



Exploring Wood Buildings: Innovative Products and New Code Provisions

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Presented by

Jessica Scarlett, EIT, WoodWorks

Apex Plaza / Courtesy William McDonough + Partner

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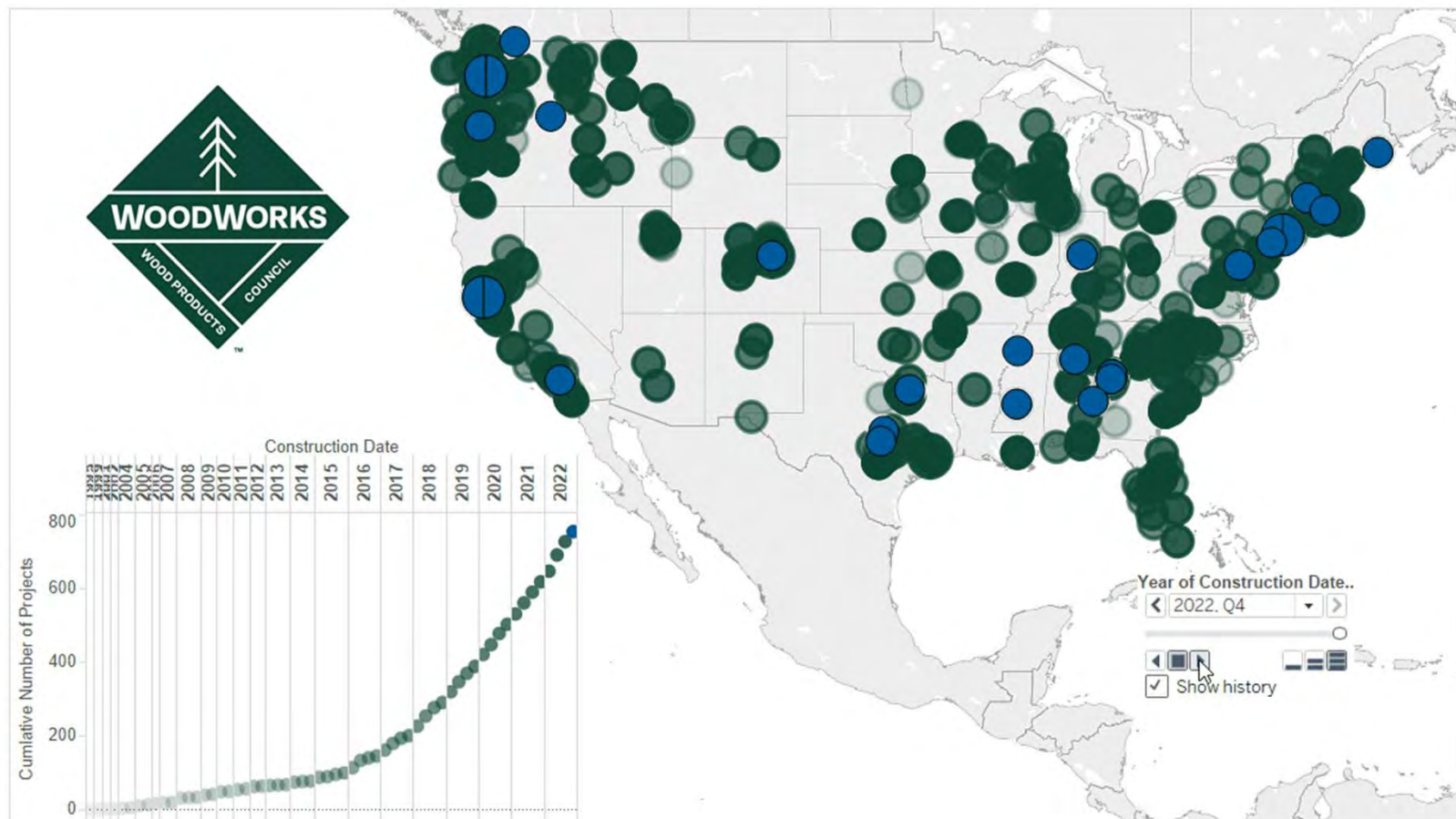
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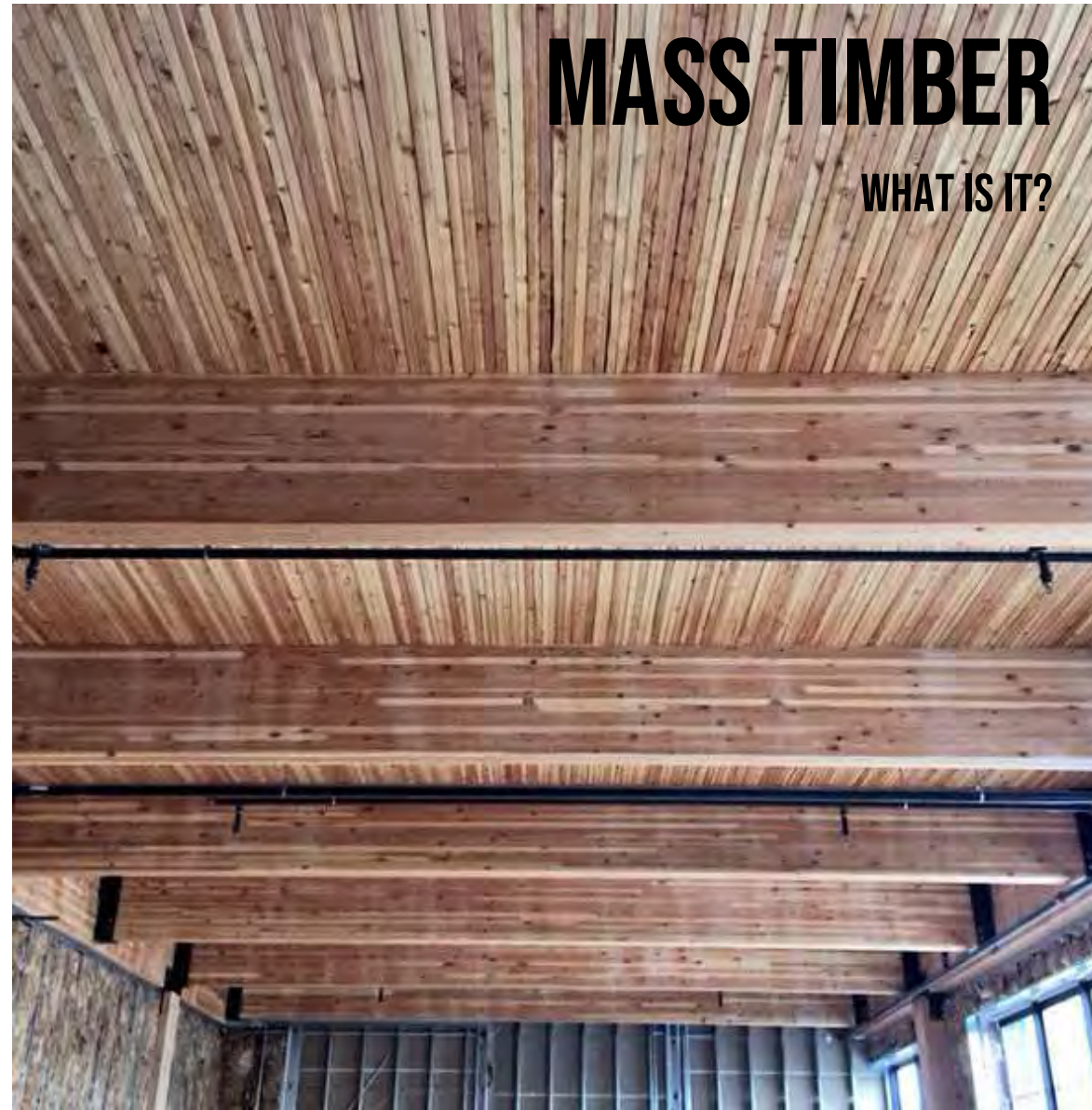


Current State of Mass Timber Projects

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**



MASS TIMBER

WHAT IS IT?



