Exploring Tall Wood:
New Code Provisions for Tall Timber Structures

Presented by Mark Bartlett, PE – WoodWorks Regional Director

Photo: Kaiser+Path

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Questions related to specific materials, methods, and services will be addressed at the conclusion of this presentation.

Course Description

As interest in and use of mass timber in the U.S. has grown, so too has interest in pushing these timber structures to greater heights. Using international examples of successful tall wood buildings as precedent, some designers have proposed tall wood projects in the states using a project-specific performance-based design approach. In order to provide a uniform set of code provisions for these tall wood buildings, the International Code Council established an ad hoc committee on tall wood buildings that proposed a set of code changes allowing up to 18 stories of mass timber construction. Those code changes were announced as approved in January 2019 and will become part of the 2021 International Building Code. Following a brief discussion of history and motivators, this presentation will introduce the new tall wood code provisions and construction types, as well as the technical research and testing that supported their adoption.

Learning Objectives

1. Review the global history of tall wood construction and highlight the mass timber products used in these structures.

2. Explore the work and conclusions of the ICC Ad Hoc Committee on Tall Wood Buildings in establishing 14 new code provisions for the 2021 IBC that address tall wood construction.

3. Discuss differences between the new tall wood mass timber construction types and existing construction types.

4. Identify the key passive fire-resistance construction requirements and active systems that enable taller wood buildings to be built safely.

Questions we'll answer:

- What is tall wood?
- How tall is tall?
- What has been done?
- What wood products are used in tall wood?
- What does the code allow now?
- How did we arrive at the proposed tall wood code changes?
- What are the new tall wood code provisions?

Photo: Michael Green Architecture

Tall Wood in North America circa 1906

9 stories

THE LANDING, VANCOUVER

Butler Square, Minneapolis

Global Tall Wood circa 2015

7-14 stories

Global Tall Wood circa 2019

18-24 stories


Photo: Moelven Limtre

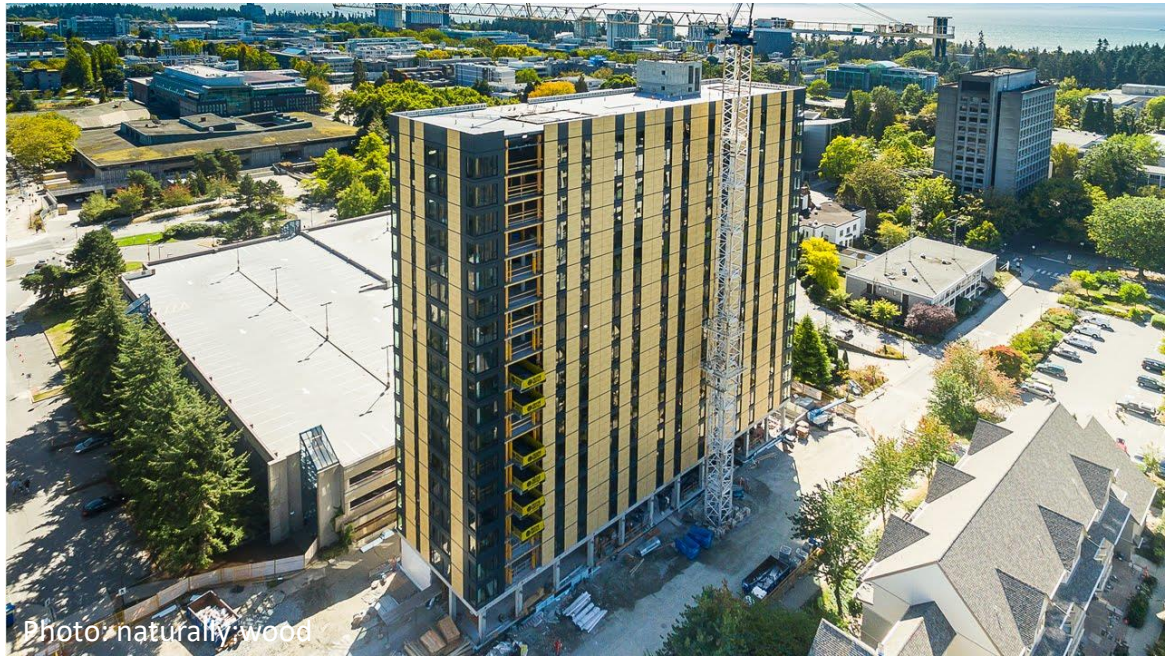
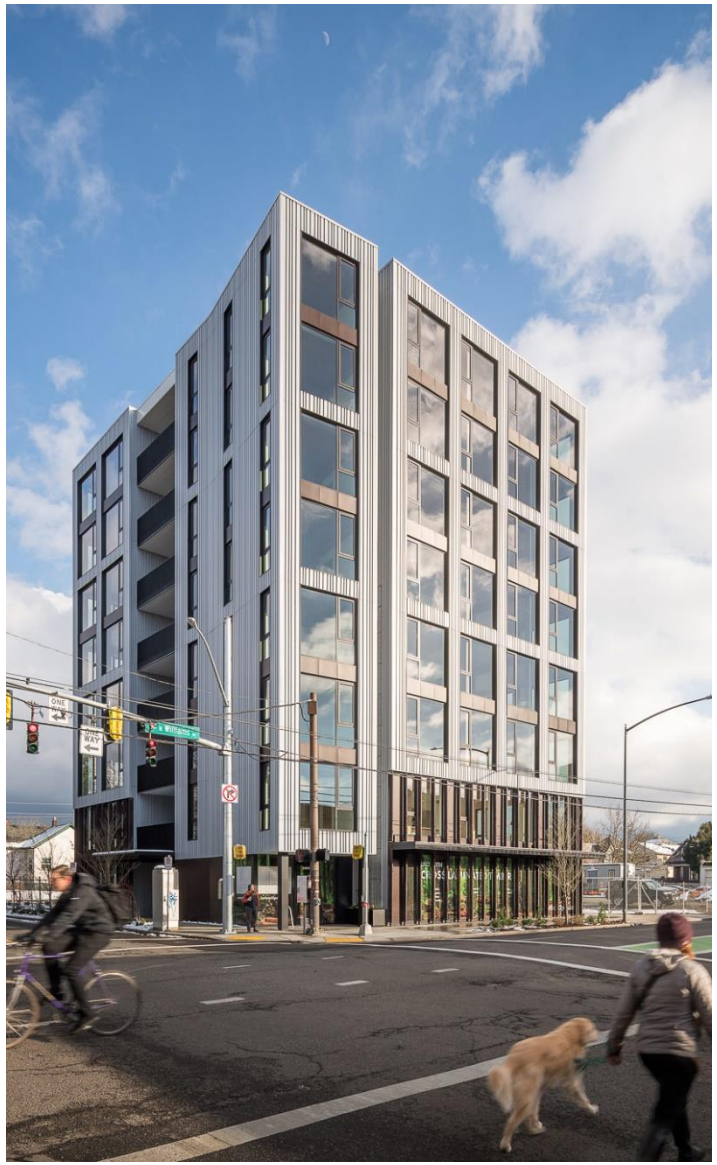


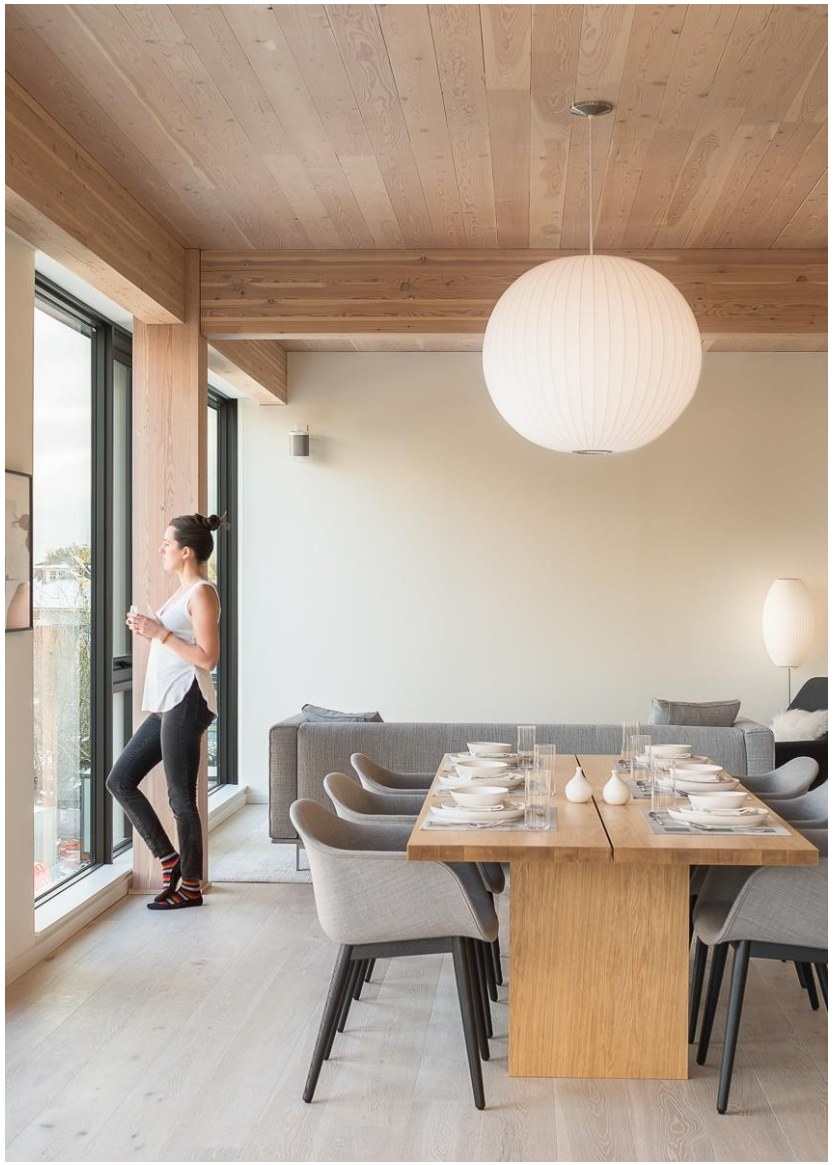
Photo: naturally:wood

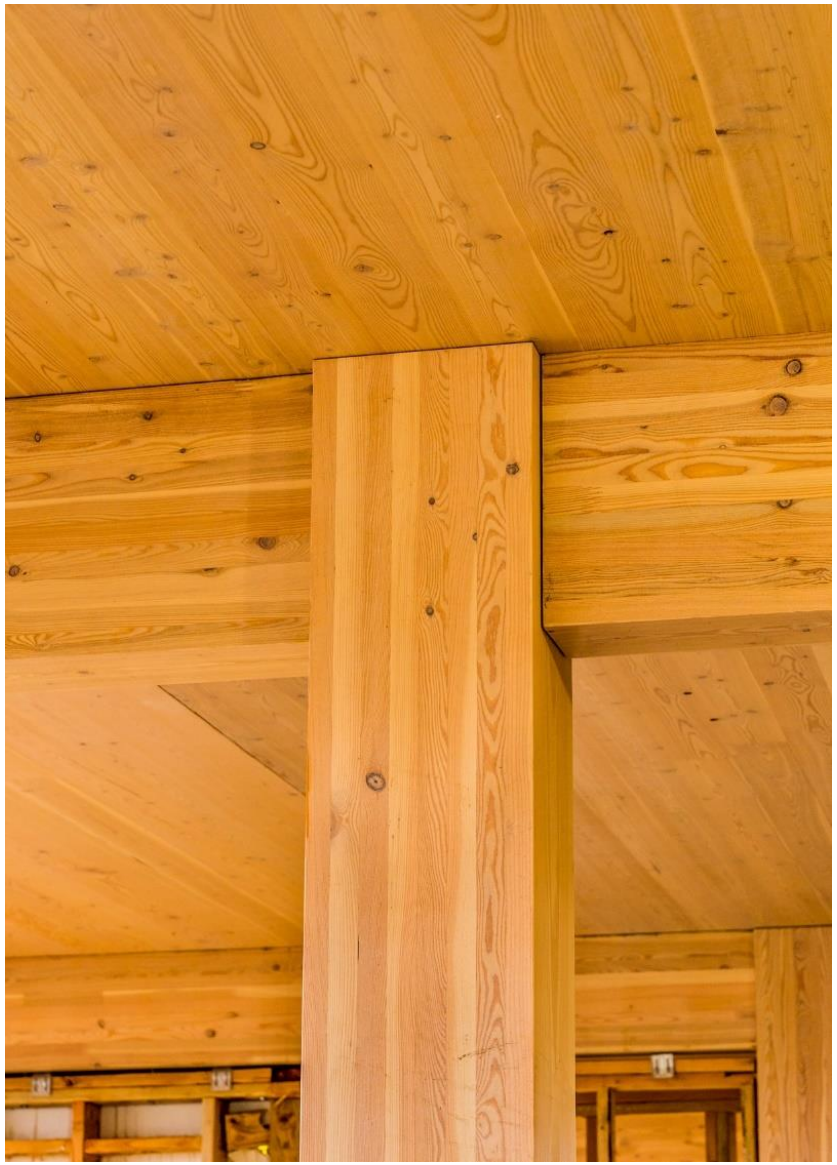

Photo: Rudiger Lainer + Partner

Tall Wood in the US circa 2019

8 stories







Photos: Baumberger Studio/PATH Architecture/Marcus Kauffman | Architect: PATH Architecture

