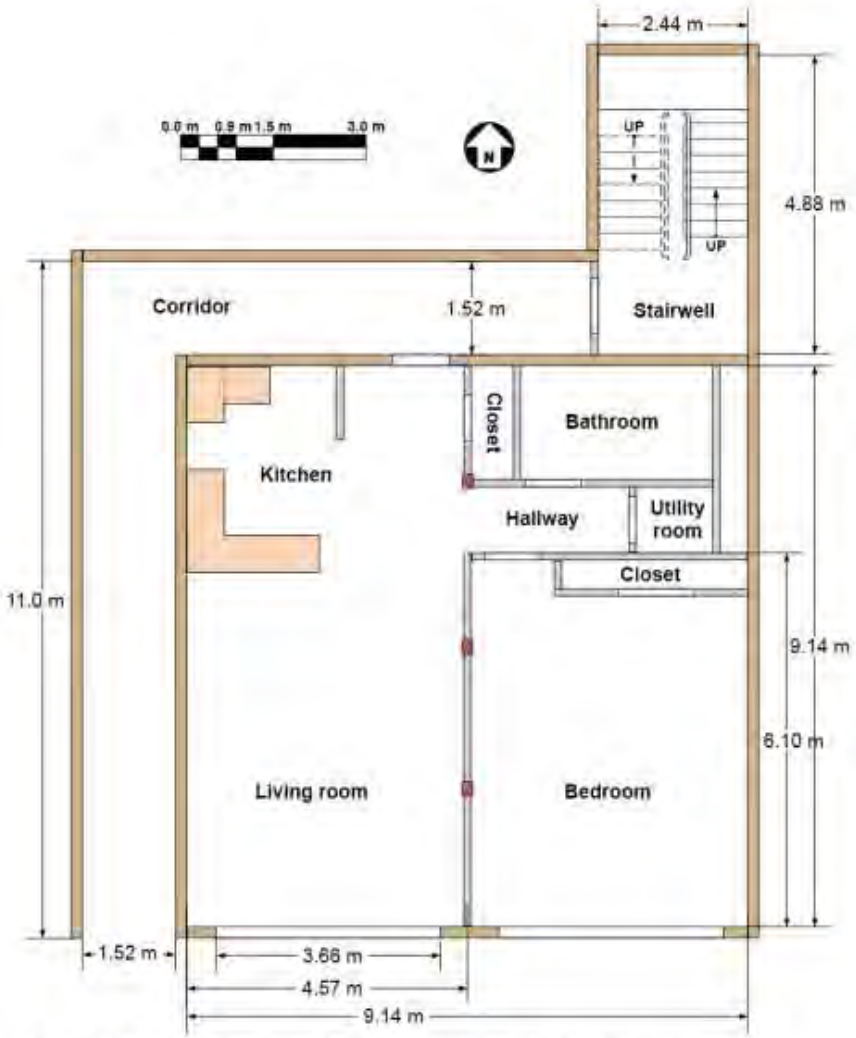


Figure 1. General plan view of cross-laminated timber test structure.

Images: AWC

U.S. BUILDING CODES
Tall Wood Ad Hoc Committee

Tests on exposed mass timber, gypsum-covered mass timber; normal sprinkler protection, delayed sprinkler protection

Majority of flames seen are from contents, not structure

U.S. BUILDING CODES
Tall Wood Ad Hoc Committee

Test	Description	Construction Type
Test 1	All mass timber surfaces protected with 2 layers of 5/8” Type X Gypsum. No Sprinklers.	IV-A
Test 2	30% of CLT ceiling area in living room and bedroom exposed. No Sprinklers.	IV-B
Test 3	Two opposing CLT walls exposed – one in bedroom and one in living room. No Sprinklers.	IV-B
Test 4	All mass timber surfaces fully exposed in bedroom and living room. Sprinklered – normal activation	IV-C
Test 5	All mass timber surfaces fully exposed in bedroom and living room. Sprinklered – 20 minute delayed activation	IV-C

U.S. BUILDING CODES
DEVELOPMENT AND CHANGES

ICC TWB Ad Hoc Committee proposals consisted 17 total code changes:

Requirements for the new Types of Construction:

- IBC Section 602.4 – Type of Construction (G108-18)
- IBC Section 703.8 – Performance Method for Fire Resistance from Noncombustible Protection (FS5-18)
- IBC Section 722.7 – Prescriptive Fire Resistance from Noncombustible Protection (FS81-18)
- IBC Section 703.9 – Sealants at Edges (FS6-18)
- IBC Section 718.2.1 – Fire and Smoke Protection (FS73-18)
- IBC Section 403.3.2 – High-Rise Sprinkler Water Supply (G28-18)
- IBC Section 701.6 – Owners' Responsibility (F88-18)

  IFC Section 3308.4 – Fire Safety During Construction (F266-18)

Allowable building size limits:

- IBC Table 504.3 – Building Height (G75-18)
- IBC Table 504.4 –Number of Stories (G80-18)
- IBC Table 506.2 – Allowable Area (G84-18)

Housekeeping changes:

- IBC Section 3102 – Special Construction (G146-18)
- IBC Appendix D – Fire Districts (G152-18)
- IBC Section 508.4 and 509.4 – Fire Barriers (G89-18)

- IBC Table 1705.5.3 Special Inspections (S100-19)
- IBC Section 110.3.5 Connection Protection Inspection (ADM35-19)
- IBC Section 2304.10.1 Connection Fire Resistance Rating (S170-19)

Photo: LendLease

TALL WOOD APPROVED!

Unofficial results posted Dec 19, 2018

Final votes ratified Jan 31, 2019

AWC: Tall Mass Timber code changes get final approval

Dec 19, 2018

LEESBURG, VA. – The International Code Council (ICC) has released the unofficial voting results on code change proposals considered in 2018, including passage of the entire package of 14 tall mass timber code change proposals. The proposals create three new types of construction (Types IV-A, IV-B and IV-C), which set fire safety requirements, and allowable heights, areas and number of stories for tall mass timber buildings. Official results are expected to be announced during the first quarter of 2019. The new provisions will be included in the 2021 *International Building Code* (IBC).

"Mass timber has been capturing the imagination of architects and developers, and the ICC result means they can now turn sketches into reality. ICC's rigorous study, testing and voting process now

SO WHAT'S CHANGED??

ICC INTERNATIONAL CODE COUNCIL®

Since its debut, IBC has contained 9 construction type options

5 Main Types (I, II, III, IV, V) with all but IV having sub-types A and B

TYPE I		TYPE II		TYPE III		TYPE IV	TYPE V	
A	B	A	B	A	B	HT	A	B

2021 IBC Introduces 3 new tall wood construction types:

IV-A, IV-B, IV-C

Previous type IV renamed type IV-HT

BUILDING ELEMENT	TYPE I		TYPE II		TYPE III		TYPE IV				TYPE V	
	A	B	A	B	A	B	A	B	C	HT	A	B

New Building Types

18 STORIES
BUILDING HEIGHT 270'
ALLOWABLE BUILDING AREA 972,000 SF
AVERAGE AREA PER STORY 54,000SF

TYPE IV-A

12 STORIES
BUILDING HEIGHT 180 FT
ALLOWABLE BUILDING AREA 648,000 SF
AVERAGE AREA PER STORY 54,000SF

TYPE IV-B

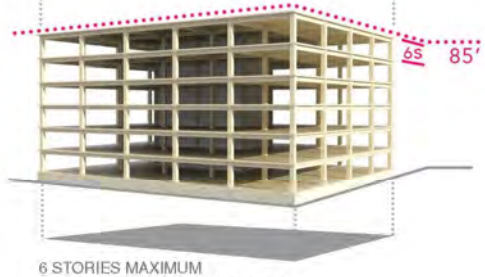
9 STORIES
BUILDING HEIGHT 85'
ALLOWABLE BUILDING AREA 405,000 SF
AVERAGE AREA PER STORY 45,000 SF