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

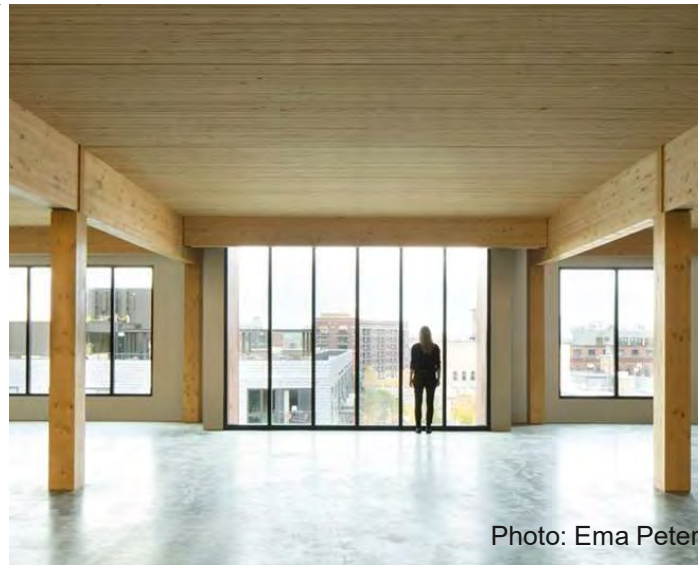


Photo: Ema Peter



Photo: Manasc Isaac
Architects/Fast + Epp

Mass Timber Building Options



Post and Beam

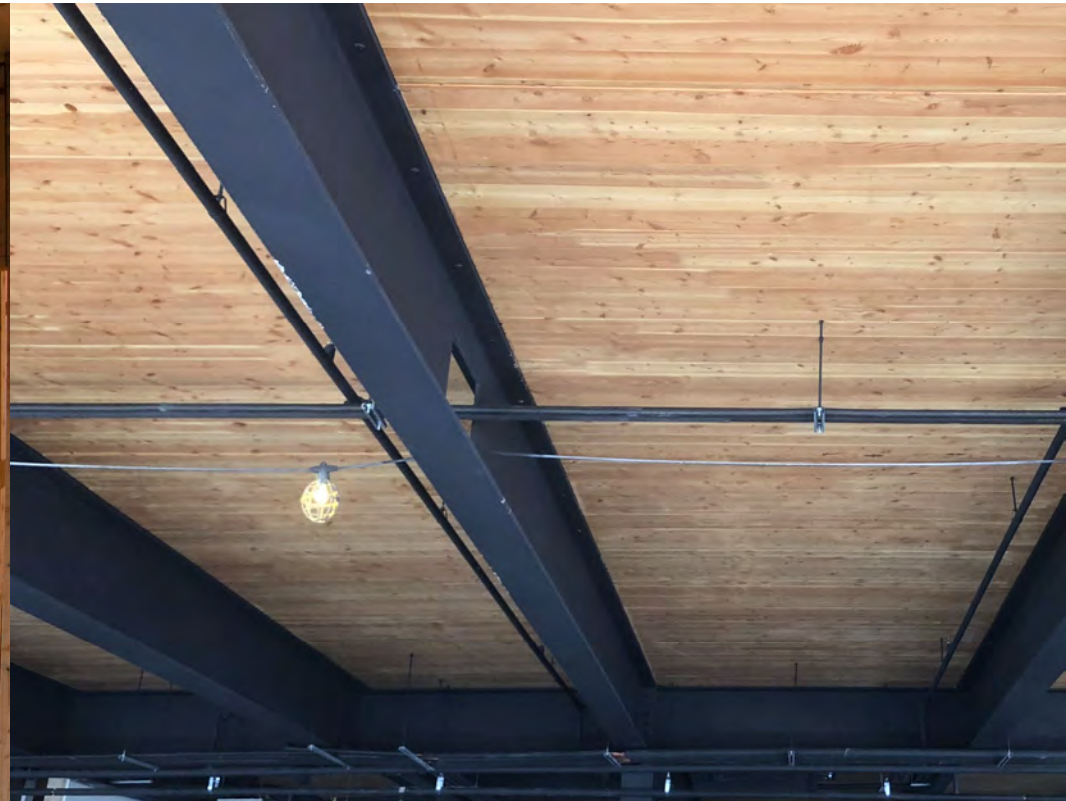
Flat Plate

Honeycomb

Mass Timber Building Options

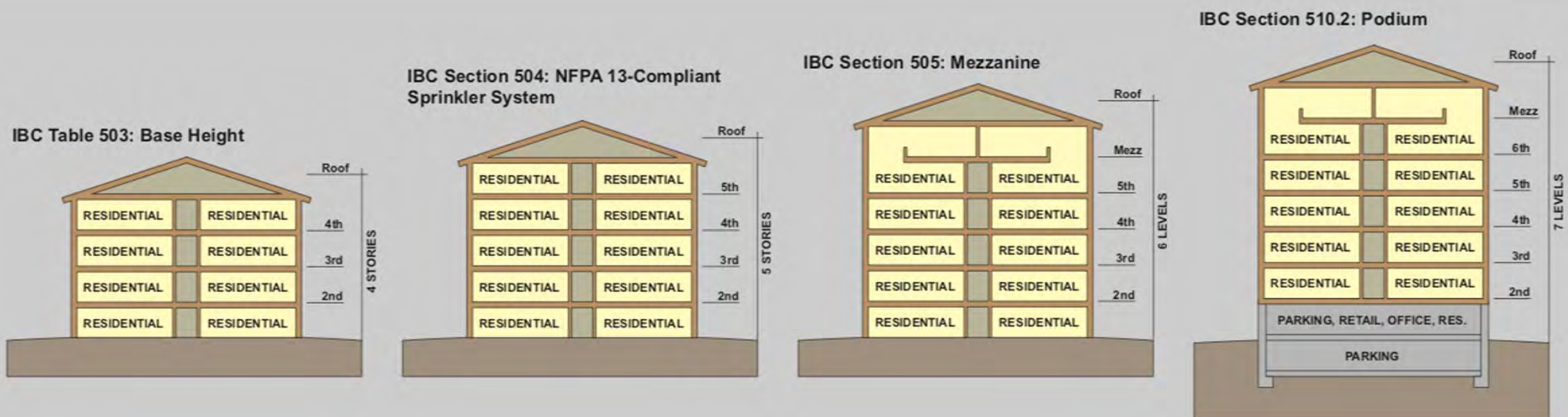


Hybrid: Light-frame



Hybrid: Steel framing

Evolution of Mid-Rise Wood Structures in the US



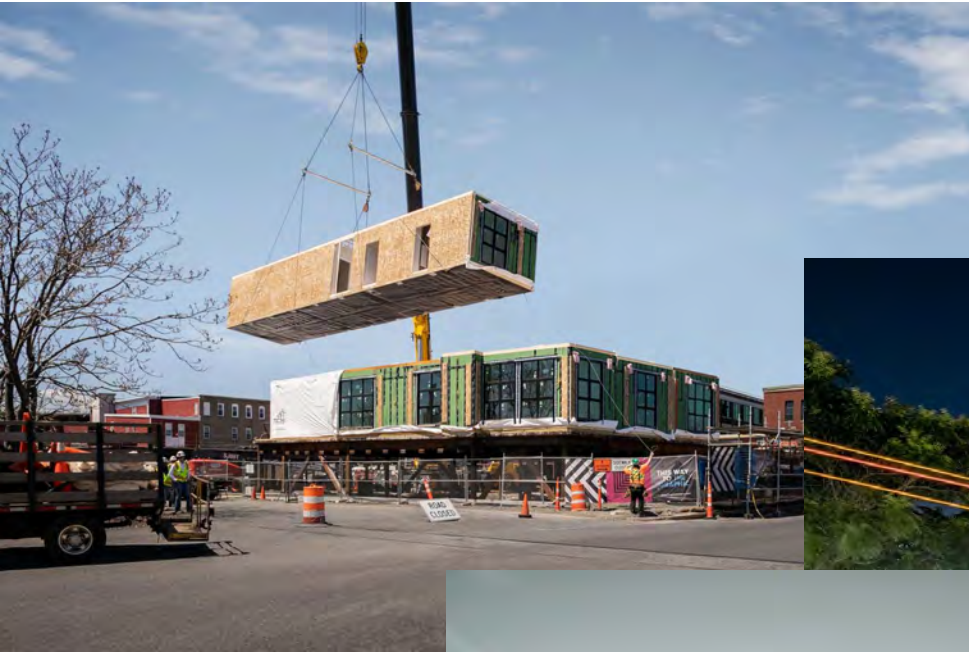
Type V → Type III → + Mezzanines → + Podiums

Off-Site Construction



Image: Ecocor

Modular Construction



The Graphic
Cambridge, MA

Credit: ICON Architecture

The image shows a bright, modern interior space, likely a rooftop terrace or a large atrium. The floor is made of polished, light-colored wooden planks that reflect the light. The walls are composed of large glass panels framed by dark metal, creating a curved view of the outside. The ceiling features exposed wooden beams and a dark metal track with a hanging light fixture. Outside, a city street is visible with various buildings, including a prominent red brick building and a white building. The sky is overcast with grey clouds. A semi-transparent grey banner with white text is overlaid in the center of the image.

INNOVATIVE TIMBER CONSTRUCTION UNDERSTANDING THE WHY

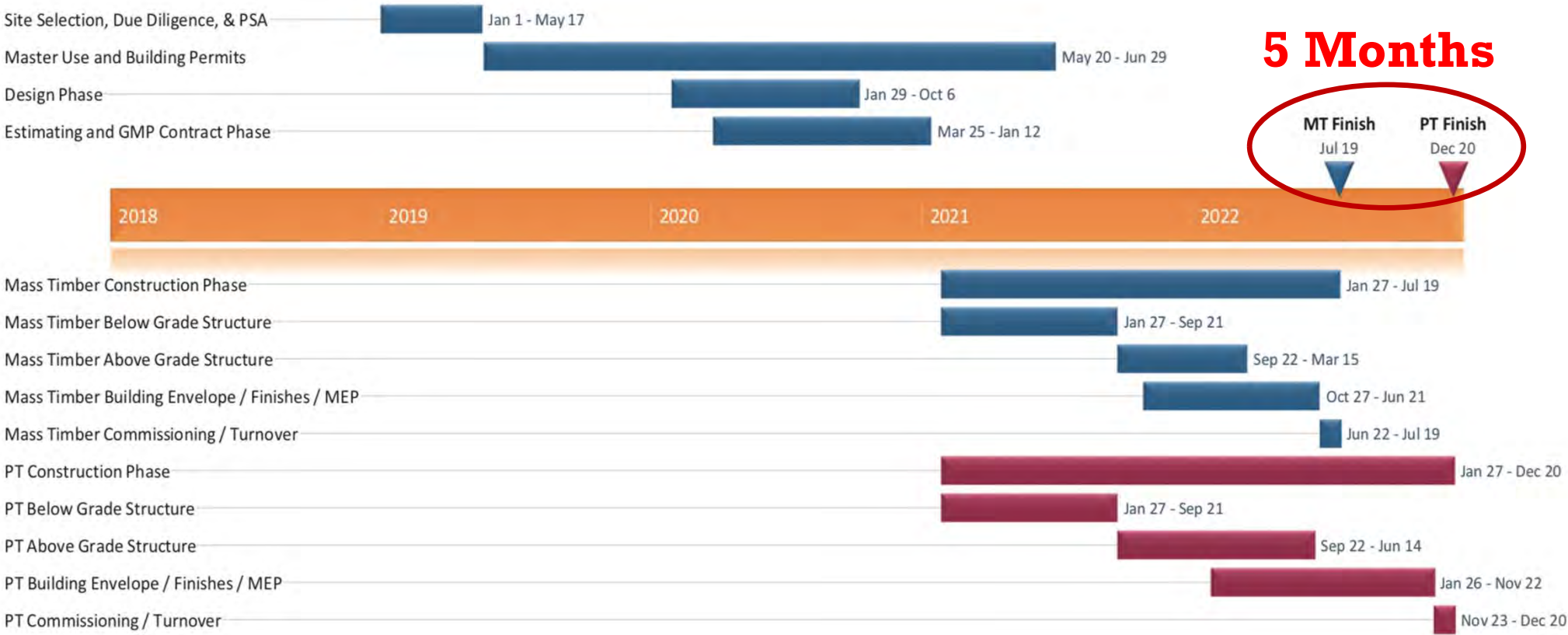
Biophilia - Structural Warmth is a Value-Add



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: STRUCTURLAM⁷

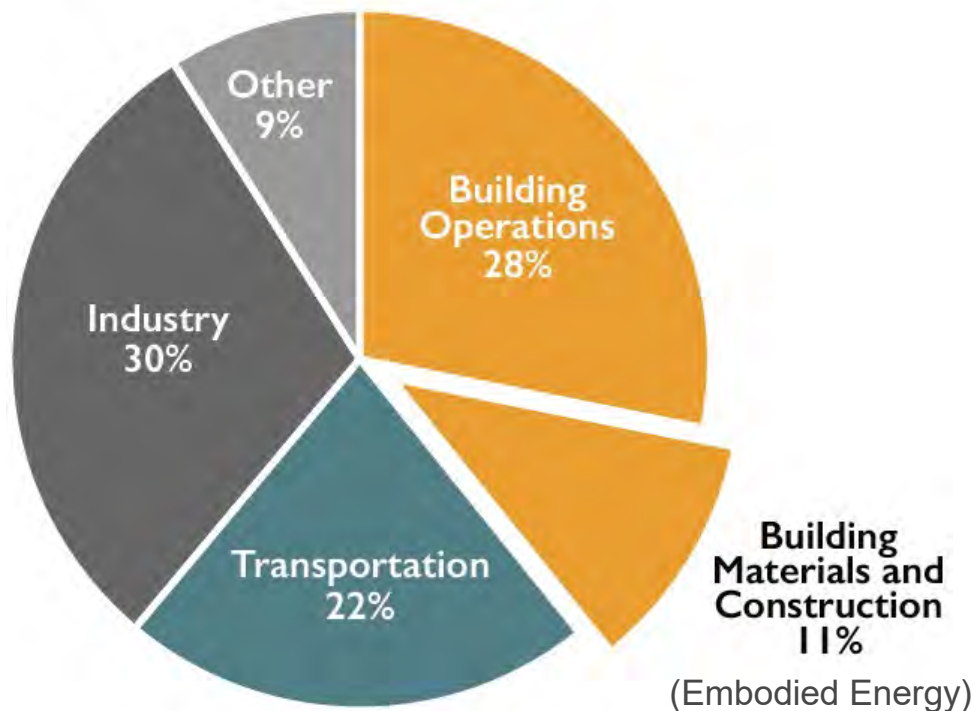


How Does Wood Fit in?

C L I M A T E

New Buildings & Greenhouse Gases

Global CO₂ Emissions by Sector



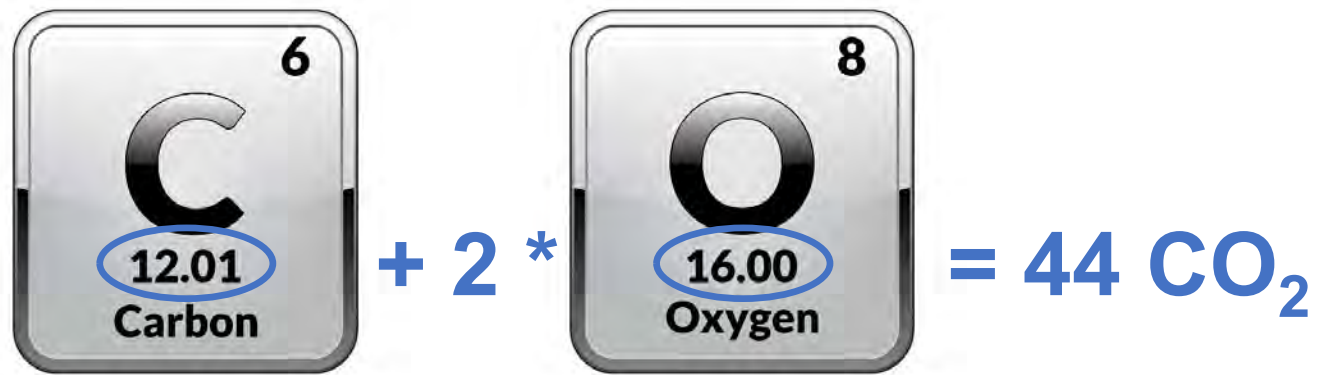
Source: © 2018 2030, Inc. / Architecture 2030. All Rights Reserved. Data Sources: UN Environment Global Status Report 2017; EIA International Energy Outlook 2017