Heavy Timber

Federal Center South, Seattle, WA
Photo: Benjamin Benschneider

Mass Timber

Bullitt Center, Seattle, WA
Photo: John Stamets

Glulam

Cross-Laminated Timber (CLT)

Nail-Laminated Timber (NLT)

Photo: Think Wood

Photo: StructureCraft

Photo: LendLease

Photo: Ema Peter

Dowel-Laminated Timber (DLT)

Photo: StructureCraft

Photo: StructureCraft

Mass plywood panels (MPP)

Photo: LEVER Architecture

T&G Decking

Photo: Bernard André Photography

Offices | Multi-Family | Commercial | Educational

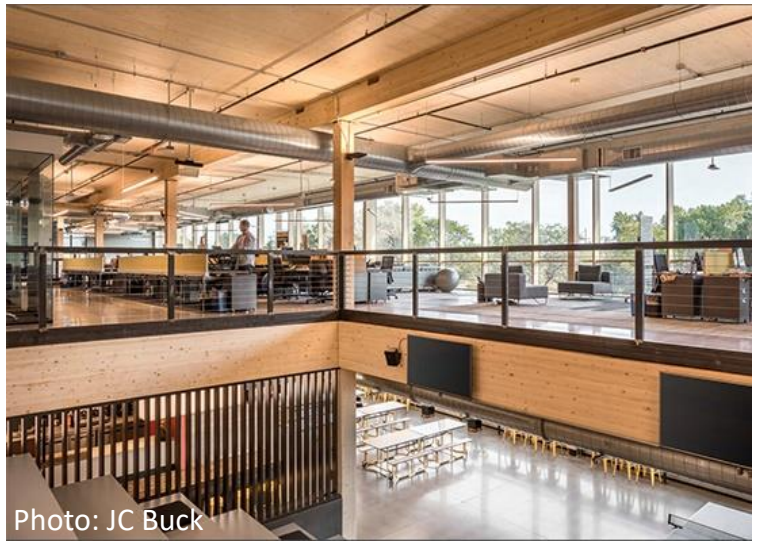


Photo: JC Buck

Photo: William Horne


Photo: LEVER Architecture


Photo: David Sundberg and Gray Organschi Architecture


Photo: ©Albert Vecerka/Esto


Photo: Christian Columbres

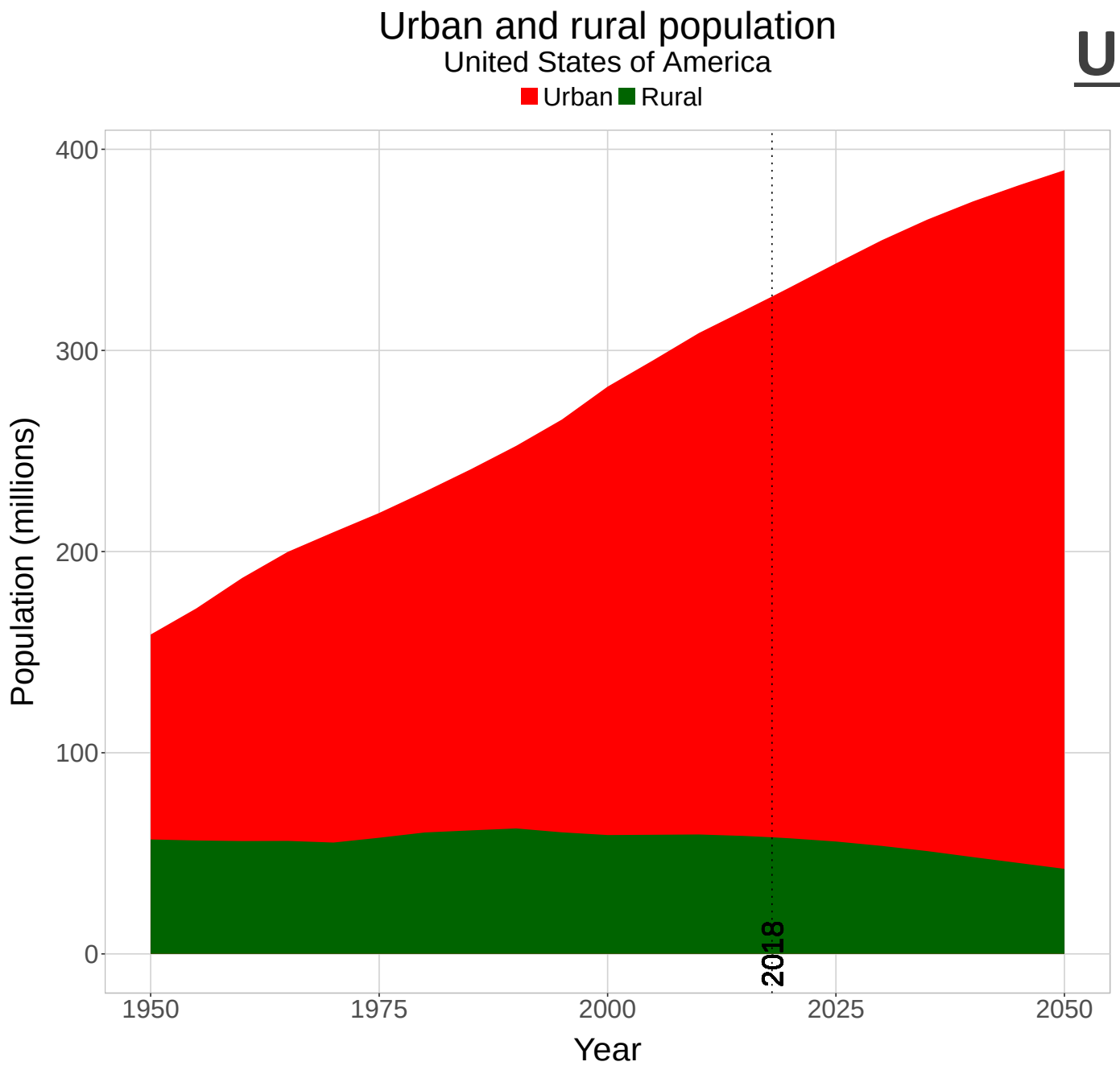
WHY TALL WOOD?

GLOBAL POPULATION BOOM

Global Population
7.6 billion now
9.8 billion by 2050
30% increase

Source: United Nations Department of Economic and Social Affairs

US URBAN POPULATION BOOM

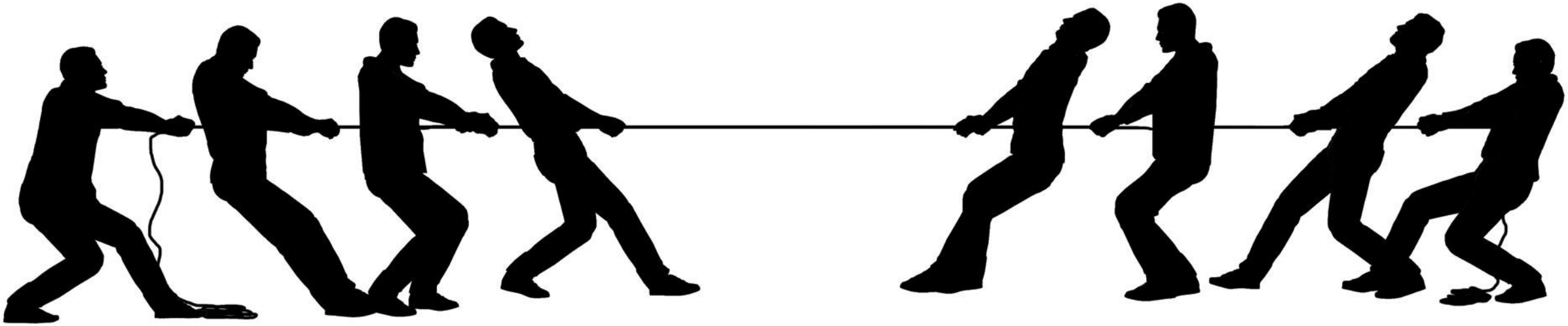


	URBAN	RURAL
2019	271.4 M	57.7 M
2030	301 M	53.7 M
2050	347.3 M	42.2 M

Construction Traffic & Noise
Material Stockpiles
Labor Costs
Labor Availability
Weather Risks

Resiliency
Sustainability
Fire & Life Safety

Urban Construction Growth



MARKET DRIVERS FOR MASS TIMBER

PRIMARY DRIVERS

- Construction Efficiency & Speed
- Construction site constraints – Urban Infill
- Innovation/Aesthetic

SECONDARY DRIVERS

- Carbon Reductions
- Structural Performance – lightweight

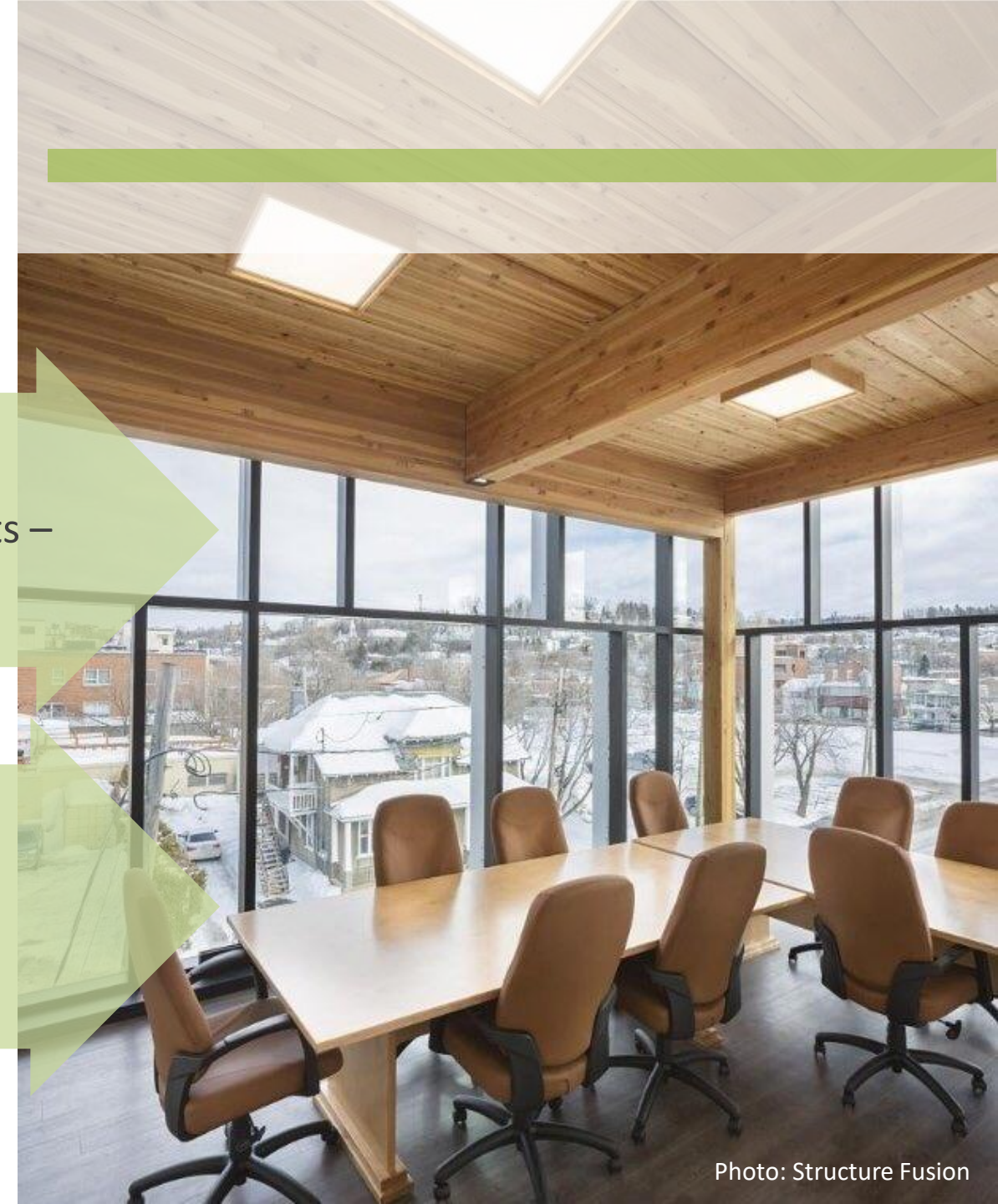


Photo: Structure Fusion


August 9, 2016

ESTIMATED ENVIRONMENTAL IMPACT OF WOOD USE

Volume of wood products used:
2,233 cubic meters of CLT and Glulam

U.S. and Canadian forests grow this much wood in:
6 minutes

Carbon stored in the wood:
1,753 metric tons of CO_2

Avoided greenhouse gas emissions:
679 metric tons of CO_2

Total potential carbon benefit:
2,432 metric tons of CO_2

THE ABOVE GHG EMISSIONS ARE EQUIVALENT

511 cars off the road for a year

Energy to operate a home for 222 years

**Estimated by the Wood Carbon Calculator for Buildings, based on research by Sathre, R. and J. O'Connor, 2010, A Synthesis of Research on Wood Products and Greenhouse Gas Impacts, FPInnovations (this relates to carbon stored and avoided GHG).*