TYPE IV-C

IBC 2021

324,000 SF
ALLOWABLE BUILDING AREA

54,000 SF
AVERAGE AREA PER STORY



6 STORIES MAXIMUM
85'-0" MAXIMUM BUILDING HEIGHT
324,00 SF MAXIMUM AREA

TYPE IV- HT

IBC 2015

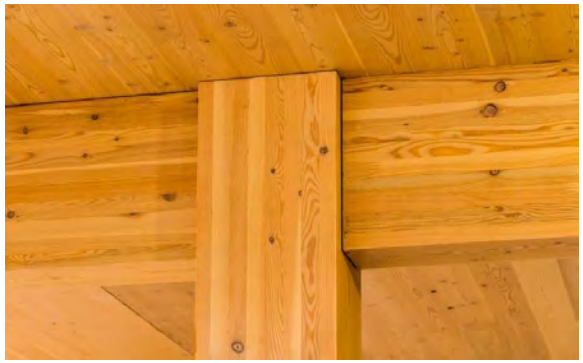
BUSINESS OCCUPANCY [GROUP B]

*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

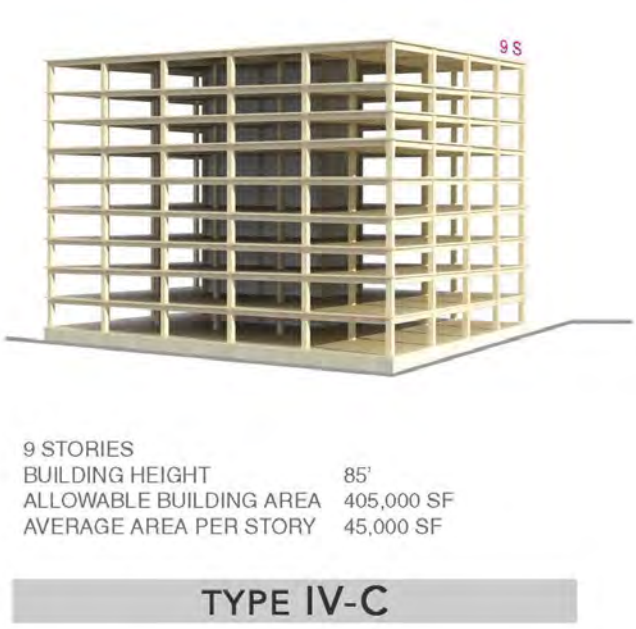
Type IV-C

Credit: Susan Jones, atelierjones



Photos: Baumberger Studio/PATH Architecture/Marcus Kauffman

Type IV-C Protection vs. Exposed



Credit: Susan Jones, atelierjones

Credit: Kaiser+Path, Ema Peter

All Mass Timber surfaces may be exposed

Exceptions: Shafts, concealed spaces, outside face of exterior walls

Type IV-C Height and Area Limits

Credit: Susan Jones, atelierjones

Occupancy	# of Stories	Height	Area per Story	Building Area
A-2	6	85 ft	56,250 SF	168,750 SF
B	9	85 ft	135,000 SF	405,000 SF
M	6	85 ft	76,875 SF	230,625 SF
R-2	8	85 ft	76,875 SF	230,625 SF

Areas exclude potential frontage increase

In most cases, Type IV-C height allowances = Type IV-HT height allowances, but add'l stories permitted due to enhanced FRR

Type IV-C area = 1.25 * Type IV-HT area

Type IV-B

12 STORIES	
BUILDING HEIGHT	180 FT
ALLOWABLE BUILDING AREA	648,000 SF
AVERAGE AREA PER STORY	54,000SF

TYPE IV-B

Credit: Susan Jones, atelierjones

Credit: LEVER Architecture

Type IV-B Protection vs. Exposed

Credit: Susan Jones, atelierjones

Credit: Kaiser+Path

NC protection on all surfaces of Mass Timber except limited exposed areas

~20% of Ceiling or ~40% of Wall can be exposed, see code for requirements

Type IV-B Height and Area Limits

Credit: Susan Jones, atelierjones

Occupancy	# of Stories	Height	Area per Story	Building Area
A-2	12	180 ft	90,000 SF	270,000 SF
B	12	180 ft	216,000 SF	648,000 SF
M	8	180 ft	123,000 SF	369,000 SF
R-2	12	180 ft	123,000 SF	369,000 SF