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 CO₂



1 ton Carbon \neq 1 ton CO₂

1 ton Carbon = (44/12=) 3.67 tons CO₂

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

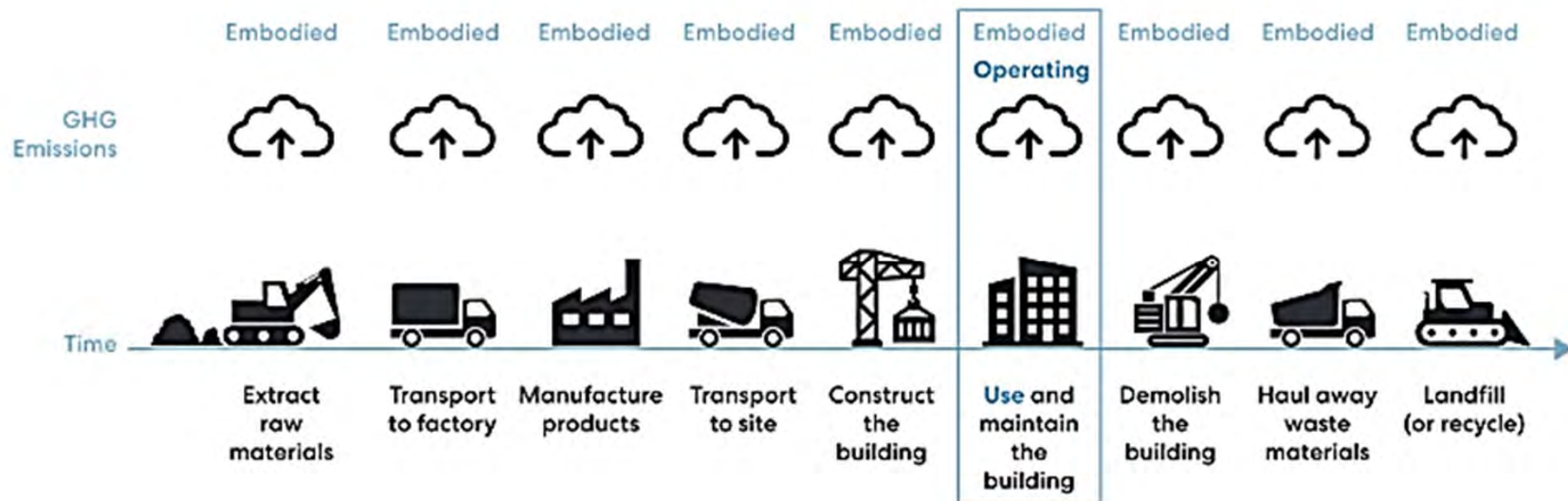


Image: ThinkWood

More Carbon Terms

Carbon Sequestration: The process by which CO₂ 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**.

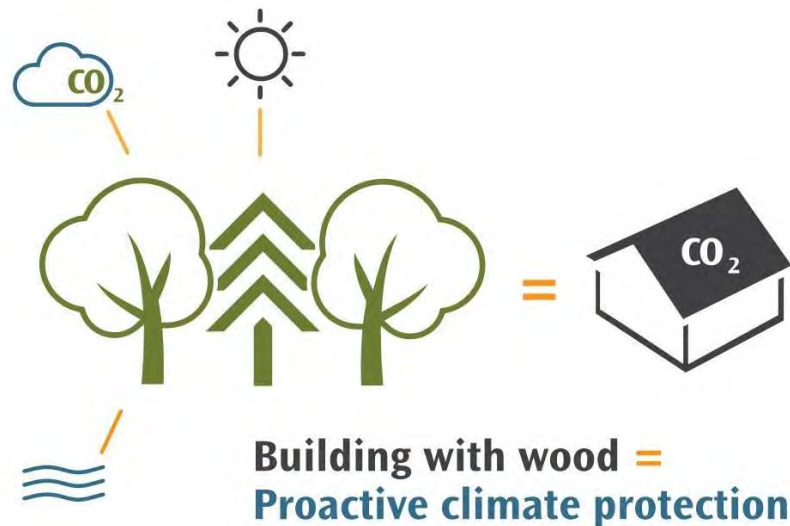


Image: Dovetail Partners, Inc.

Carbon Storage

Wood \approx 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**

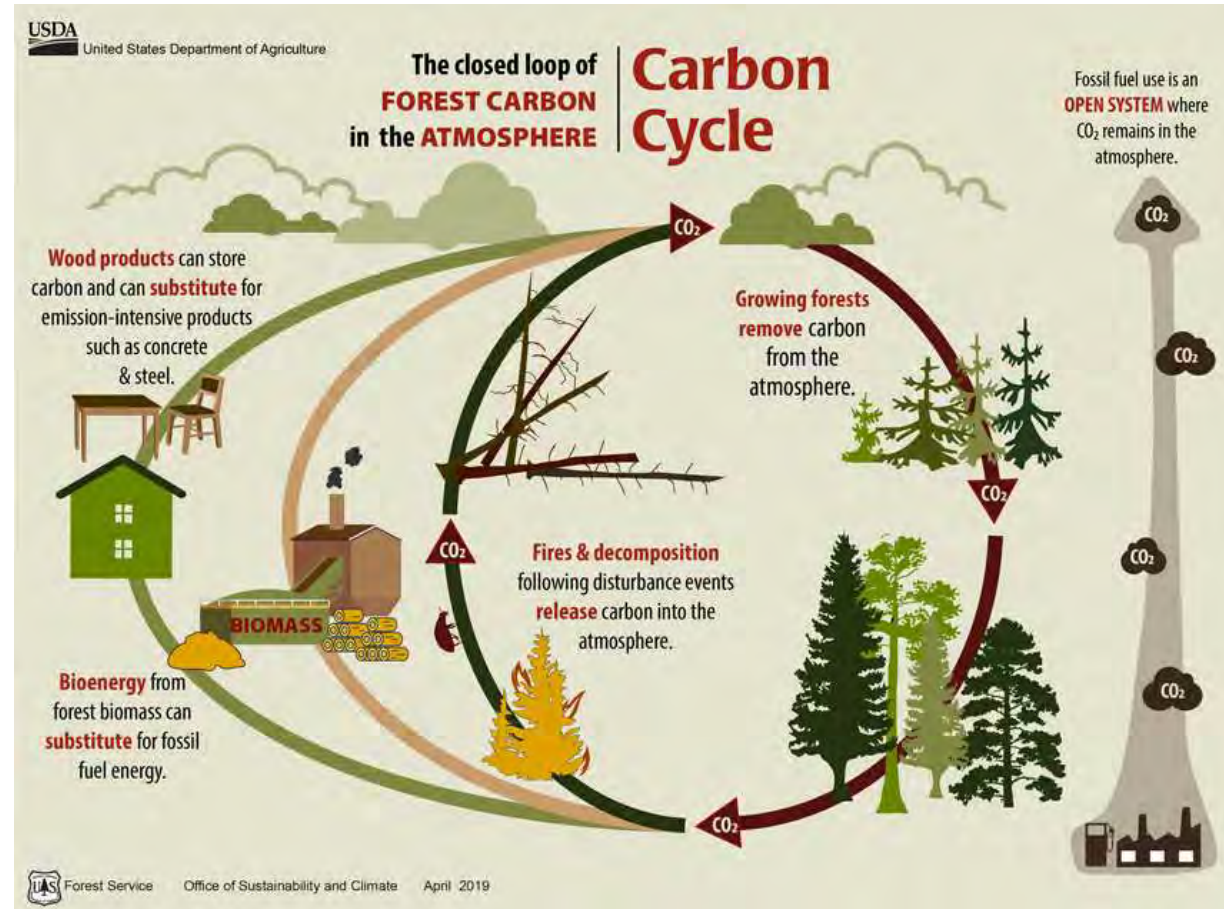


Image: USDA US Forest Service

WoodWorks Carbon Calculator

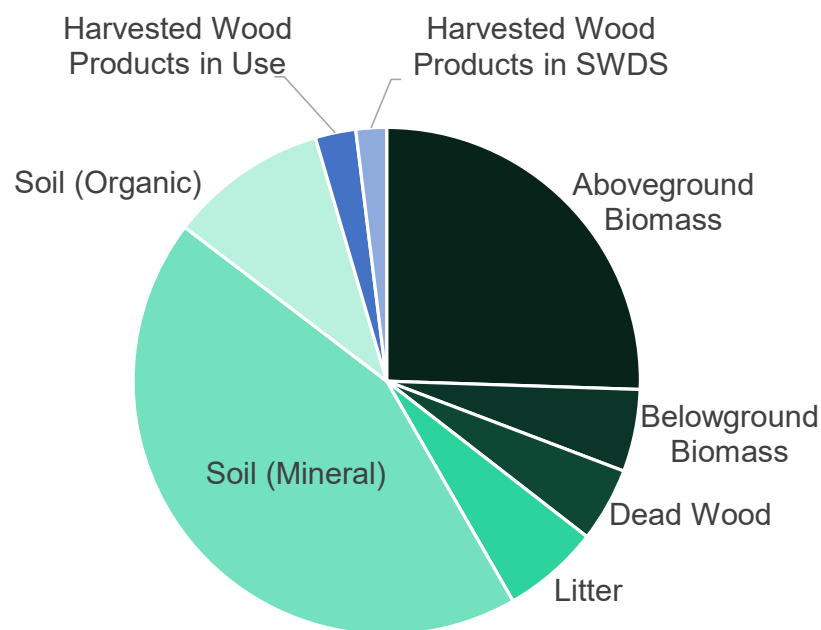
- Available at woodworks.org
- Estimates total wood mass in a building
- Relays **estimated** carbon impacts:
 - Amount of **carbon stored** in wood
 - Amount of **greenhouse gas emissions avoided** by choosing wood over a non-wood material



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

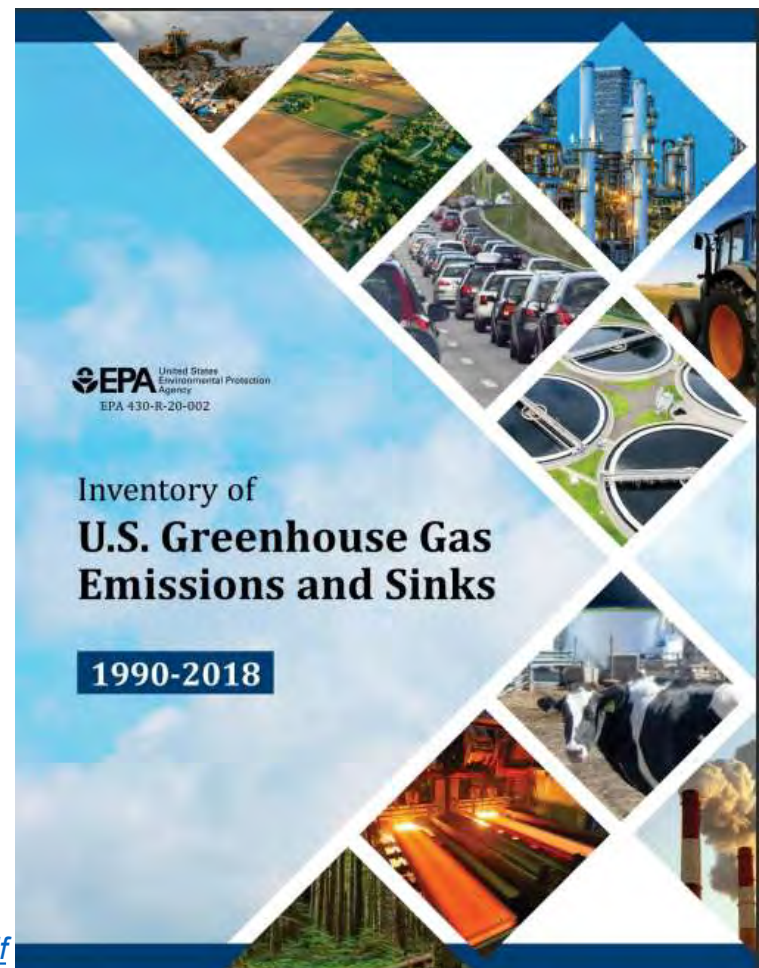
Carbon Storage in Harvested Wood Products