**CO2 in this case study refers to CO2 equivalent*

Source: Naturally:Wood9

Reduced Embodied Carbon

Brock Commons, Vancouver, BC

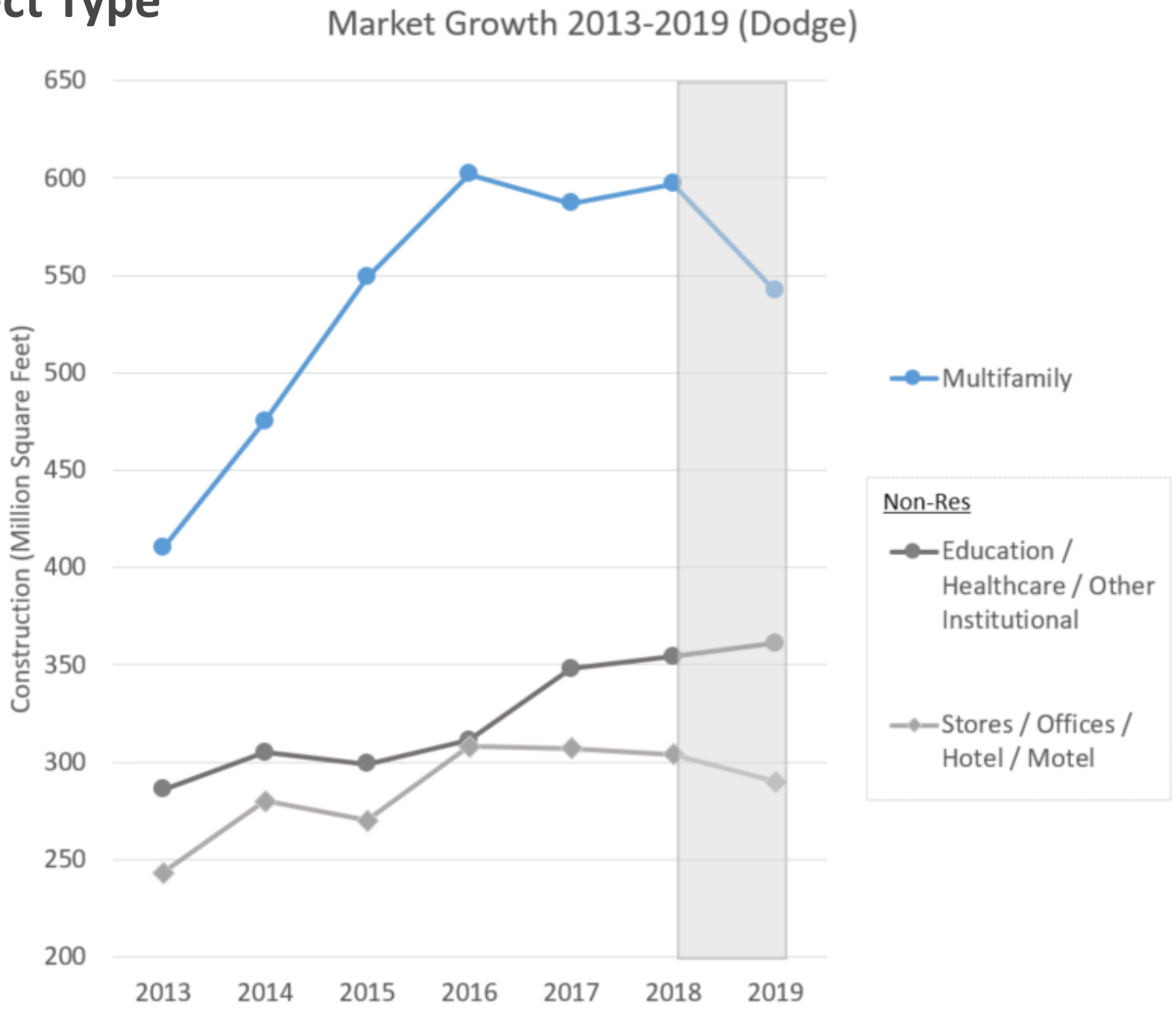
Photo Credit: UBC

Market Opportunity by Project Type

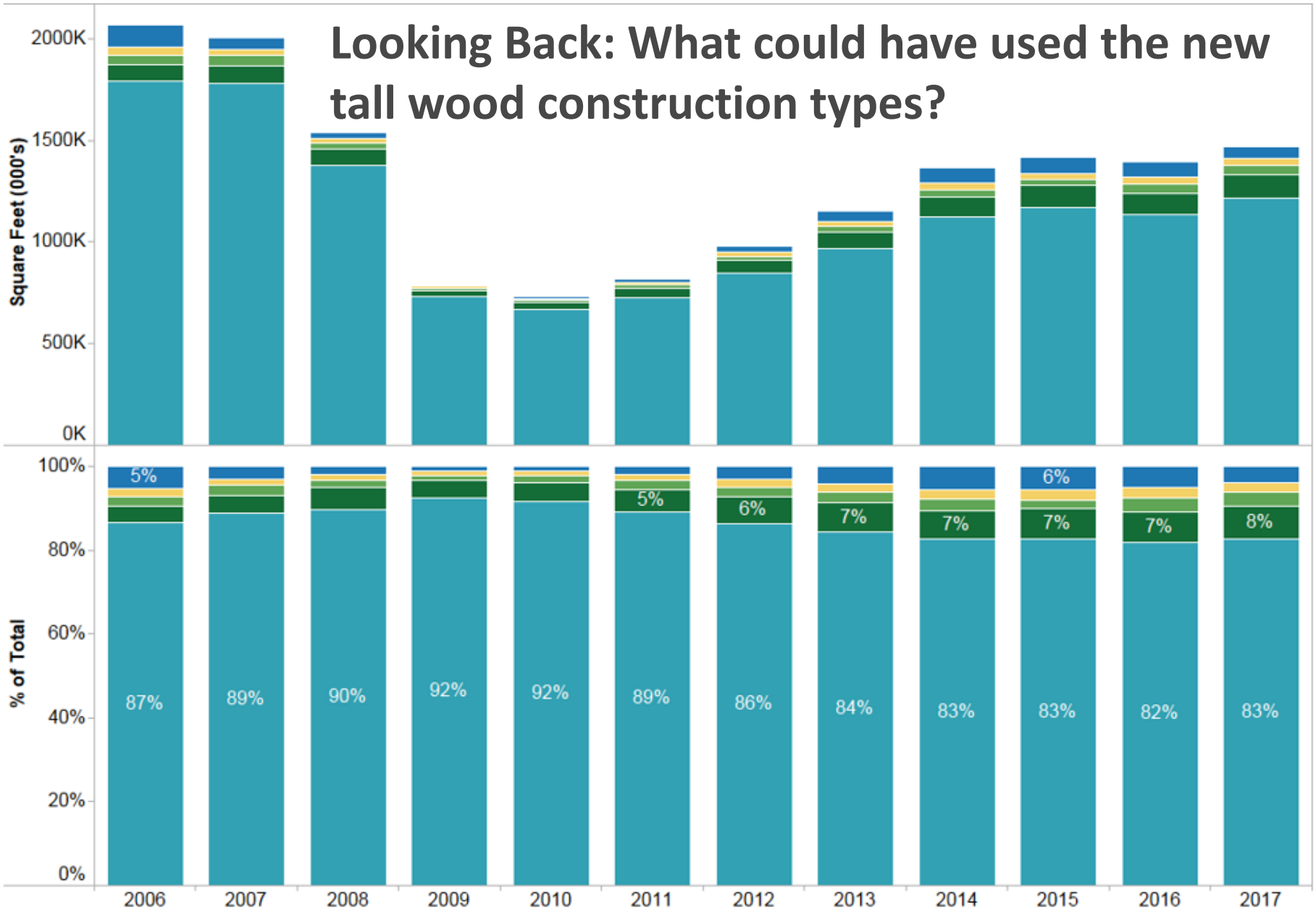
Forecast: Mass Timber "Type" Projects

All stories (not just tall wood)

~1 Billion SF per Year



All Multifamily and Non-residential

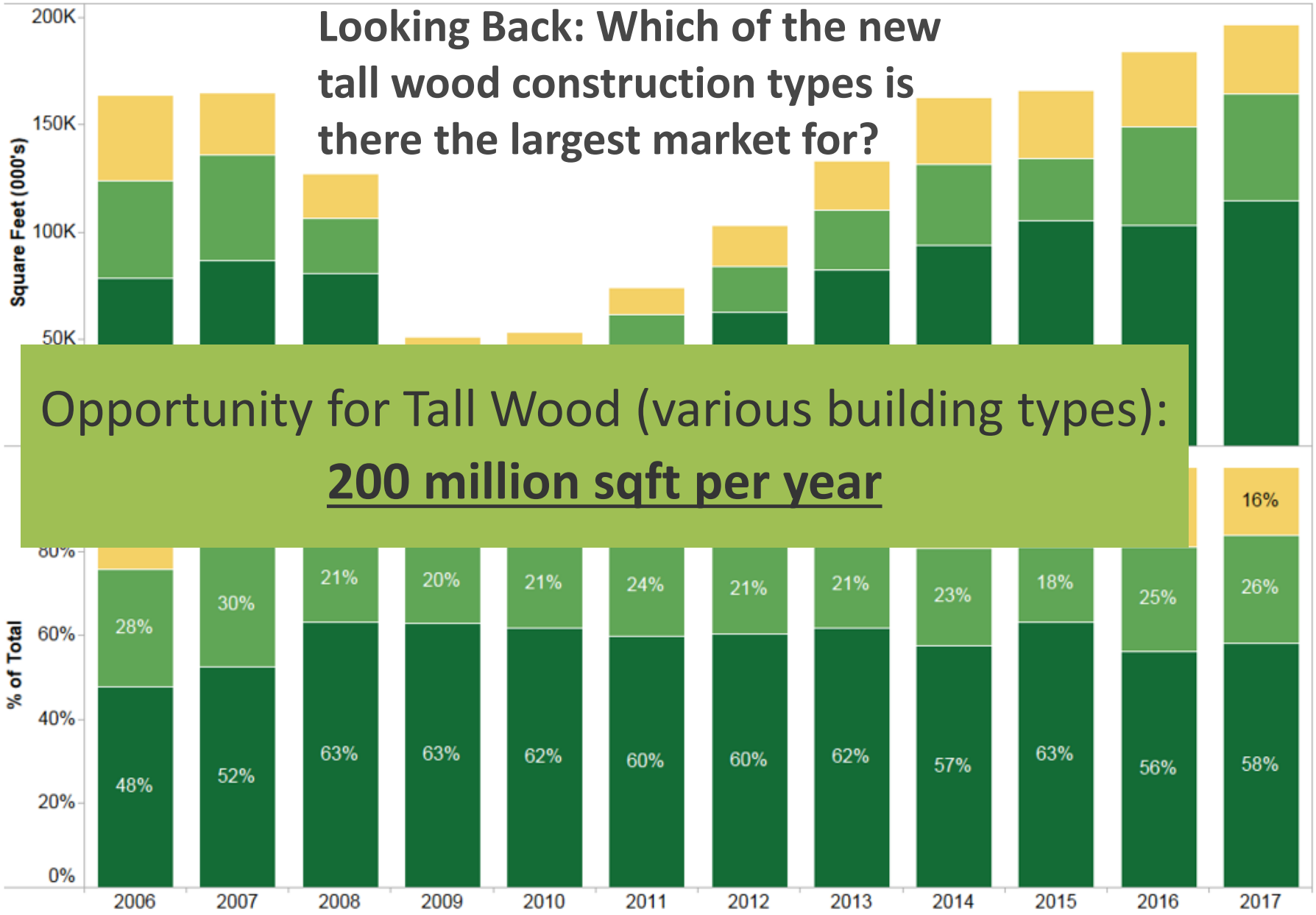


2021 IBC Construction Types

- 19+
- IV-A
- IV-B
- IV-C
- III, IV, V

Estimated construction types calculated using building stories and occupancy

Type IV-A,B,C – MF and Non-residential



Opportunity for Tall Wood (various building types):