Areas exclude potential frontage increase

In most cases, Type IV-B height & story allowances = Type I-B height & story allowances

Type IV-B area = 2 * Type IV-HT area

Type IV-A

18 STORIES	
BUILDING HEIGHT	270'
ALLOWABLE BUILDING AREA	972,000 SF
AVERAGE AREA PER STORY	54,000SF

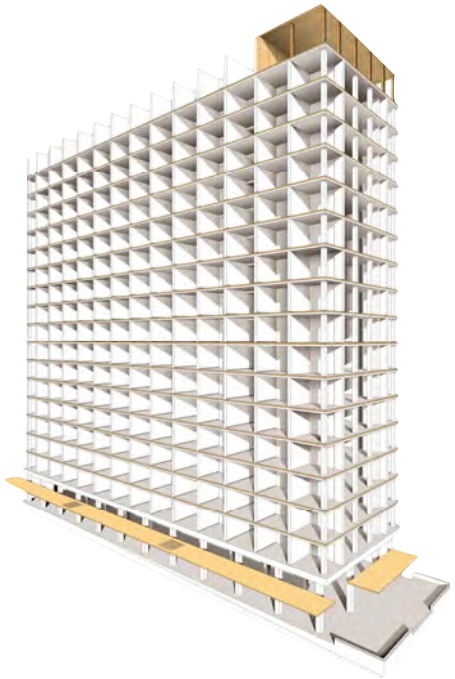
TYPE IV-A

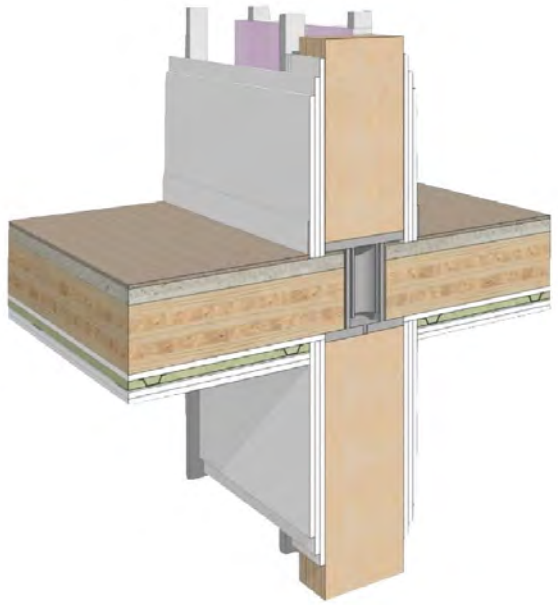
Credit: Susan Jones, atelierjones

Photos: Structurlam, naturally:wood, Fast + Epp, Urban One

Type IV-A Protection vs. Exposed

Credit: Susan Jones, atelierjones





Credit: Acton Ostry Architects, Fast + Epp

100% NC protection on all surfaces of Mass Timber

Type IV-A Height and Area Limits

Occupancy	# of Stories	Height	Area per Story	Building Area
A-2	18	270 ft	135,000 SF	405,000 SF
B	18	270 ft	324,000 SF	972,000 SF
M	12	270 ft	184,500 SF	553,500 SF
R-2	18	270 ft	184,500 SF	553,500 SF

Areas exclude potential frontage increase

In most cases, Type IV-A height & story allowances = 1.5 * Type I-B height & story allowances

Type IV-A area = 3 * Type IV-HT area

WoodWorks™
WOOD PRODUCTS COUNCIL

Tall Wood Buildings in the 2021 IBC
Up to 18 Stories of Mass Timber

Scott Breneman, PhD, SE, WoodWorks – Wood Products Council • Matt Timmers, SE, John A. Martin & Associates • Dennis Richardson, PE, CBO, CASp, American Wood Council

In January 2019, the International Code Council (ICC) approved a set of proposals to allow tall wood buildings as part of the 2021 International Building Code (IBC). Based on these proposals, the 2021 IBC will include three new construction types—Type IV-A, IV-B and IV-C—allowing the use of mass timber or noncombustible materials. These new types are based on the previous Heavy Timber construction type (renamed Type IV-HT) but with additional fire-resistance ratings and levels of required noncombustible protection. The code will include provisions for up to 18 stories of Type IV-A construction for Business and Residential Occupancies.