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



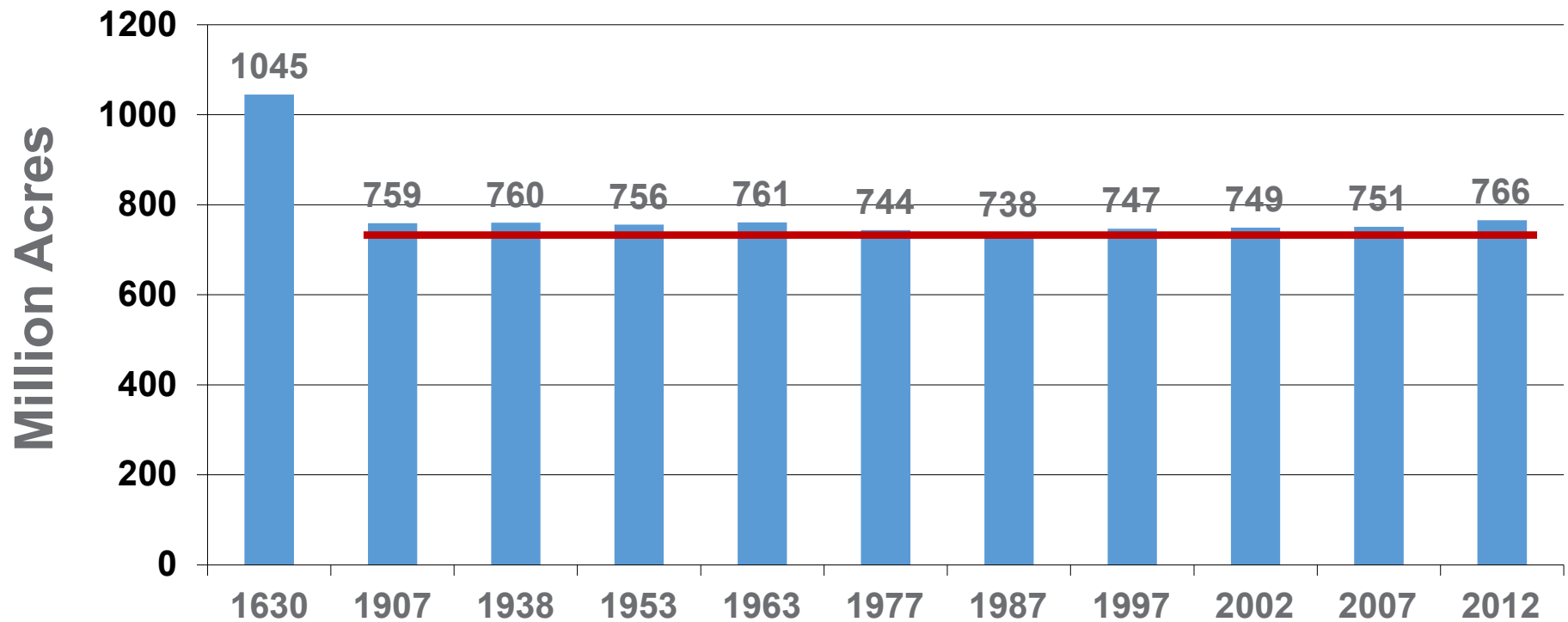


Common Environmental Concerns About Specifying Wood

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

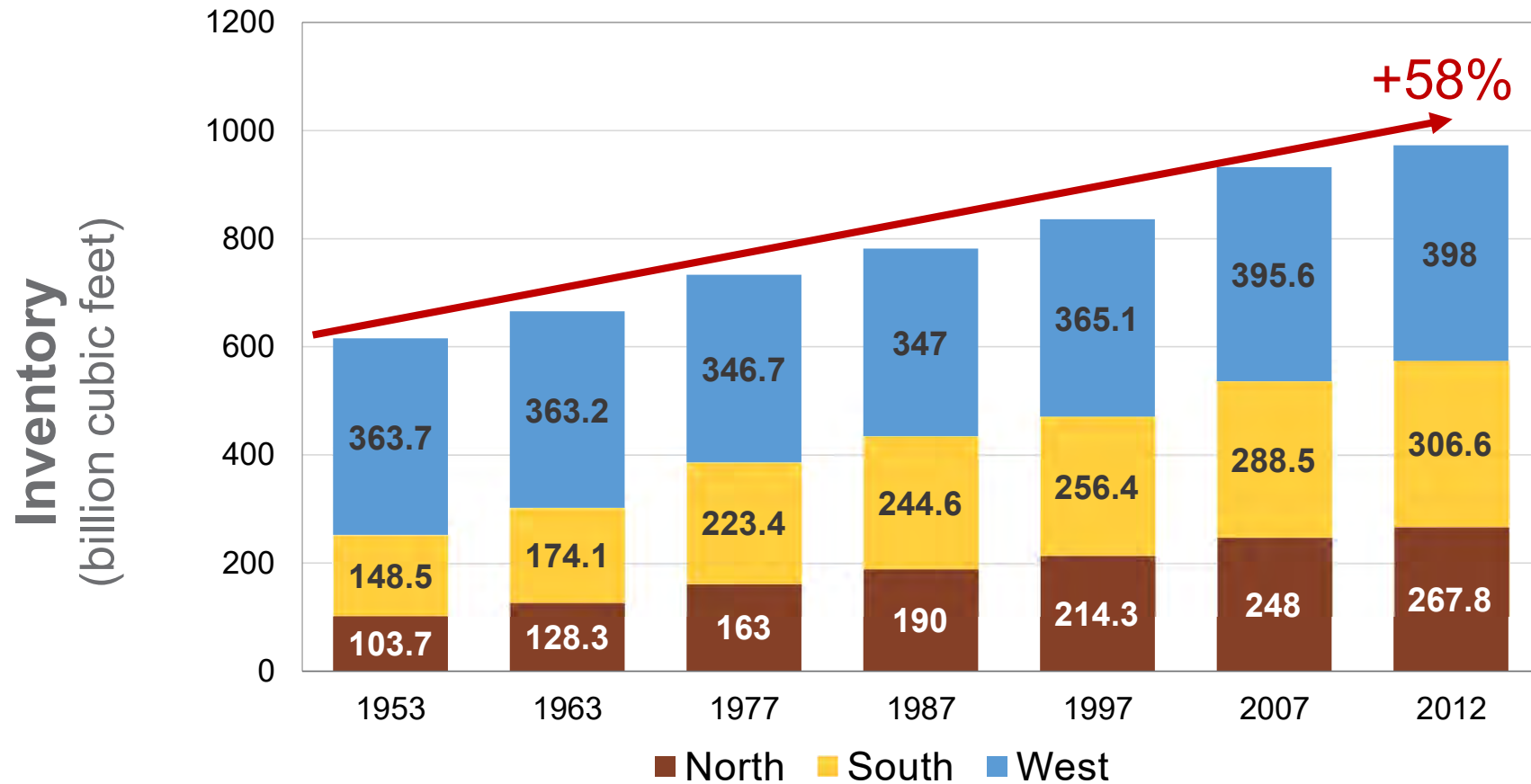
U.S. Forest Land:

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

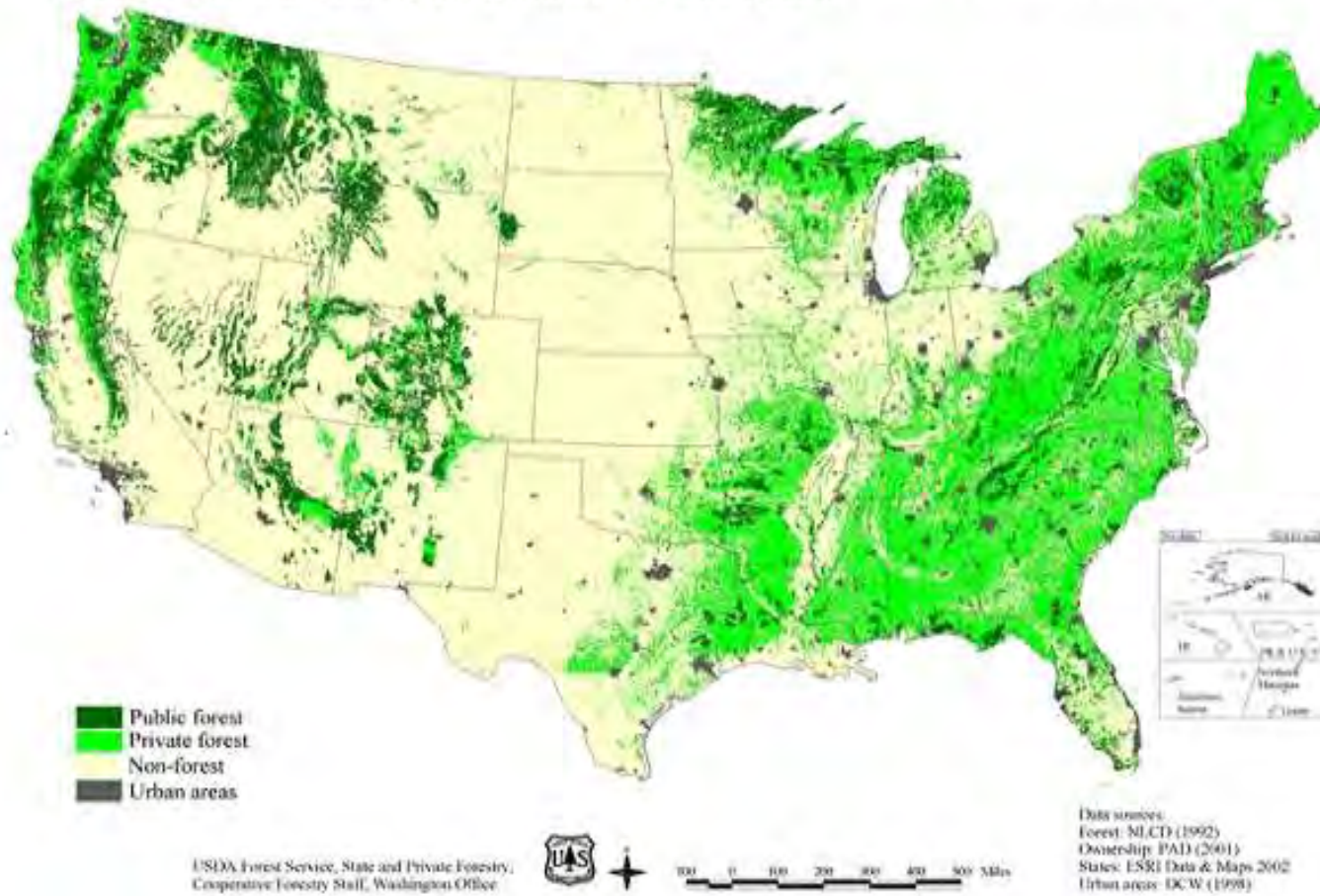


Source: USDA-Forest Service, US Forest Resource Facts and Historical Trends FS-1035. (2014).