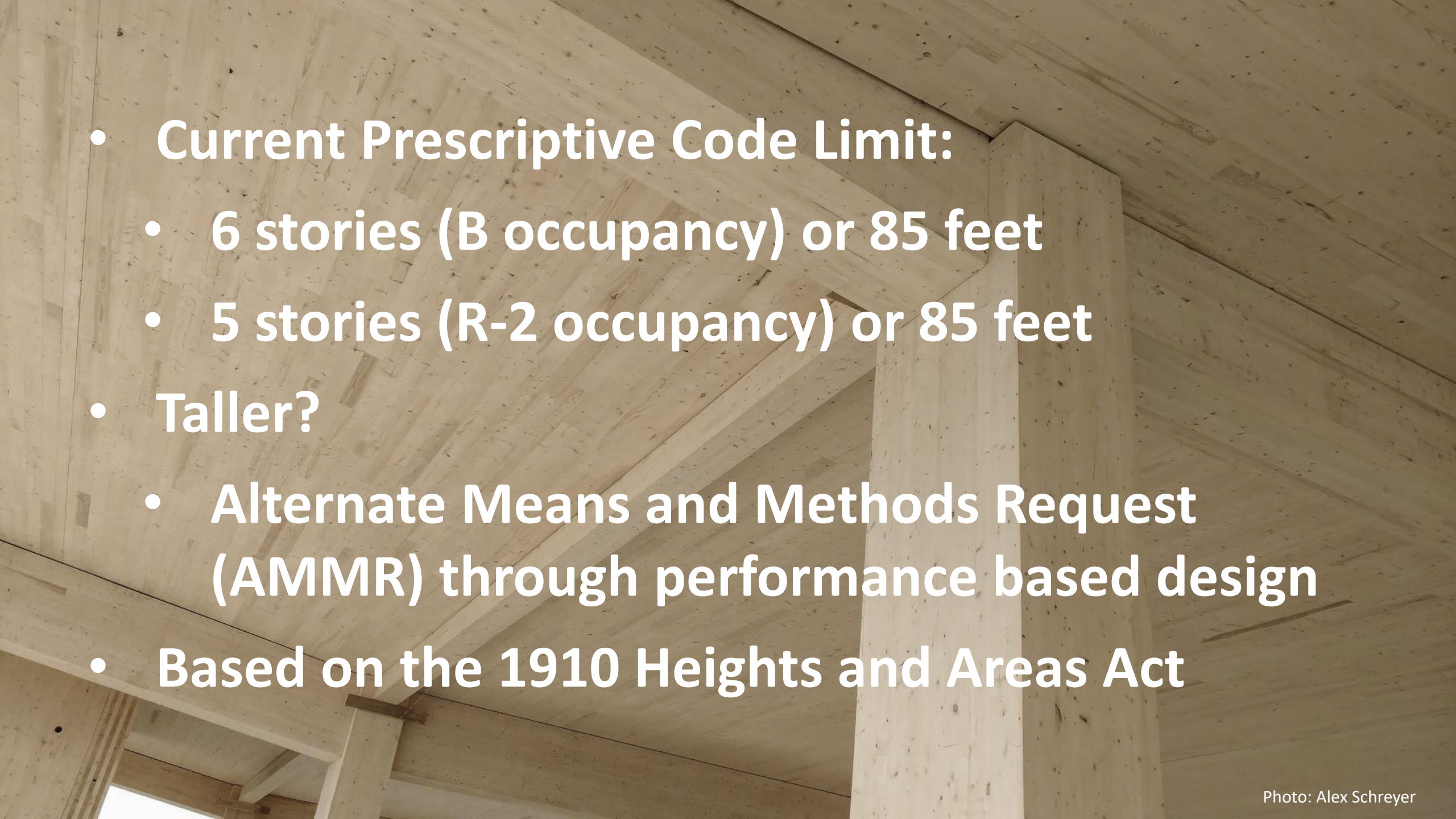
<u>200 million sqft per year</u>

2021 IBC Construction Types

- IV-A
- IV-B
- IV-C

Estimated construction types calculated using building stories and occupancy

TALL WOOD IN THE U.S.



- Current Prescriptive Code Limit:
  - 6 stories (B occupancy) or 85 feet
  - 5 stories (R-2 occupancy) or 85 feet
- Taller?
  - Alternate Means and Methods Request (AMMR) through performance based design
- Based on the 1910 Heights and Areas Act

Photo: Alex Schreyer

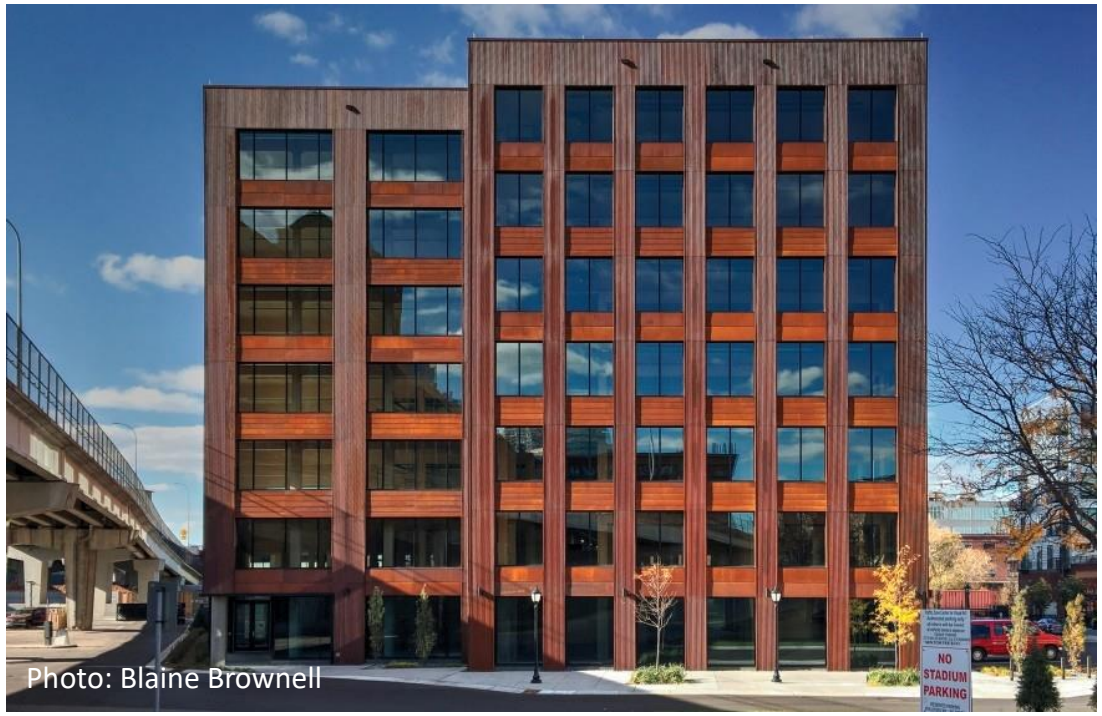


Photo: Blaine Brownell

Photo: Christian Columbres

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

Photo: Swinerton

T3 Minneapolis

Minneapolis, MN

Image Credit: Michael Green Architects/Hines Group

T3 Minneapolis

Minneapolis, MN

Type IV Construction
7 stories (6 Timber on 1 Concrete)
234,000 sf
2x8 NLT Floor Panels w/3” Concrete Topping
Glulam Beam and Column Frame
20’x25’ Grid