Based on information first published in the Structural Engineers Association of California (SEAOC) 2018 Conference Proceedings, this paper summarizes the background to these proposals, technical research that supported their adoption, and resulting changes to the IBC and product-specific standards.

Background: ICC Tall Wood Building Ad Hoc Committee

Over the past 10 years, there has been a growing interest in tall buildings constructed from mass timber materials (Breneman 2013, Timmers 2015). Around the world there

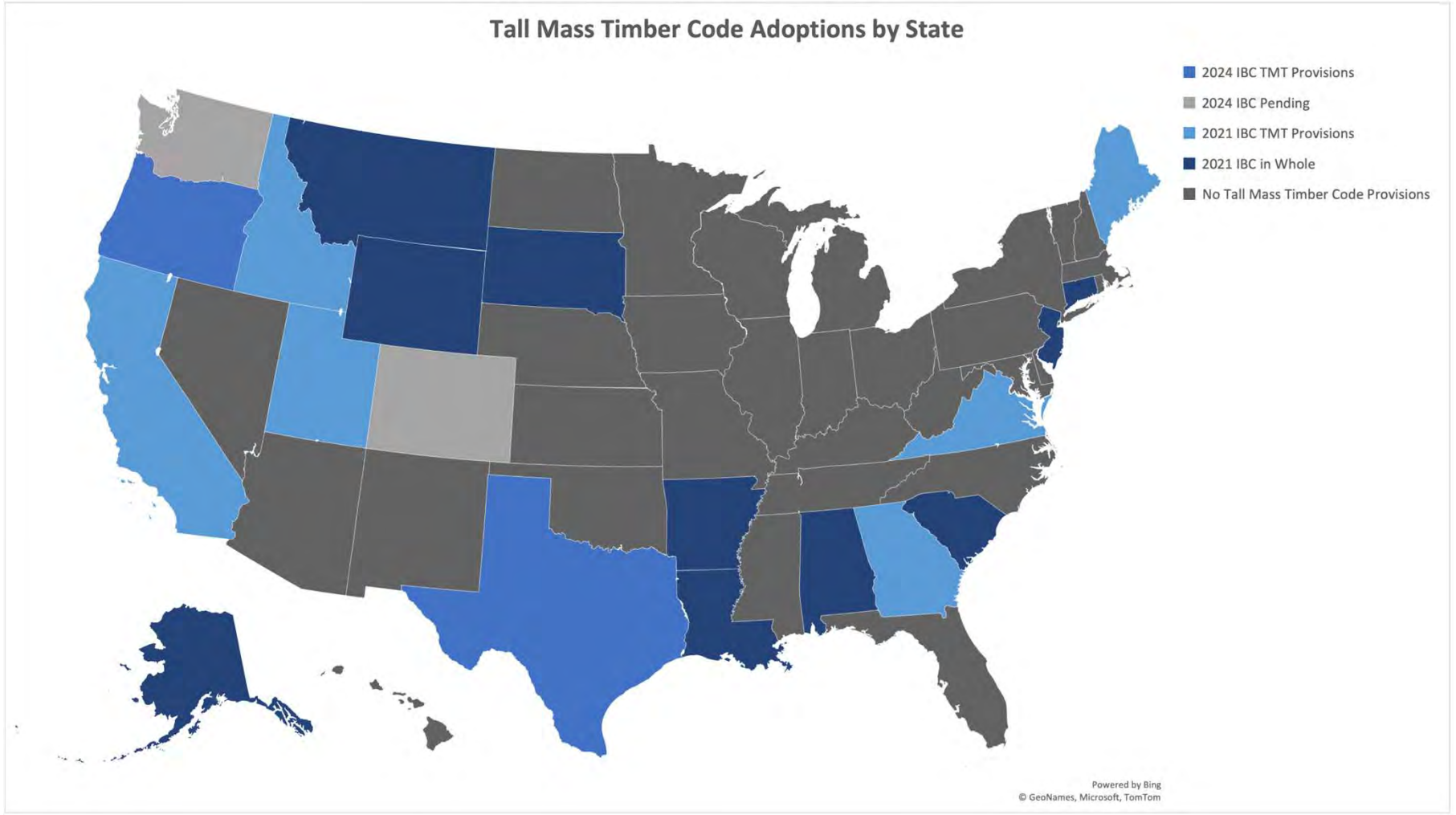
Via Cenni	Milan, Italy	9	2013

WoodWorks Tall Wood Design Resource