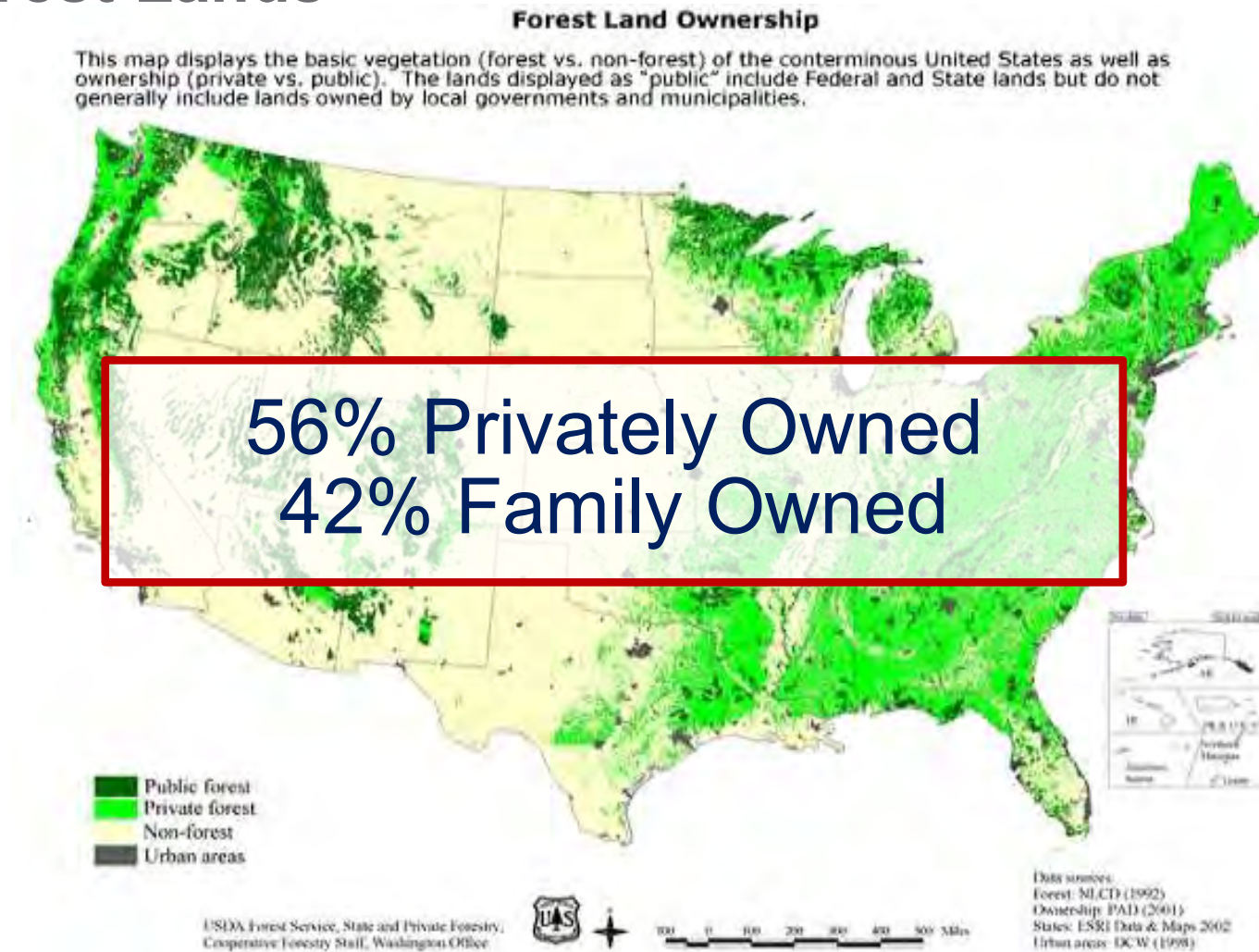
US Forest Lands

Forest Land Ownership

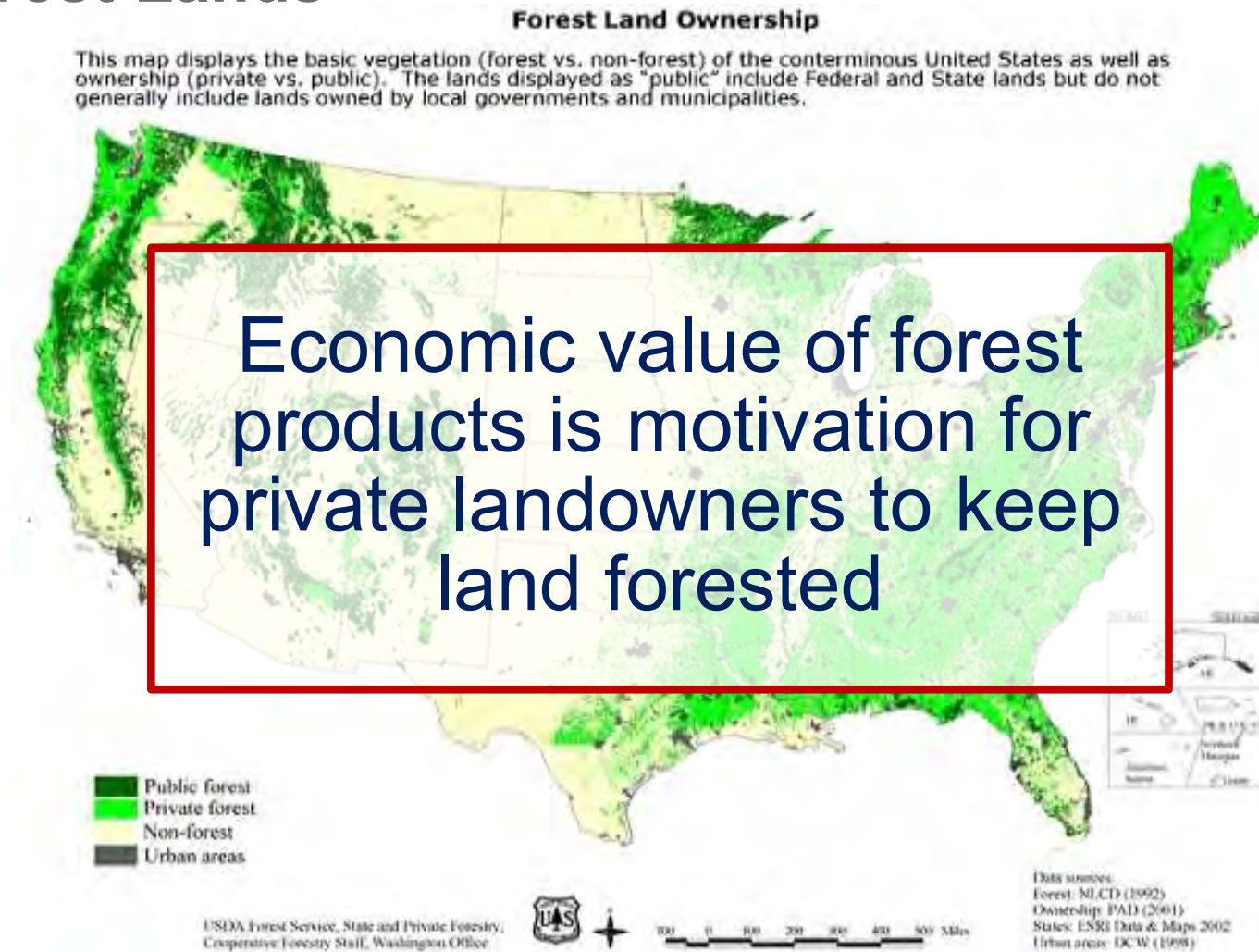
This map displays the basic vegetation (forest vs. non-forest) of the conterminous United States as well as ownership (private vs. public). The lands displayed as "public" include Federal and State lands but do not generally include lands owned by local governments and municipalities.



US Forest Lands



US Forest Lands



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.

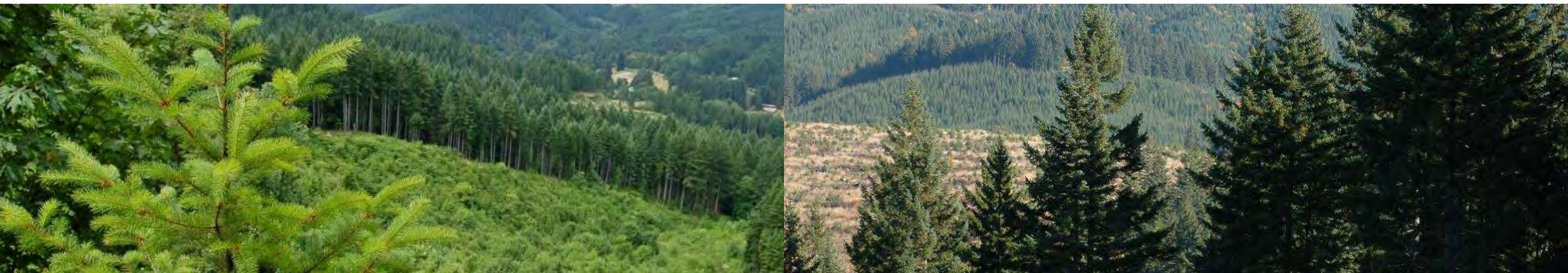
Source: State of the World's Forests—2020— FAO and UNEP, USDA Forest Service, US Forest Resource Facts and Historical Trends FS-1034 (2014)

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 image is a horizontal composition. The left half shows a dense forest of tall, thin evergreen trees shrouded in a thick, white mist. The ground is covered with green undergrowth and fallen branches. The right half shows a close-up of a modern building's exterior. The building is clad in vertical and horizontal wooden slats, creating a textured, warm appearance. Two large, dark-framed windows are visible, showing the interior of the building which has a high ceiling and wooden floors. The overall theme is the integration of natural timber into modern architecture.

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

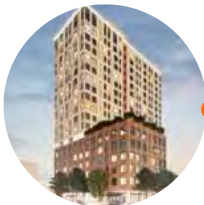
Carbon 12
Portland, OR
8 stories
mass timber