T3 Minneapolis

Minneapolis, MN

Image Credit: Ema Peter

Type III Construction, Residential occupancy: 5 stories

Photo: Leers Weinzapfel Associates

Light-frame wood

Mass timber

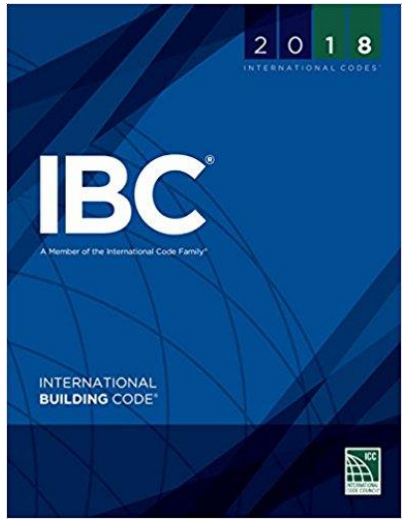

525 at the Enclave, Baylis Architects, Rafn Company, photo Sky-Pix

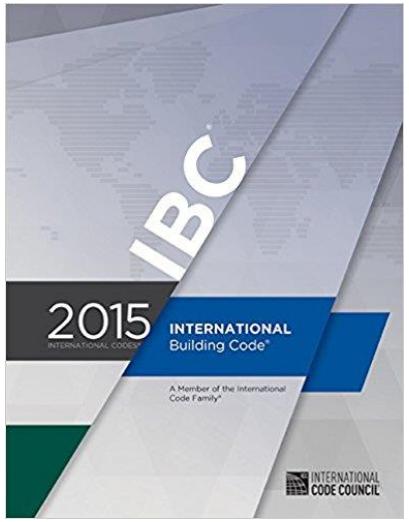
U.S. BUILDING CODE STATUS

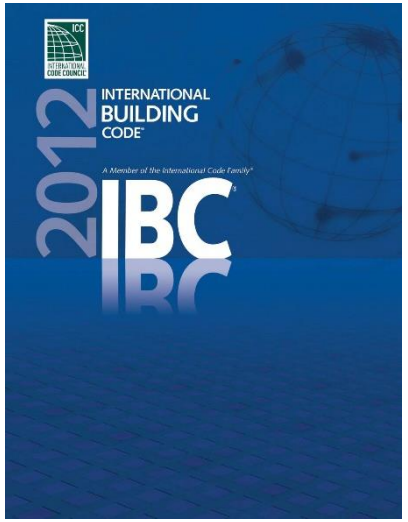
Photo: Ema Peter

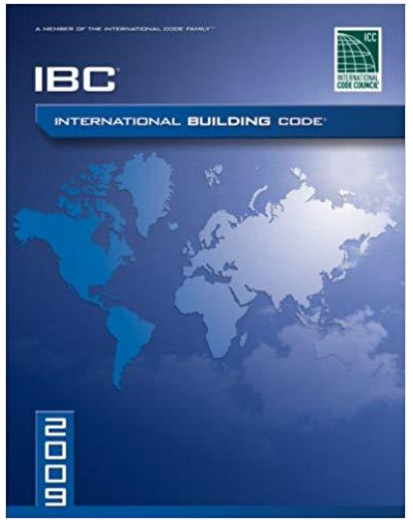
ICC INTERNATIONAL CODE COUNCIL®

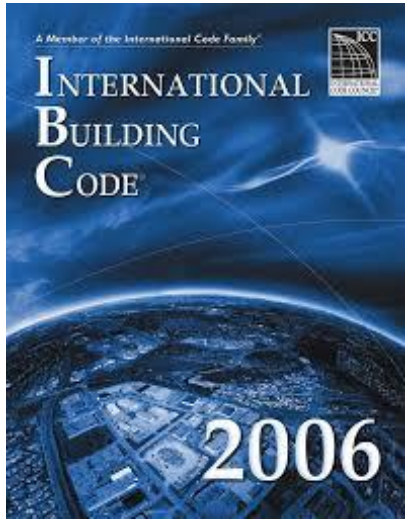
3 YEAR CODE CYCLE

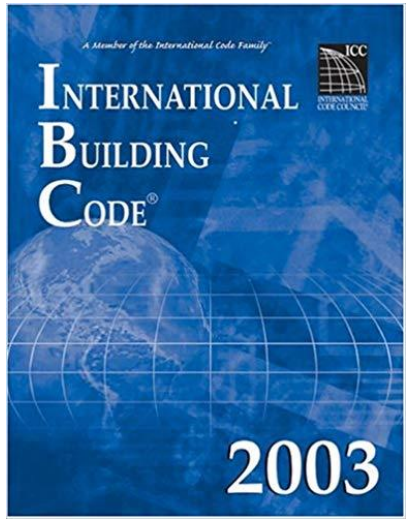


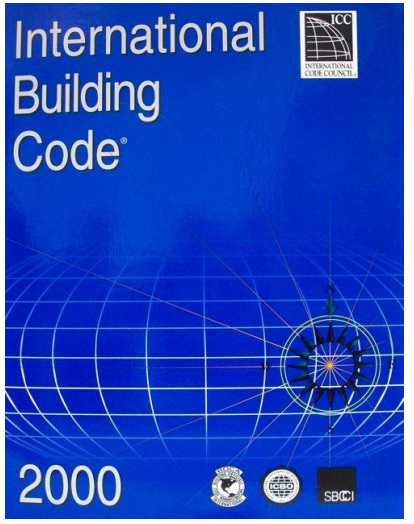










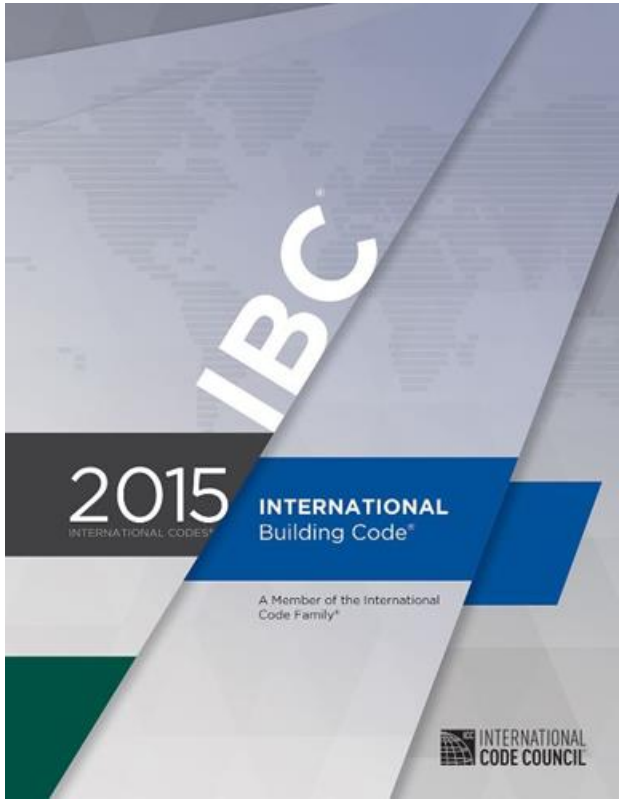


U.S. TALL WOOD
DEVELOPMENT AND CHANGES

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 Structures

UBC Brock Commons Student Residence, Vancouver, British Columbia, 2016

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

Timeline:

Submission of code changes for the 2018 Group A Cycle (IBC) in January 2018 – changes for 2021 IBC

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**

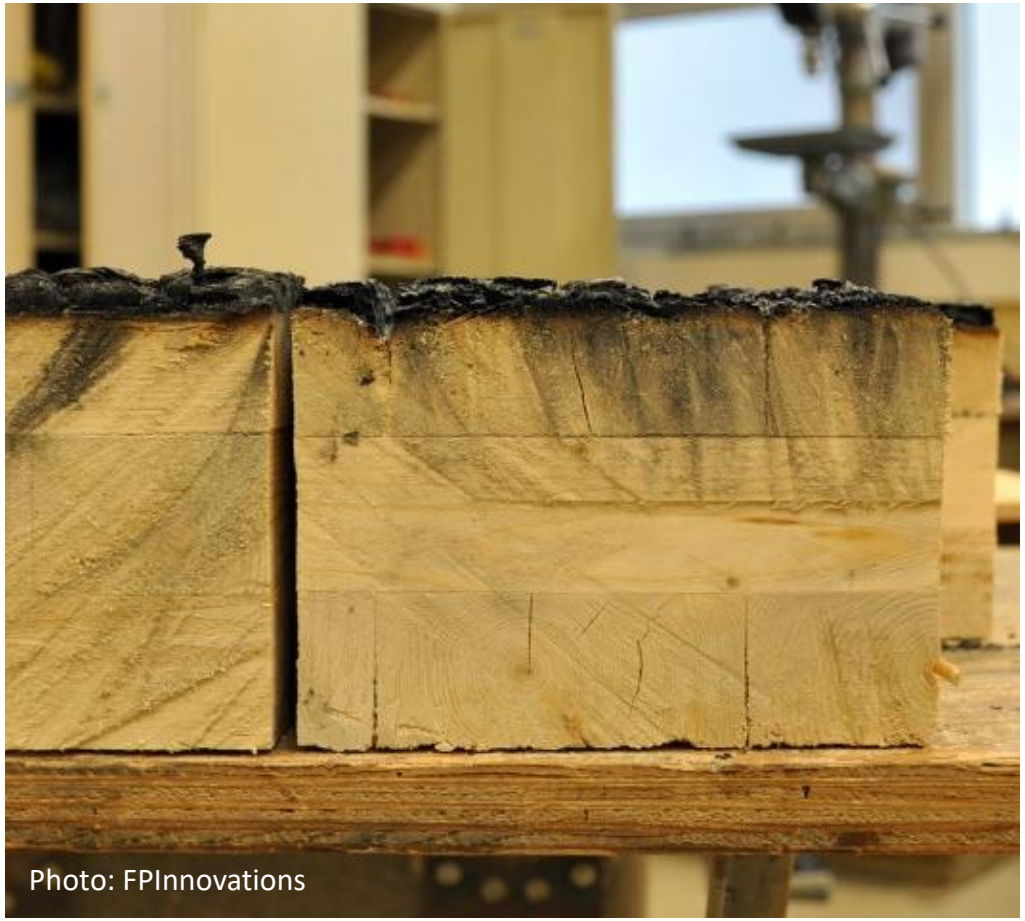
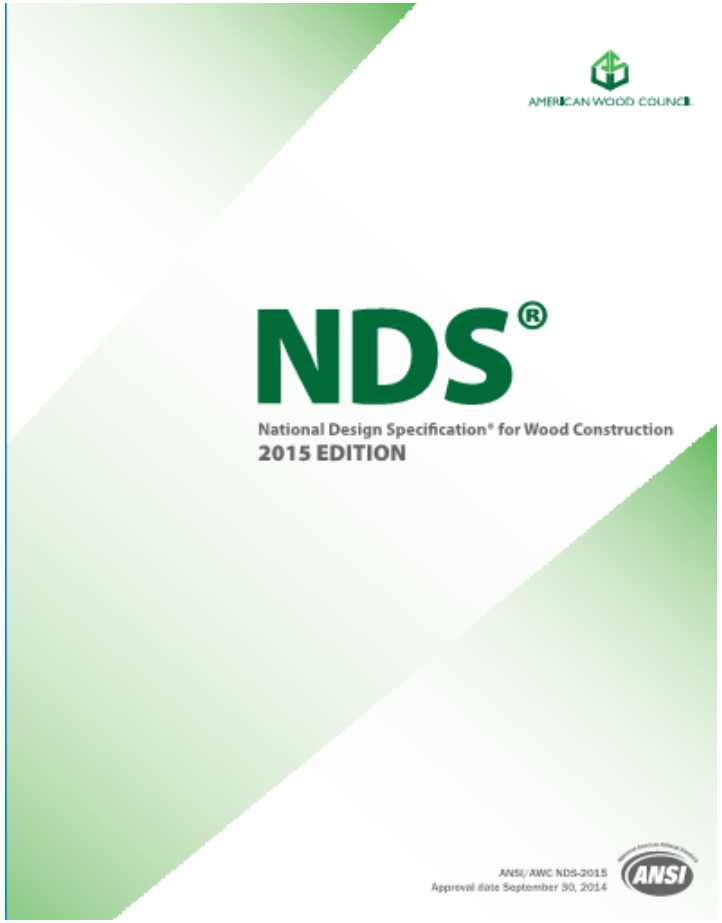


Photo: FPInnovations



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:

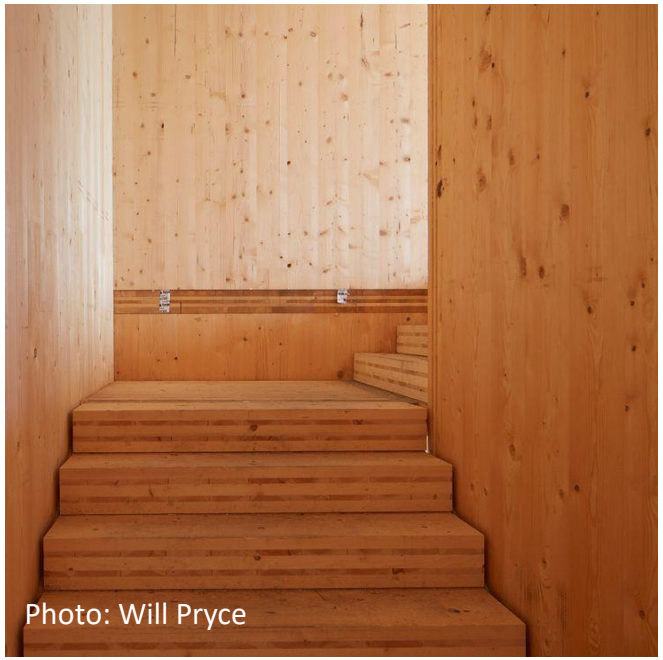
1. No collapse under reasonable scenarios of complete burn-out of fuel without automatic sprinkler protection being considered.
2. Highly reliable fire suppression systems to reduce the risk of failure during reasonably expected fire scenarios. The degree of reliability should be proportional to evacuation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

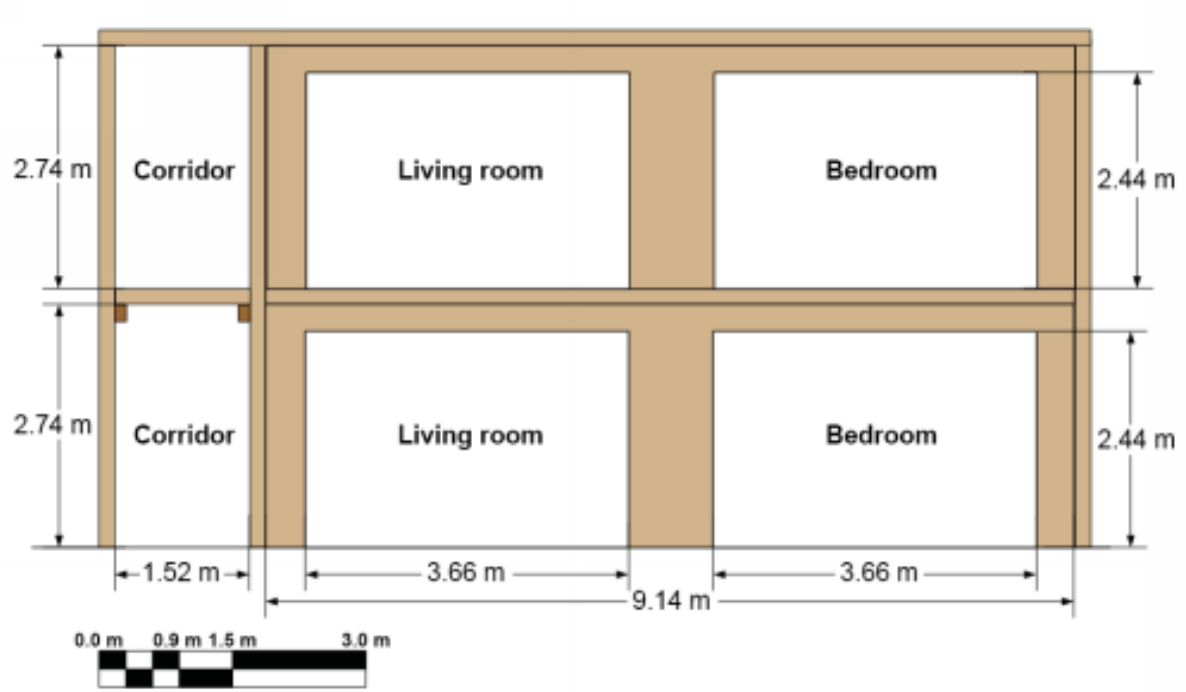


Figure 2. Elevation view of the front of the cross-laminated timber test structure.