http://www.woodworks.org/wp-content/uploads/wood_solution_paper-TALL-WOOD.pdf

TALL TIMBER CODE ADOPTION

TALL MASS TIMBER RESOURCES



Kaiser Group, Path Architecture, photo Andrew Pogue

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111 East Grand / Neumann Monson Architects
photo Mike Sinclair

Resources for Developers/Owners

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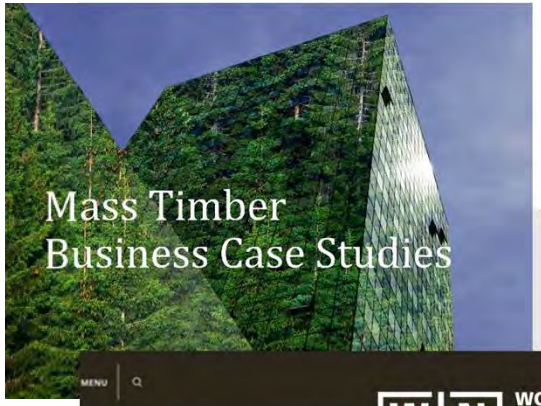
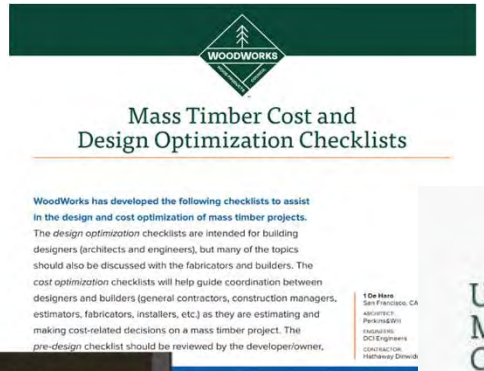
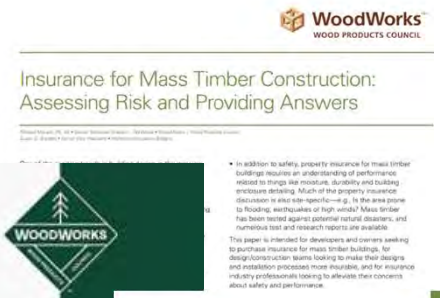
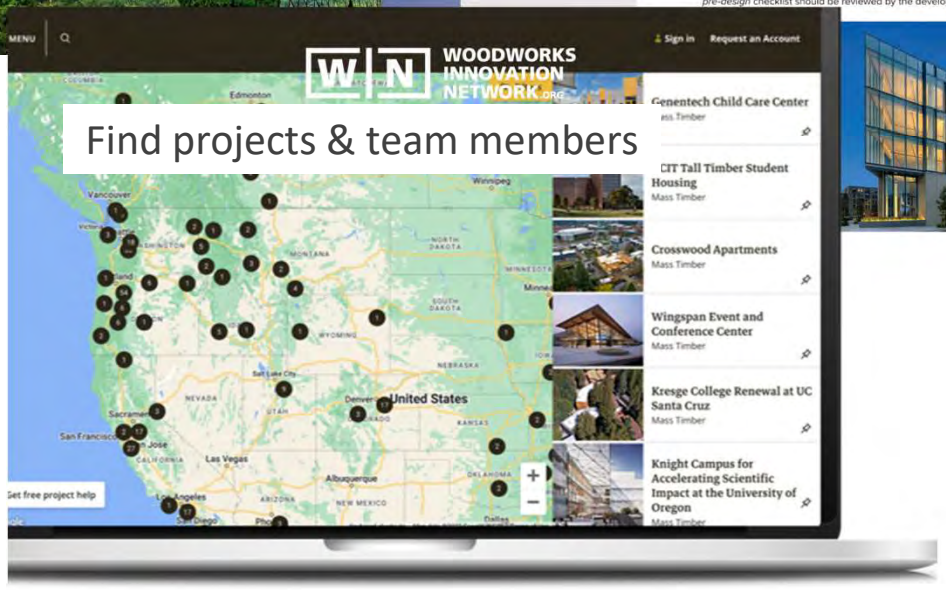
www.woodworks.org/learn/mass-timber-clt/mass-timber-business-case/