Minnesota Places
Portland, OR
8 stories –
7 mass timber



1510 Webster
Oakland, CA
18 stories –
16 mass timber



Heartwood
Seattle, WA
8 stories mass timber



INTRO Cleveland
Cleveland, OH
9 stories –
8 mass timber



Ascent
Milwaukee, WI
25 stories –
19 mass timber



11 E Lenox
Boston, MA
7 stories
mass timber



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



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



MJOSTARNET, NORWAY



Photos: Bygg Mesteren | Voll Arkitekter

18 STORIES | 280 FT



HOHO, AUSTRIA



Photos: *RLP Rüdiger Lainer + Partner, RWTplus*

24 STORIES | 275 FT



PRECEDENT PROJECTS | CARBON 12 | PORTLAND, OR

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

Tallest Mass Timber Building in the World

25 STORIES

19 TIMBER OVER 6 PODIUM, 284 FT

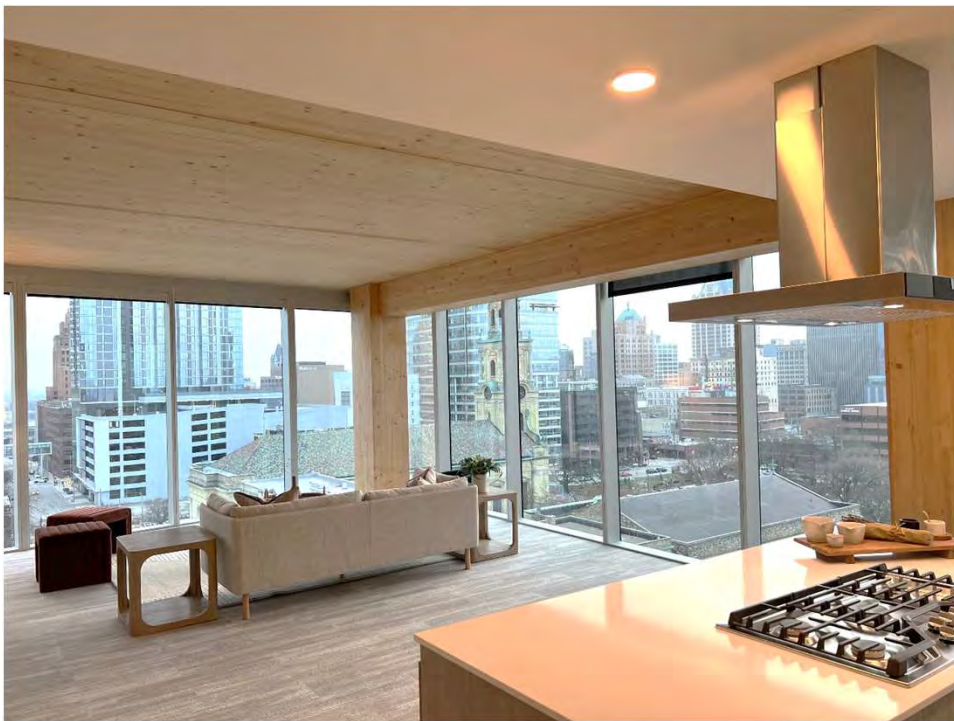


Photo: CD Smith Construction |
Architect: Korb & Associates Architects



APEX PLAZA

CHARLOTTESVILLE, VA

8 STORIES

6 TIMBER OVER 2 PODIUM, 100 FT



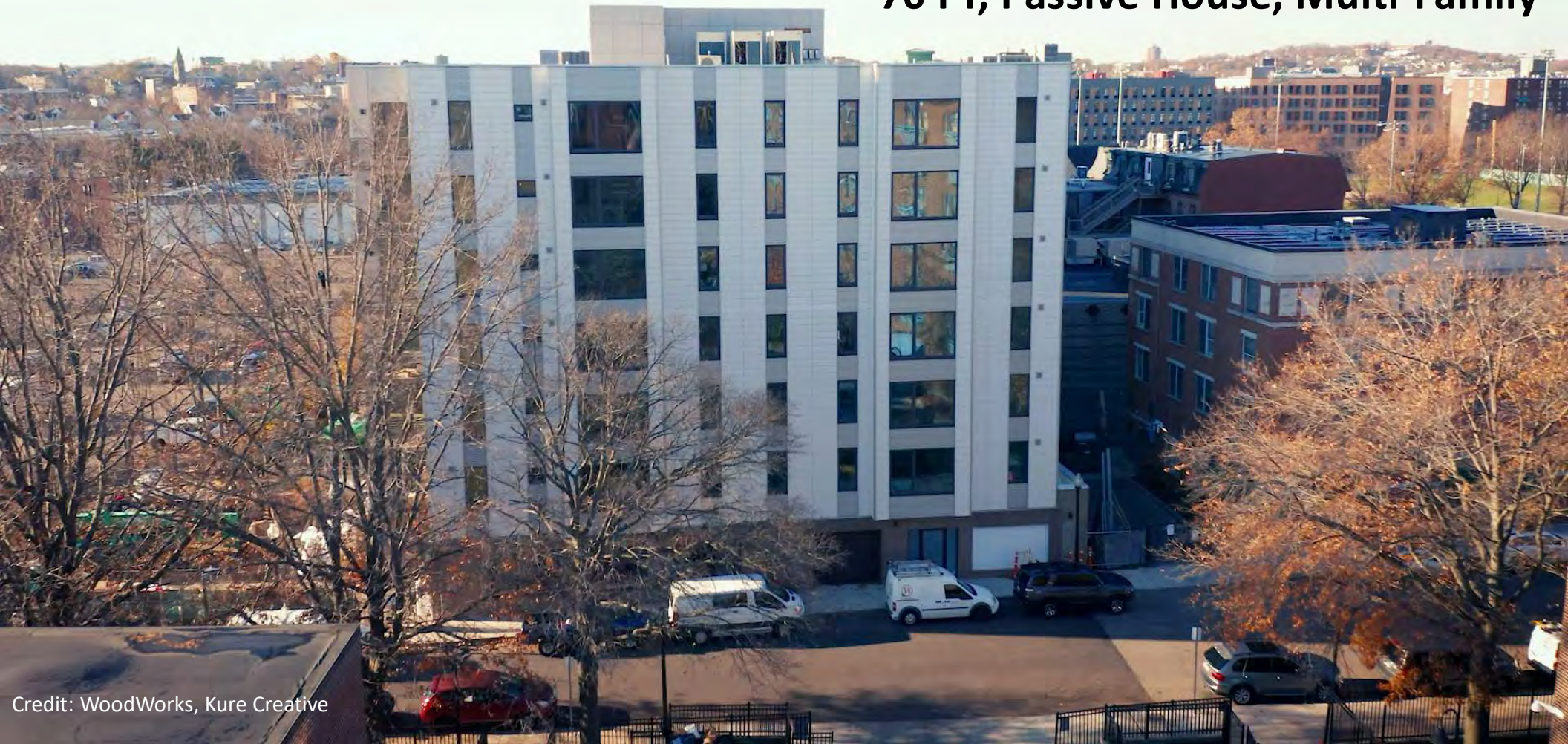
Photo: William McDonough + Partners | Architect: William McDonough + Partners

PRIMARYLY OFFICE SPACE

11 E LENOX, BOSTON, MA

7 STORIES

70 FT, Passive House, Multi-Family



Credit: WoodWorks, Kure Creative

A photograph of a multi-story building under construction. The building features a new vertical addition on the left side, which is a glass-enclosed structure. The existing building is made of brick and has several floors with concrete frames. Workers in safety gear are visible on the construction site. A blue crane is visible in the background. The sky is clear and blue.

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

©2011 NATTAPOL PORNSAENUWAY
WWW.FIVECLOCKSTUDIO.COM



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: Blaine Brownell



Photo: Christian Columbres



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

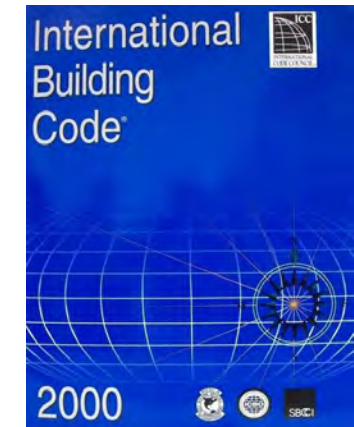
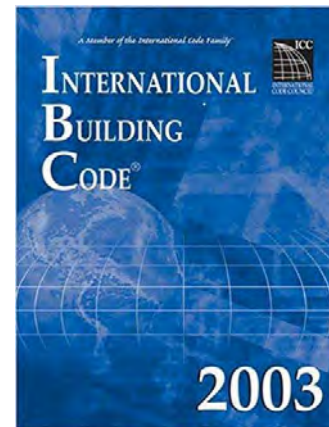
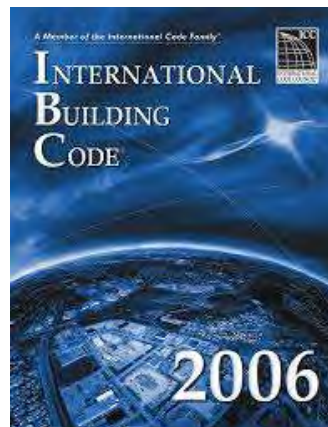


Photo: Swinerton



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CODE
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3 YEAR CODE CYCLE



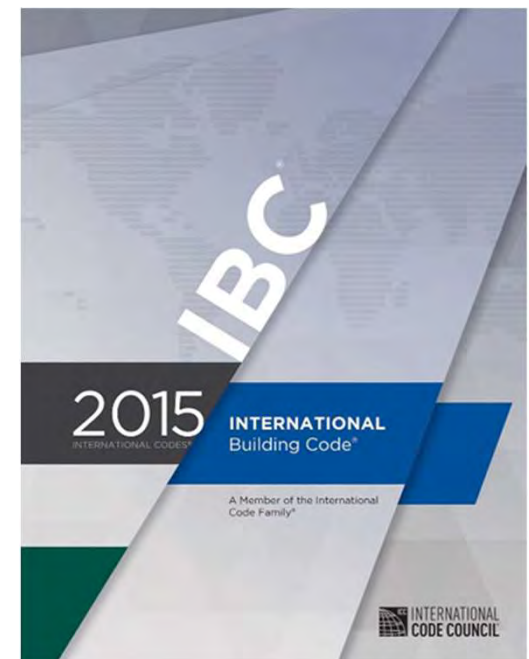
Source: ICC

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 Building, 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

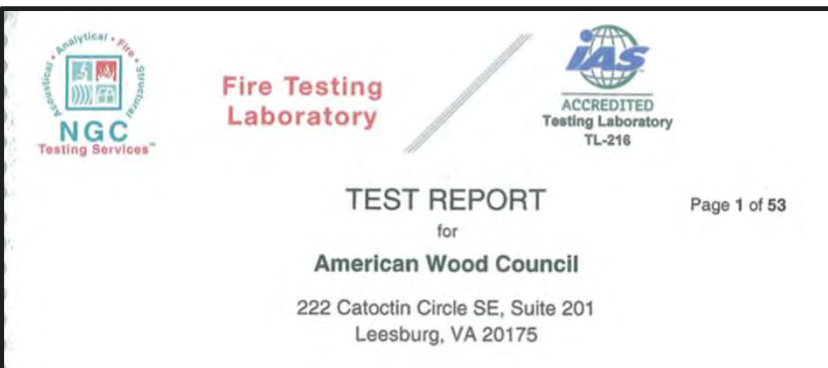
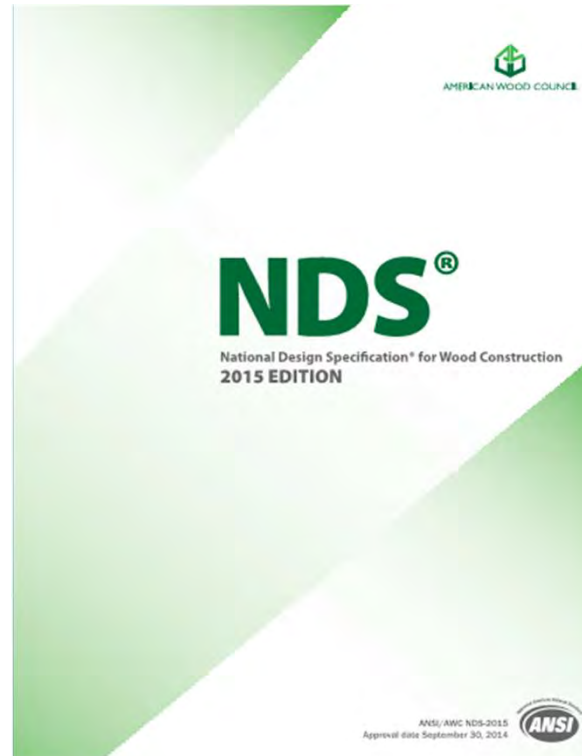


5 Working Groups Created

- 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 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.



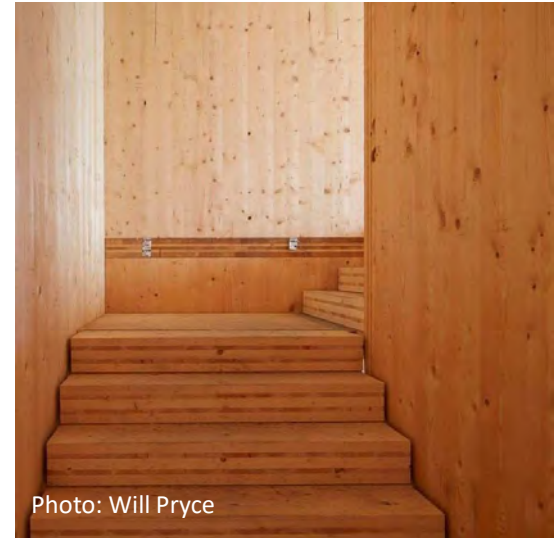
AHC established 6 performance objectives:

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.



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

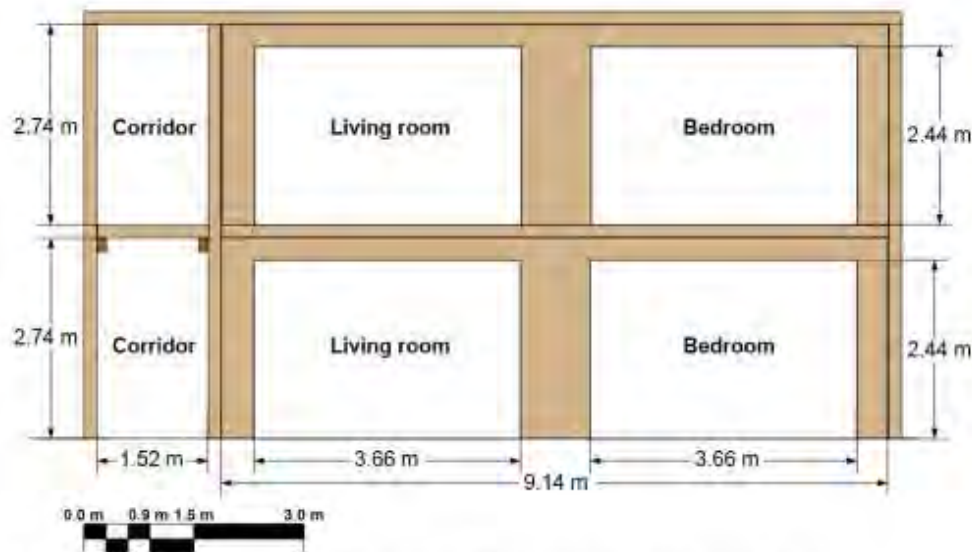


Figure 2. Elevation view of the front of the cross-laminated timber test structure.