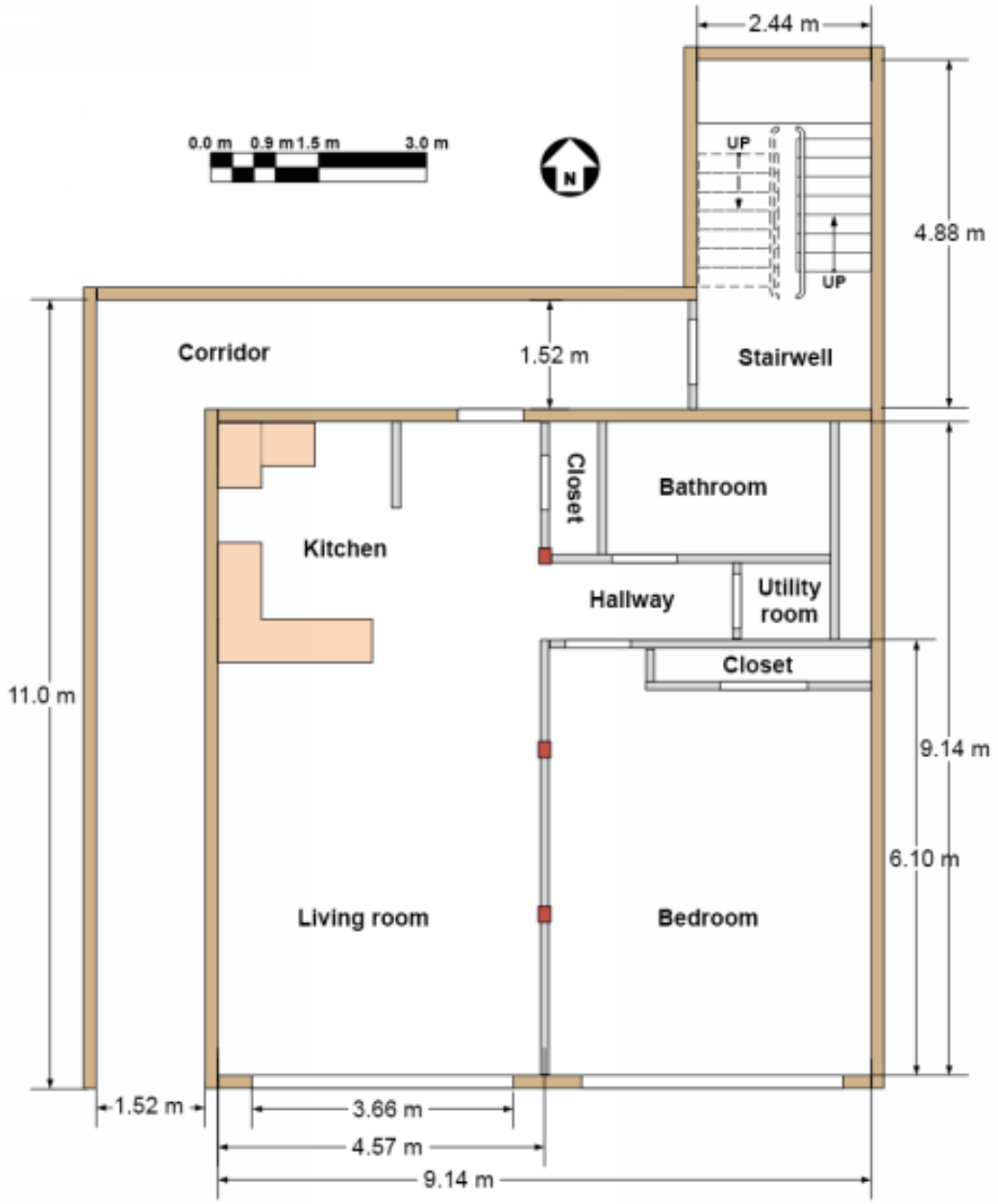


Figure 1. General plan view of cross-laminated timber test structure.

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

TEST 1

Photos provided by U.S. Forest Products Laboratory, USDA

Source: AWC

TEST 2

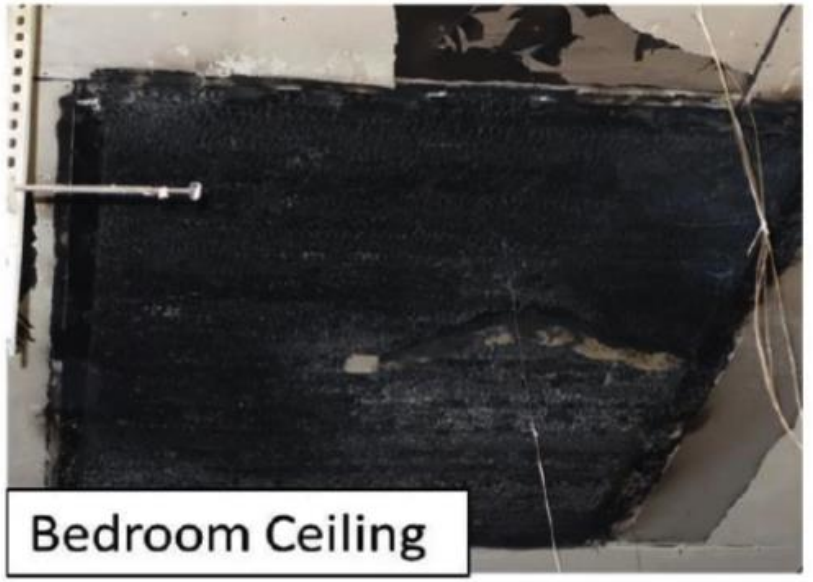

Ignition


Living Room / Kitchen Flashover


Bedroom Flashover


Decay Phase


Living Room Ceiling


Bedroom Ceiling

Photos provided by U.S. Forest Products Laboratory, USDA

Source: AWC

TEST 3

Ignition

Living Room/
Kitchen Flashover

Bedroom Flashover

Ignition

Ignition

Ignition

Photos provided by U.S. Forest Products Laboratory, USDA

Source: AWC

TEST 4

All mass timber surfaces fully exposed in bedroom and living room.

Sprinkler – normal activation

Source: AWC

Photos provided by U.S. Forest Products Laboratory, USDA

TEST 5

All mass timber surfaces fully exposed in bedroom and living room.

Sprinkler – activation delayed for 20 minutes after smoke detector activation…approximately 23-1/2 minutes from ignition

Source: AWC

Photo: LendLease

Photo: LendLease

Photo: LendLease

Photo: LendLease

Photo: LendLease

Although not directly affiliated with the TWB AHC, other mass timber and tall wood testing & research was occurring, the results of which the AHC included in their final decisions

NFPA RESEARCH FOUNDATION

RESEARCH FOR THE NFPA MISSION

Fire Safety Challenges of Tall Wood Buildings – Phase 2: Task 5 – Experimental Study of Delamination of Cross Laminated (CLT) Timber in Fire

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CHEMISTRY AND CHEMICAL ENGINEERING DIVISION

FIRE TECHNOLOGY DEPARTMENT
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FAX (210) 522-3377

NSF

DEVELOPMENT OF A FIRE PERFORMANCE ASSESSMENT METHODOLOGY FOR QUALIFYING CROSS-LAMINATED TIMBER ADHESIVES

WFCI

WESTERN FIRE CENTER, INC.

2204 Parrott Way, Kelso, Washington 98626
Phone: 360-423-1400 | Fax: 360-423-5003

Fire Resistance Testing of CLT Floor/Ceiling Assemblies to Establish Contribution of Gypsum Protection

U.S. BUILDING CODES
DEVELOPMENT AND CHANGES

ICC TWB Ad Hoc Committee Group A proposals consisted of the following 14 parts

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)

U.S. BUILDING CODES
DEVELOPMENT AND CHANGES

ICC INTERNATIONAL CODE COUNCIL®

2018 TIMELINE:

Step 1: January 8 – Final Proposed Language submitted to ICC

Step 2: February 28 – Changes are posted for Public Viewing

Step 3: April 15-25 – Committee Action Public Hearing – Columbus, OH

Photo: LendLease

Tall Mass Timber Building Code Changes Pass First Hurdle

The highly-anticipated International Code Council (ICC) Tall Mass Timber Building code changes passed a first hurdle in April with approval by the ICC code changes committee responsible for this part of the process. By wide margins a series of 14 proposals was each approved. The Hearings brought together code and fire officials, along with engineers, architects, builders, and other construction professionals as part of the first public step in approving code change proposals for the 2021 set of ICC codes. The proposals submitted by the ICC Ad Hoc Committee on Tall Wood Buildings (TWB), once officially approved by year-end, would allow mass timber buildings to be constructed up to 18 stories in height. AWC had a significant number of staff in attendance at the Hearings who spoke in support of the Ad Hoc Committee proposals. For more information see www.awc.org/tallmasstimber.

Back to Top

Credit: AWC

U.S. BUILDING CODES
DEVELOPMENT AND CHANGES

ICC INTERNATIONAL CODE COUNCIL®

2018 (& BEYOND) TIMELINE:

Step 4: May 30 – Committee Action Hearing results posted

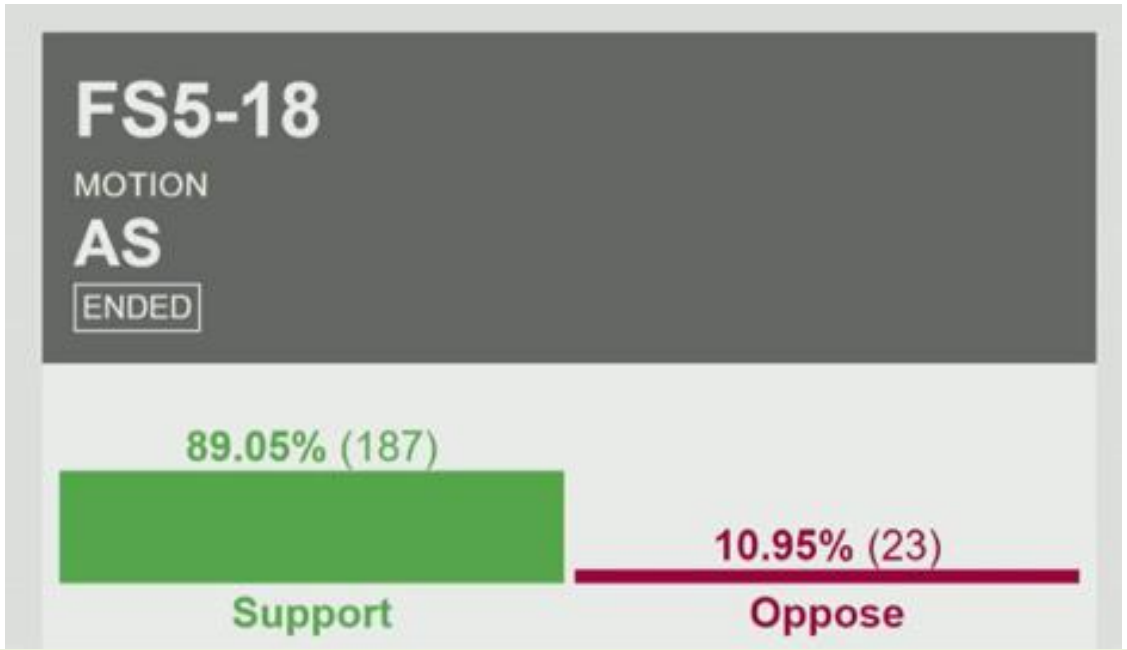
Step 5: June 1 - July 16 – Public Comments Sought on Committee Action Hearing Results