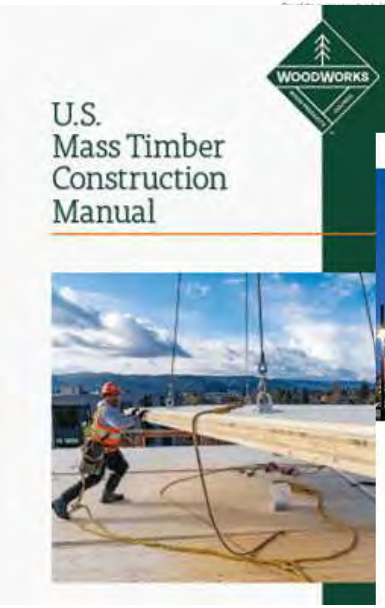






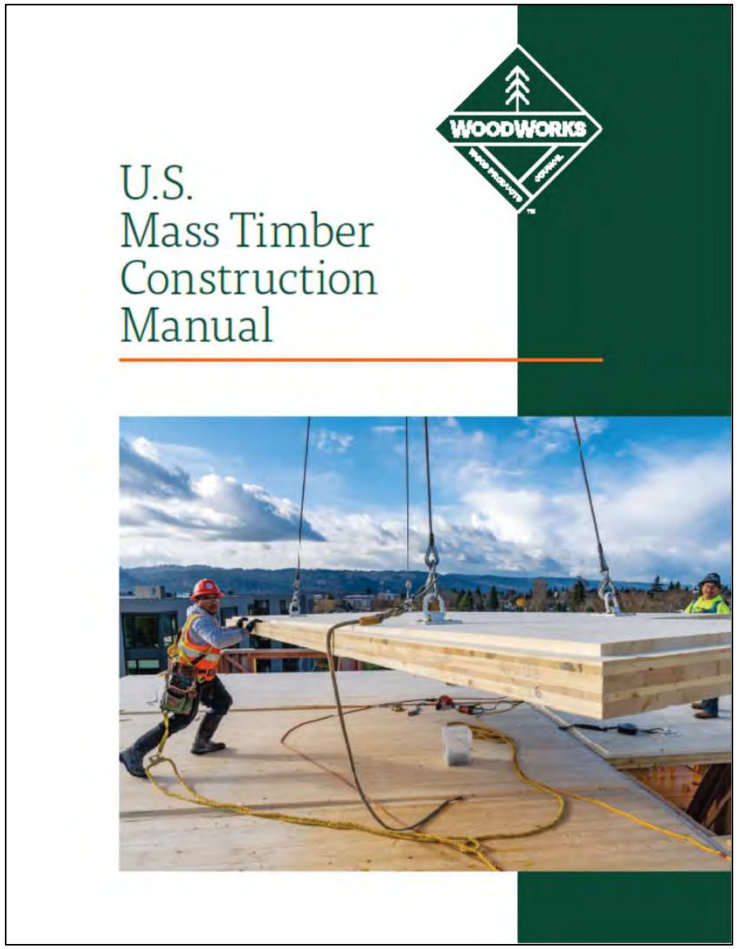


Find projects & team members



Released on 20 October 2021

https://www.woodworks.org/mass-timber-construction-management-program/



The Loading Dock, OZ Architecture, KL&A, photo Joe Anastasi

Questions? Ask us anything.

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901 East Sixth, Thoughtbarn-Delineate Studio, Leap!Structures, photo Casey Dunn