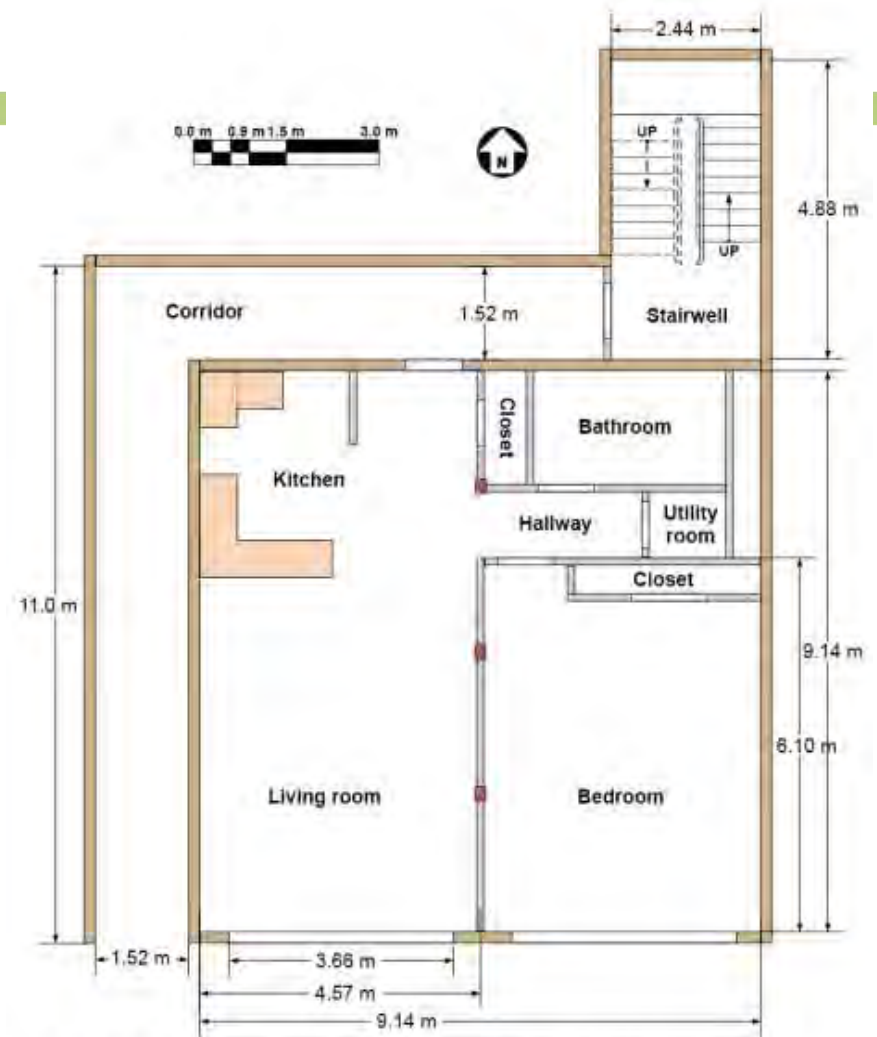


Figure 1. General plan view of cross-laminated timber test structure.

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??



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

U.S. BUILDING CODES

Tall Wood Ad Hoc Committee

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

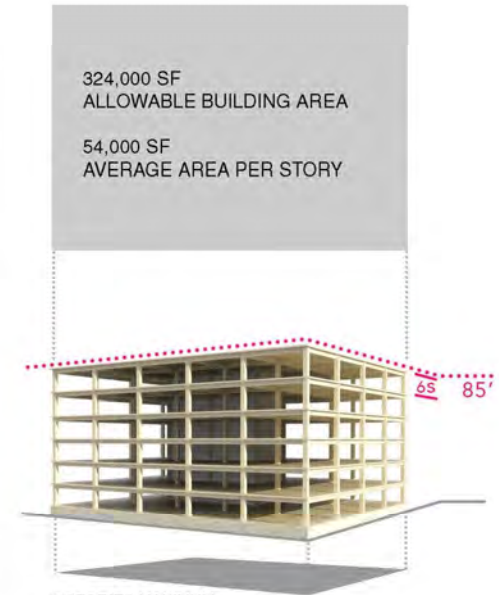
TYPE IV-B



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



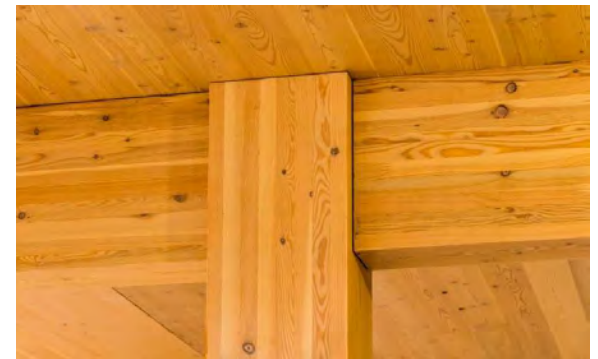
9 STORIES
BUILDING HEIGHT 85'
ALLOWABLE BUILDING AREA 405,000 SF
AVERAGE AREA PER STORY 45,000 SF

TYPE IV-C

Credit: Susan Jones, atelierjones



Photos: Baumberger Studio/PATH
Architecture/Marcus Kauffman



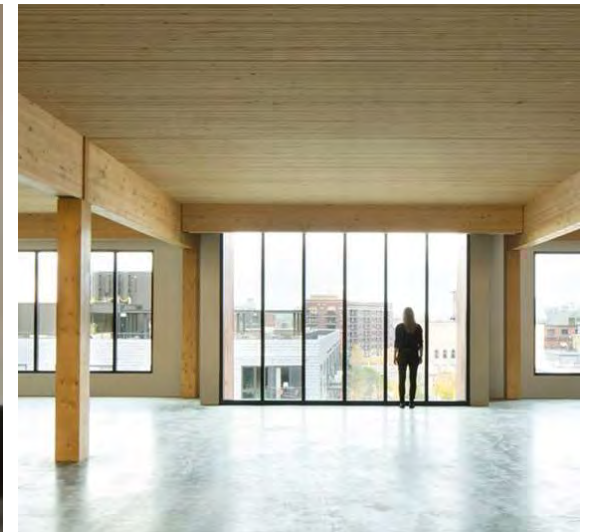
Type IV-C Protection vs. Exposed



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

TYPE IV-C

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



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

TYPE IV-C

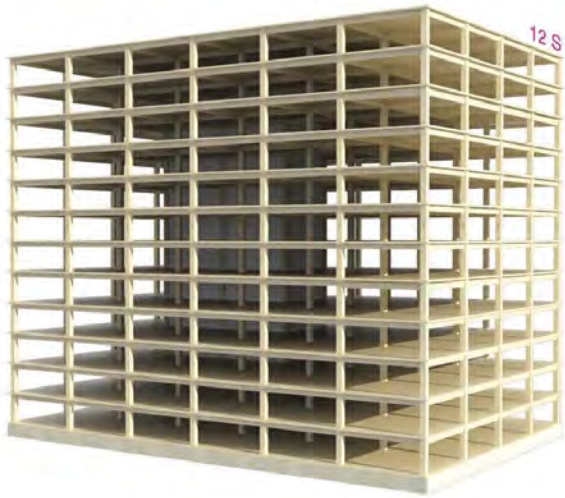
Occupancy	# of Stories	Height	Area per Story	Building Area
A-2	6	85 ft	56,250 SF	168,750 SF
B	9	85 ft	135,000 SF	405,000 SF
M	6	85 ft	76,875 SF	230,625 SF
R-2	8	85 ft	76,875 SF	230,625 SF

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



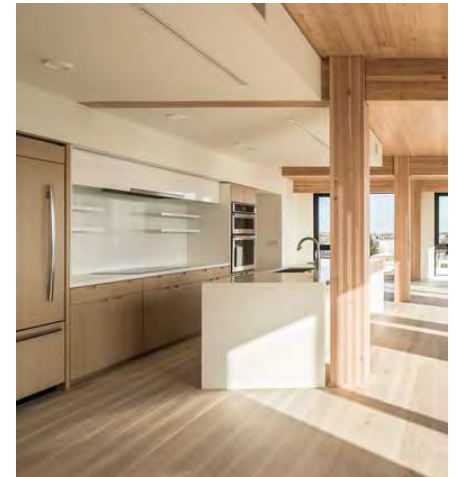
Type IV-B Protection vs. Exposed



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

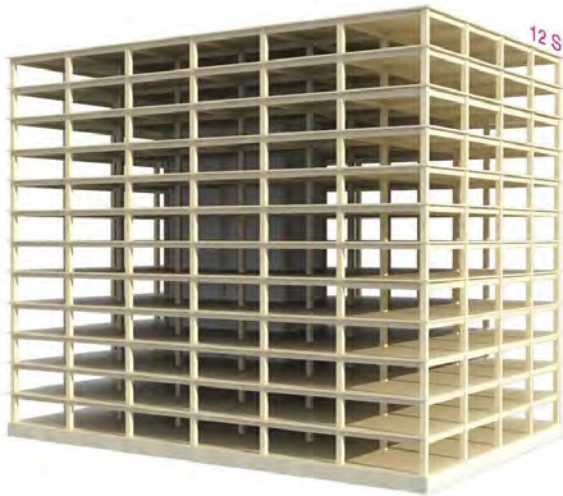


Credit: Kaiser+Path

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



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

TYPE IV-B

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

Credit: Susan Jones, atelierjones

Type IV-A



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

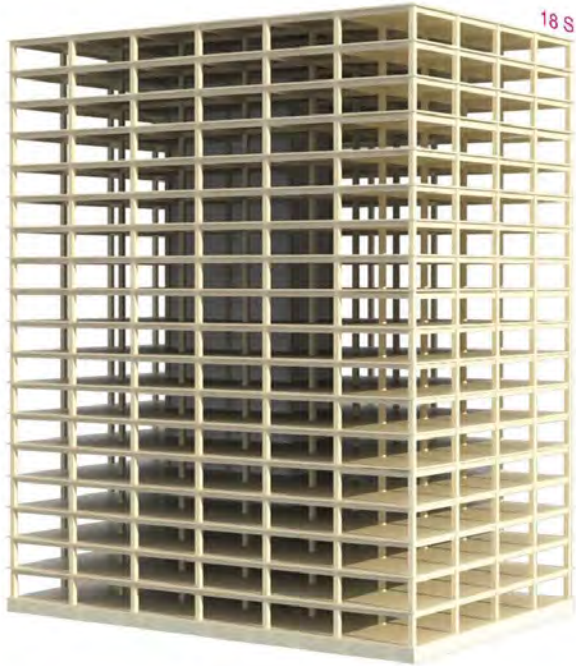
TYPE IV-A

Credit: Susan Jones, atelierjones



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

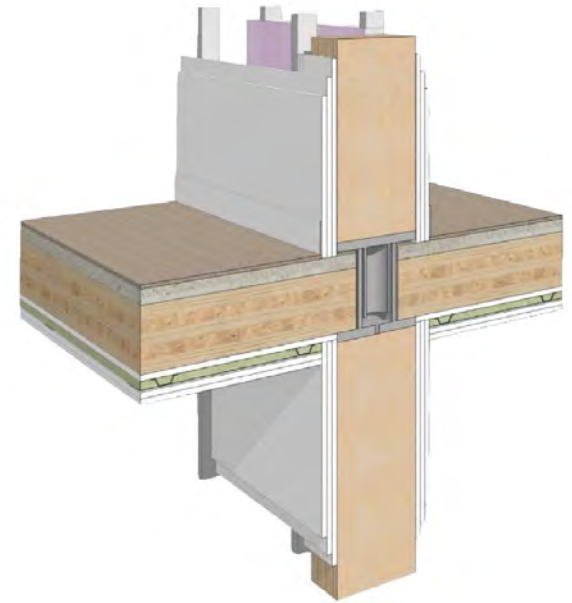
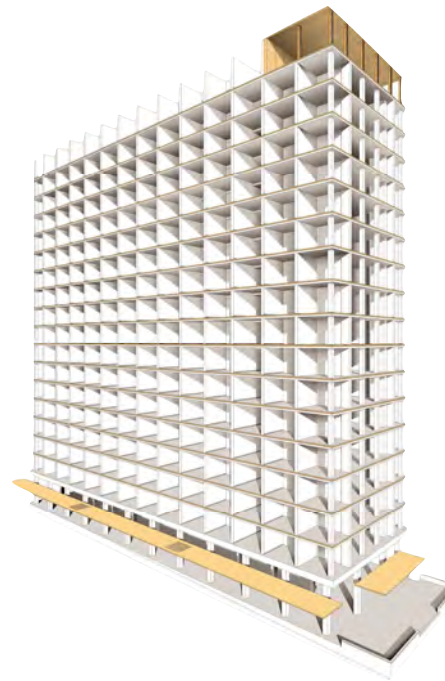
Type IV-A Protection vs. Exposed