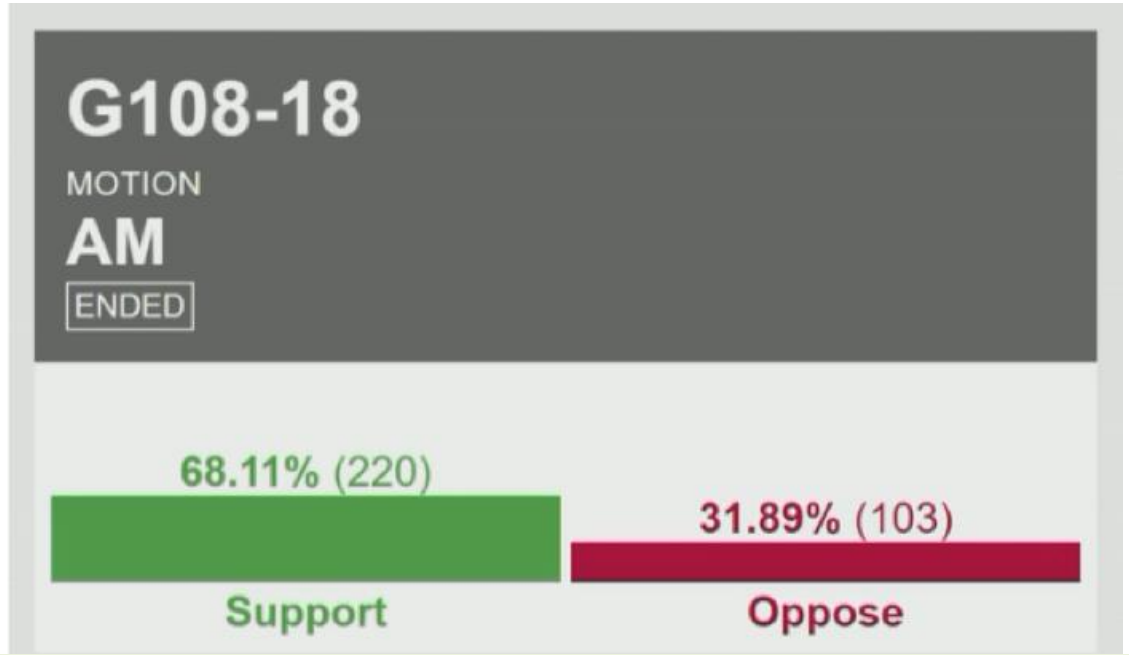
Step 6: August 31 – Public Comments Posted

Step 7: October 24-31 – Public Comment Hearing and Vote

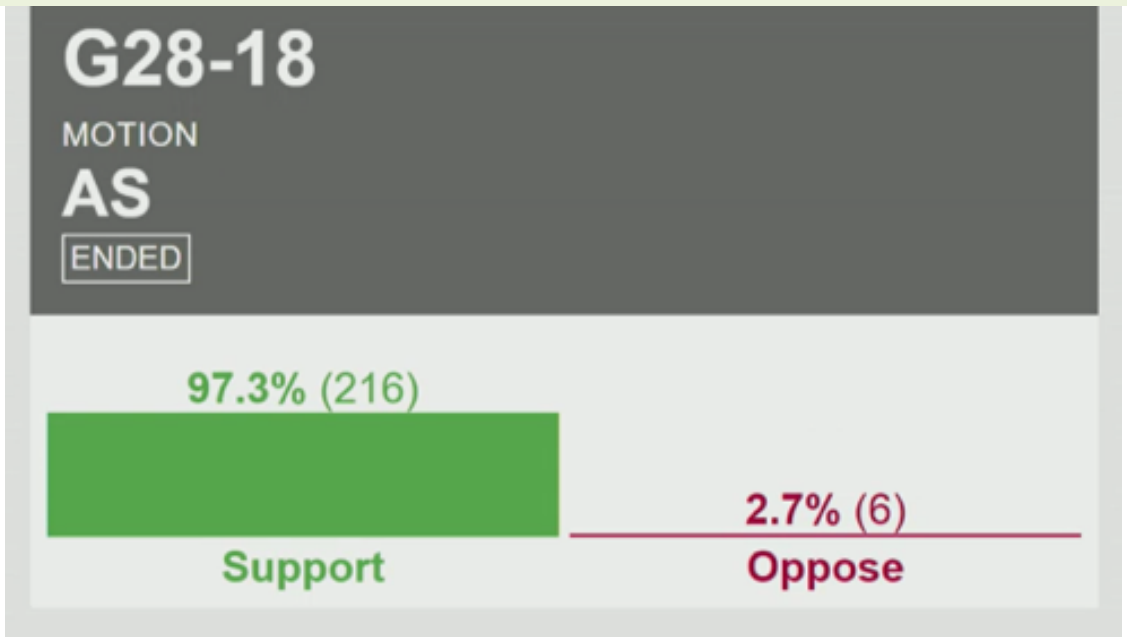
Step 8: November 19 – December 7 Final Online Vote

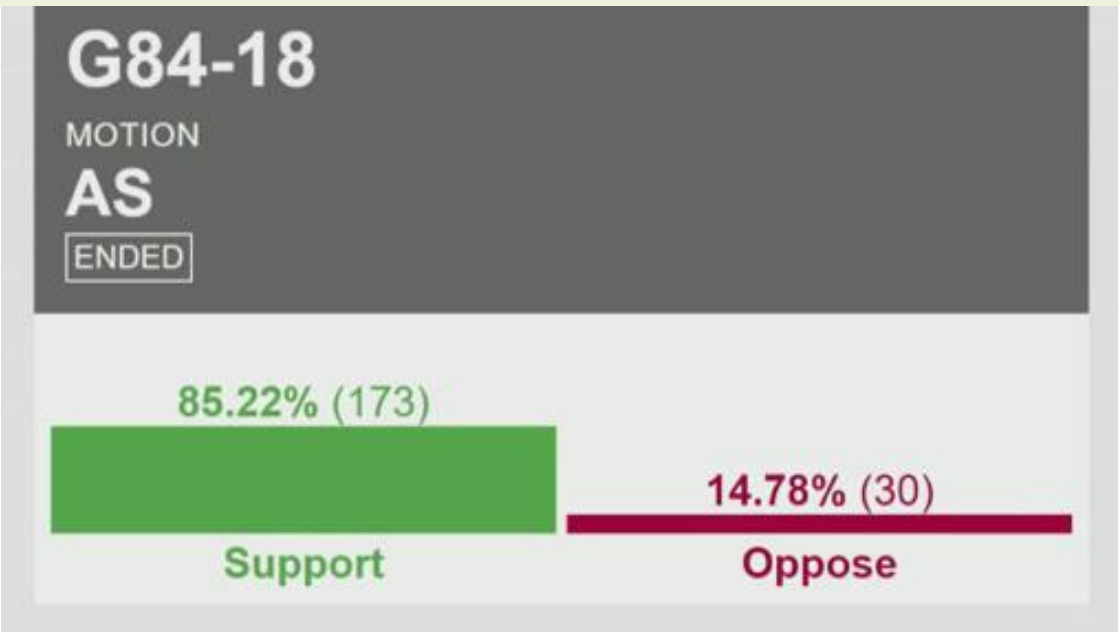
Step 9: Fall 2020 – New Edition is Published





ICC Public Comment Hearing Voting Results on Tall Wood Changes, October 2018





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

ICC Online Governmental Consensus Voting Results, Ratified January 2019

Tall Wood Code Changes as submitted by TWB Ad Hoc Committee

Code Change	Final Action	CAH Results	PCH Results	OGCV Results/Final Action										Required Majority
					PCH	OGCV	TOTAL			PCH	OGCV	TOTAL		
FS5-18	**AS**	AS	AS	**AS**	186	479	665	88.8%	D	23	61	84	11.2%	Simple Majority
FS6-18	**AMPC 1**	AS	AMPC 1	**AMPC 1**	219	479	698	91.4%	D	6	60	66	8.6%	2/3 Majority
FS73-18	**AS**	AS	AS	**AS**	214	480	694	91.2%	D	8	59	67	8.8%	Simple Majority
FS81-18	**AM**	AM	AM	**AM**	183	485	668	91.6%	D	5	56	61	8.4%	Simple Majority
F266-18	**AMPC 1**	AM	AMPC 1	**AMPC 1**	211	455	666	89.9%	D	13	62	75	10.1%	Simple Majority
G28-18	**AS**	AS	AS	**AS**	215	514	729	94.1%	D	6	40	46	5.9%	Simple Majority
G75-18	**AM**	AM	AM	**AM**	161	386	547	69.0%	D	40	206	246	31.0%	Simple Majority
G80-18	**AS**	AS	AS	**AS**	160	382	542	67.9%	D	62	194	256	32.1%	Simple Majority
G84-18	**AS**	AS	AS	**AS**	172	383	555	71.8%	D	30	188	218	28.2%	Simple Majority
G89-18	**AM**	AM	AM	**AM**	177	482	659	88.7%	D	9	75	84	11.3%	Simple Majority
G108-18	**AM**	AM	AM	**AM**	219	471	690	70.6%	D	103	184	287	29.4%	Simple Majority

% of Vote in Favor of Code Change

% of Vote Req'd for Code Change Approval

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

Three Main Categories:

1. Noncombustible (Types I and II)
2. Light-Frame (Types III and V)
3. **Heavy/Mass Timber (Type IV)**

Although use of mass timber products in low- to mid-rise in types III and V is very common

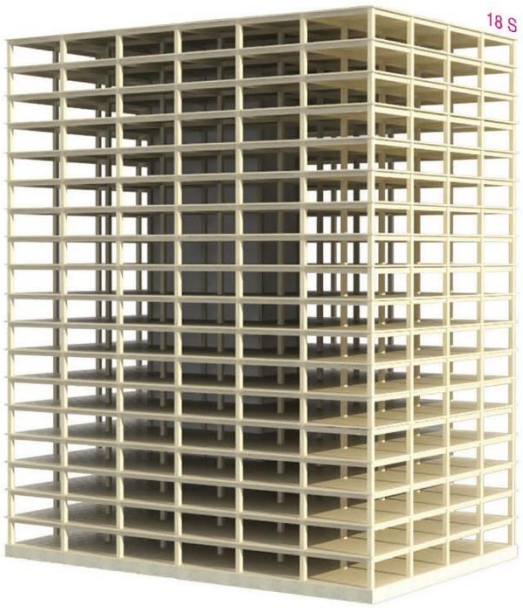
2021 IBC Introduces 3 new tall wood construction types:

IV-A, IV-B, IV-C

Previous type IV renamed type IV-HT

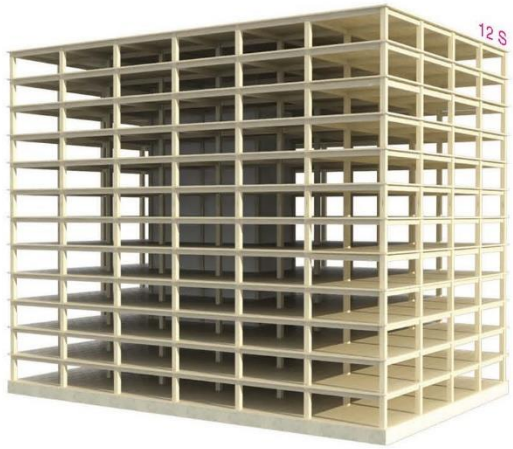
BUILDING ELEMENT	TYPE I		TYPE II		TYPE III		TYPE IV				TYPE V	
	A	B	A	B	A	B	A	B	C	HT	A	B

New Building Types



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

TYPE IV-A



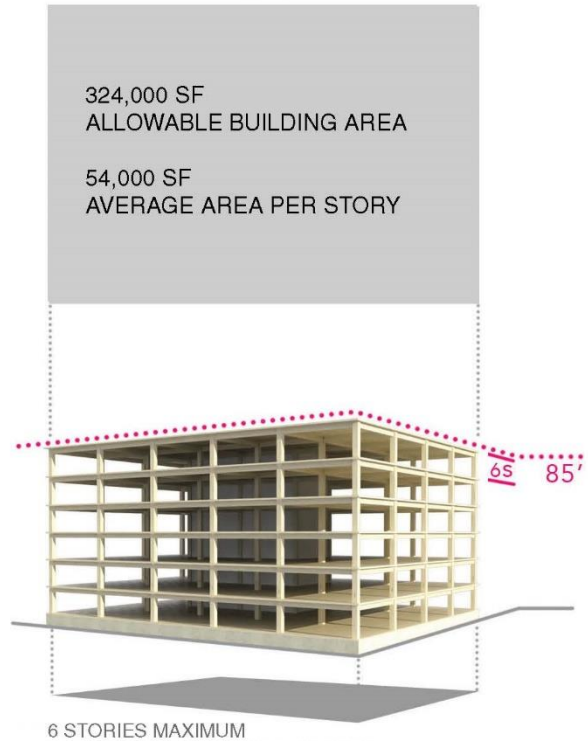
12 STORIES
BUILDING HEIGHT 180 FT
ALLOWABLE BUILDING AREA 648,000 SF
AVERAGE AREA PER STORY 54,000SF