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

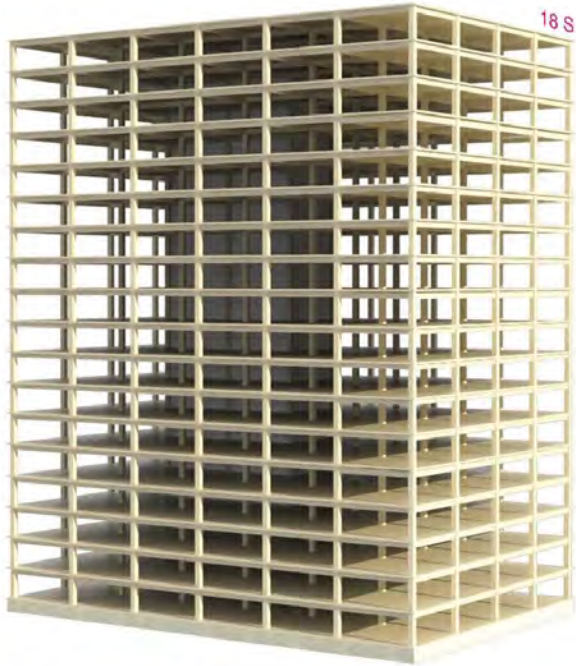
TYPE IV-A

Credit: Susan Jones, atelierjones



100% NC protection on all surfaces of Mass Timber

Type IV-A Height and Area Limits



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

TYPE IV-A

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

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

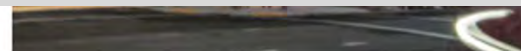
Over the past 10 years, there has been a growing interest in tall buildings constructed from mass timber materials (Breneman 2013, Timmers 2015). Around the world there



WoodWorks Tall Wood Design Resource

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

	Via Cenni	Milan, Italy	9	2013

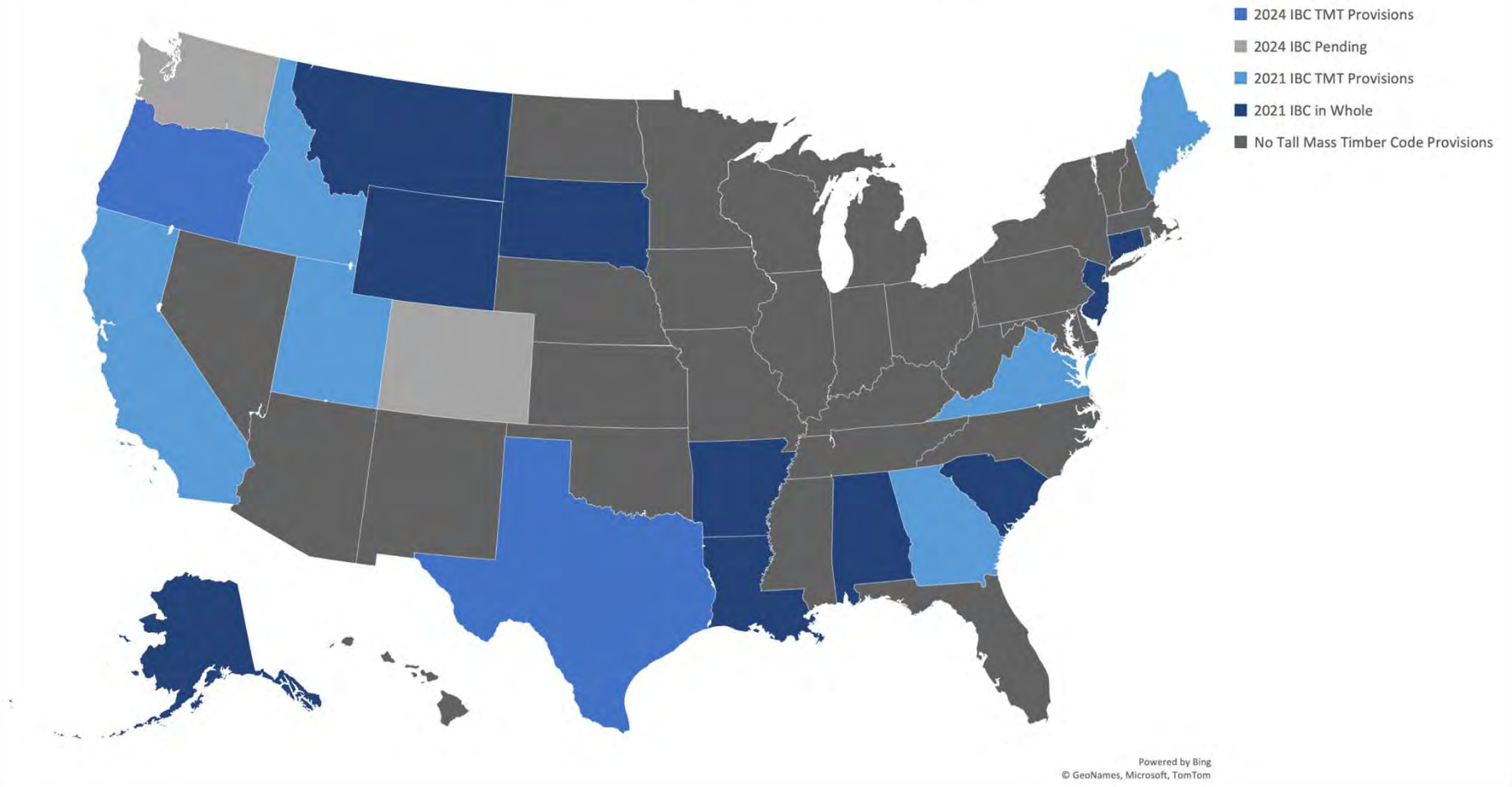




TALL TIMBER CODE ADOPTION

TALL MASS TIMBER RESOURCES

Tall Mass Timber Code Adoptions by State



Mass Timber

Design Manual



THINK
WOOD®

vol. 2

Kaiser Group, Path Architecture, photo Andrew Pogue

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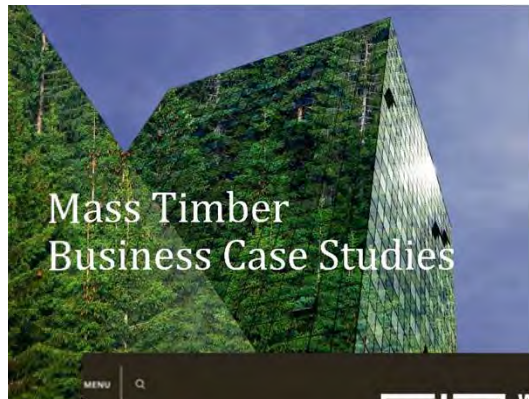
**WOODWORKS
INNOVATION
NETWORK.ORG**



111 East Grand / Neumann Monson Architects
photo Mike Sinclair

Resources for Developers/Owners

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



Mass Timber Cost and Design Optimization Checklists

WoodWorks has developed the following checklists to assist in the design and cost optimization of mass timber projects. The design optimization checklists are intended for building designers (architects and engineers), but many of the topics should also be discussed with the fabricators and builders. The cost optimization checklists will help guide coordination between designers and builders (general contractors, construction managers, estimators, fabricators, installers, etc.) as they are estimating and making cost-related decisions on a mass timber project. The pre-design checklist should be reviewed by the developer/owner.

1 De Haan
San Francisco, CA
Architect
Perkins+Worth
Engineers
DCI Engineers
Contractor
Hatchway Group

Insurance for Mass Timber Construction: Assessing Risk and Providing Answers

WoodWorks.org, 10000 WoodWorks Drive, Suite 100, San Francisco, CA 94133
Phone: 415.774.4400 | Email: info@woodworks.org | Website: www.woodworks.org

In addition to safety, property insurance for mass timber buildings requires an understanding of performance related to things like moisture, durability and building enclosure detailing. Much of the property insurance discussion is also site-specific—e.g., is the area prone to flooding, earthquakes or high winds? Mass timber has been tested against potential natural disasters, and numerous test and research reports are available. This paper is intended for developers and owners seeking to purchase insurance for mass timber buildings, for design/construction teams looking to make their designs and installation processes more insurable, and for insurance industry professionals looking to address their concerns about safety and performance.

U.S. Mass Timber Construction Manual



How Can a Developer/Owner Get Started with Mass Timber?



ICE Block 1
Heller Pacific
Developer Michael Heller of Heller Pacific identified a prime mass timber site in the heart of downtown San Francisco, CA. He identified a prime mass timber site in the heart of downtown San Francisco, CA. He identified a prime mass timber site in the heart of downtown San Francisco, CA.

Mass Timber & Hybrid Structures

To realize the potential benefits of mass timber, such as faster construction and the cost and other advantages of a light-weight system, some developers and owners are gaining experience with mid-rise buildings before pursuing the greater heights allowed under the 2021 International Building Code. Most early mass timber projects developed under capital market forces have been mid-rise speculative offices. Tenants appreciate the beauty of exposed timber, as well as the innovation and sustainability that aligns with their values.

Mass Timber Structural Components

Mass timber can be used in many ways, from an entire structural system to components of the system that can benefit most from the beauty and warmth of an exposed wood structure. One example is Trammel Crow Residential's 975 Bryant Street in San Francisco, which features mass timber mezzanines in its back-floor townhome units. Others include exposed mass timber at amenity areas or penthouses, or for the roof structure.

INTRO

Harbor Bay Real Estate Advisors
Developer Dan Whelan of Harbor Bay Real Estate Advisors recently broke ground on the new story (INTRO). "While some developers and contractors are just now dipping their toes into mass timber, we're gaining as much experience as we can, as quickly as possible by studying every detail of fabrication and erection. We're also investing in R&D to make the entire design and construction process even more efficient. Recent projects have proven that using mass timber can shave 30% off the schedule. We are establishing means and methods that could double that."



WOODWORKS INNOVATION NETWORK

Find projects & team members

Genentech Child Care Center
Mass Timber

CIT Tall Timber Student Housing
Mass Timber

Crosswood Apartments
Mass Timber

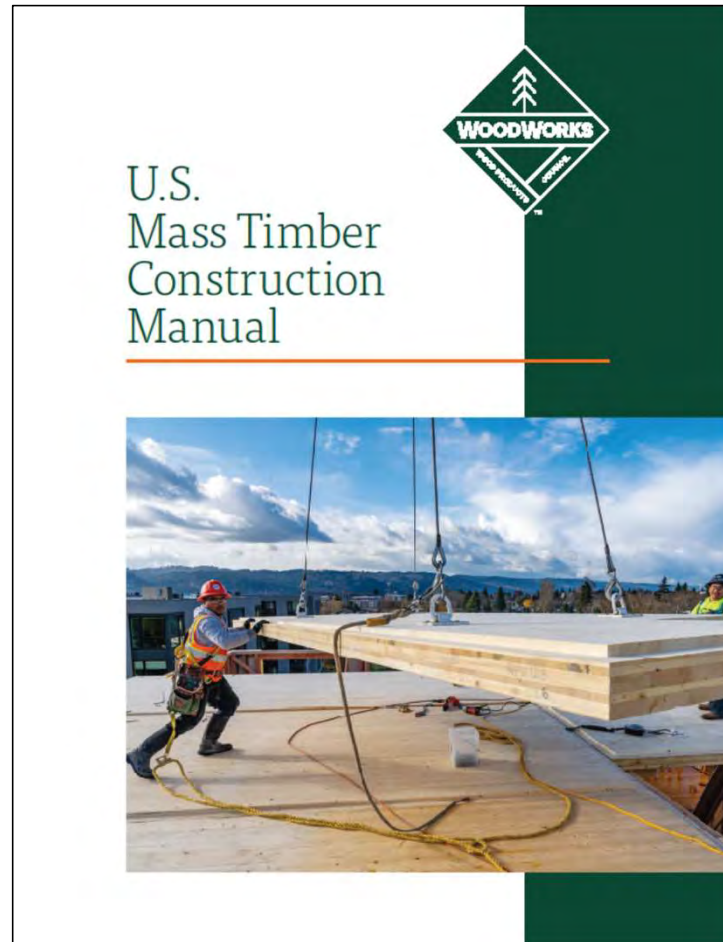
Wingspan Event and Conference Center
Mass Timber

Kresge College Renewal at UC Santa Cruz
Mass Timber

Knight Campus for Accelerating Scientific Impact at the University of Oregon
Mass Timber



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.



Jessica Scarlett, EIT
Regional Director | NC, SC, TN
(803) 616-6231
jessica.scarlett@woodworks.org



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