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



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

TYPE IV- HT

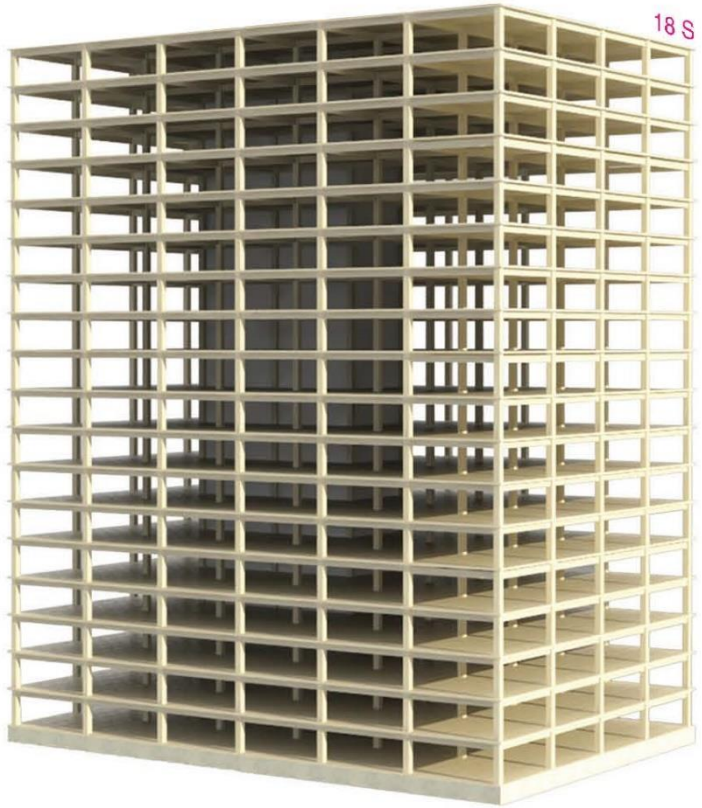
IBC 2015

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-A



18 STORIES

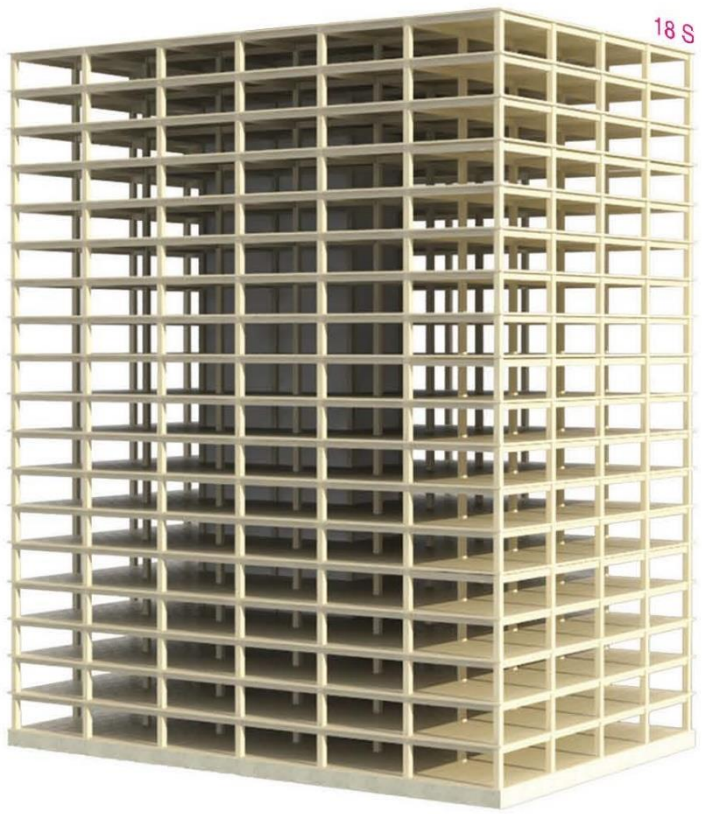
BUILDING HEIGHT	270’
ALLOWABLE BUILDING AREA	972,000 SF
AVERAGE AREA PER STORY	54,000SF

TYPE IV-A

Credit: Susan Jones, atelierjones

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

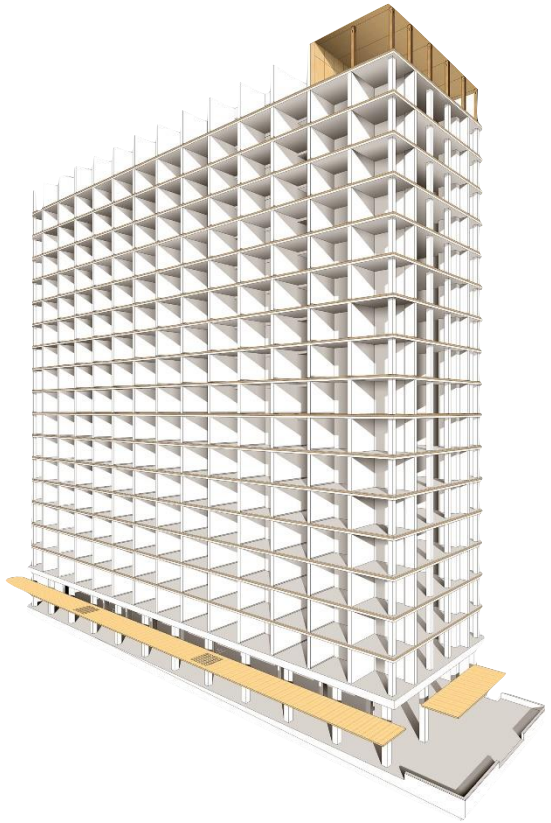
Type IV-A Protection vs. Exposed

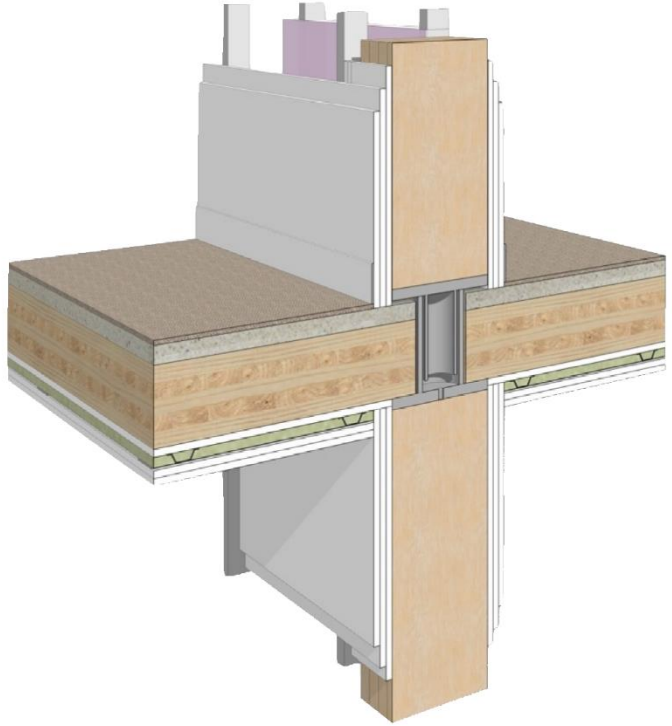


18 STORIES
BUILDING HEIGHT 270'
ALLOWABLE BUILDING AREA 972,000 SF
AVERAGE AREA PER STORY 54,000SF

TYPE IV-A

Credit: Susan Jones, atelierjones

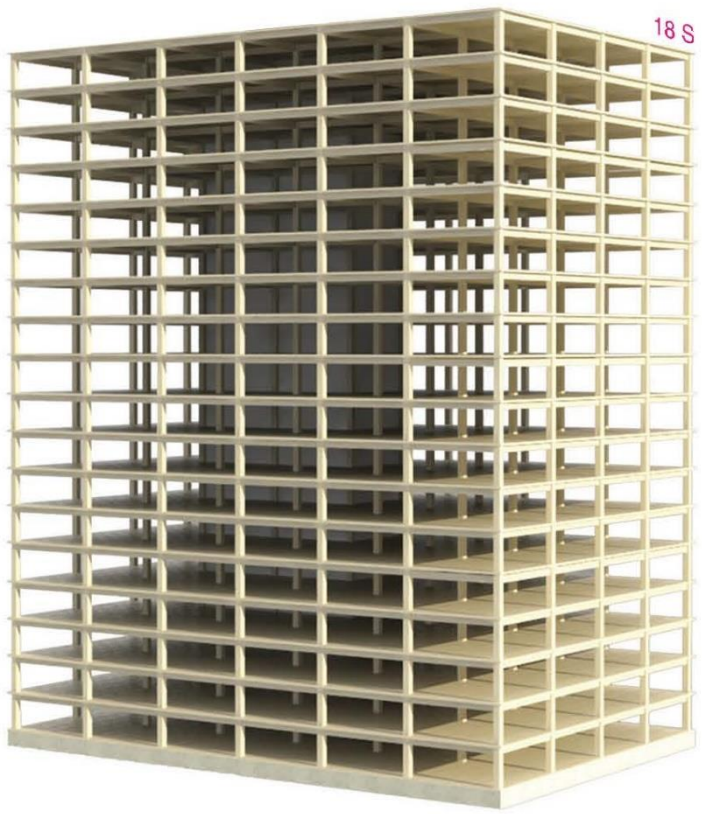




Credit: Acton Ostry Architects, Fast + Epp

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

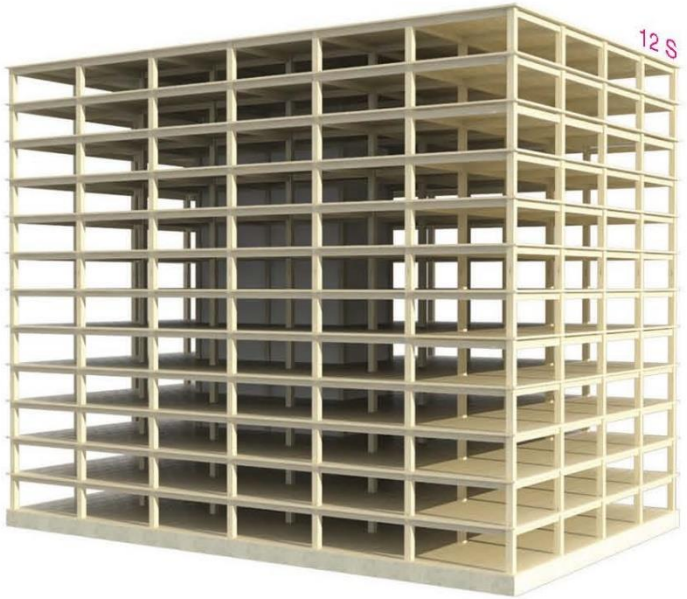
Occupancy	# of Stories	Height	Area per Story	Building Area
A-2	18	270 ft	135,000 SF	405,000 SF
B	18	270 ft	324,000 SF	972,000 SF
M	12	270 ft	184,500 SF	553,500 SF
R-2	18	270 ft	184,500 SF	553,500 SF

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

Type IV-B



12 STORIES

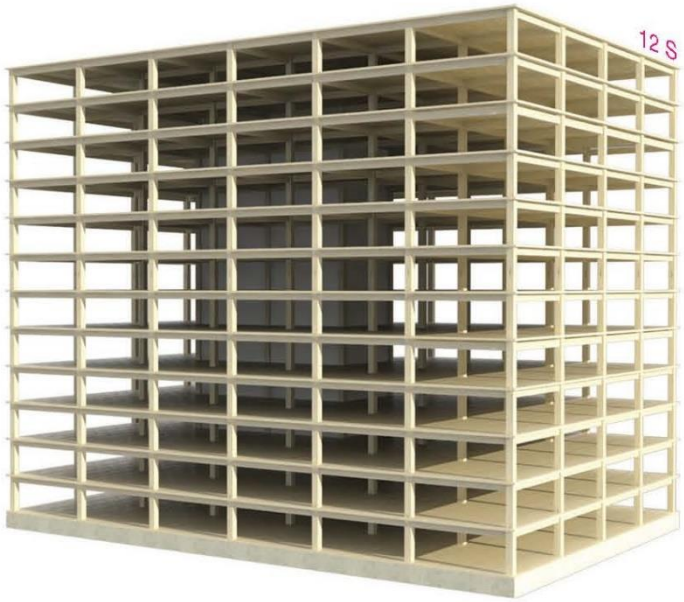
BUILDING HEIGHT	180 FT
ALLOWABLE BUILDING AREA	648,000 SF
AVERAGE AREA PER STORY	54,000SF

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

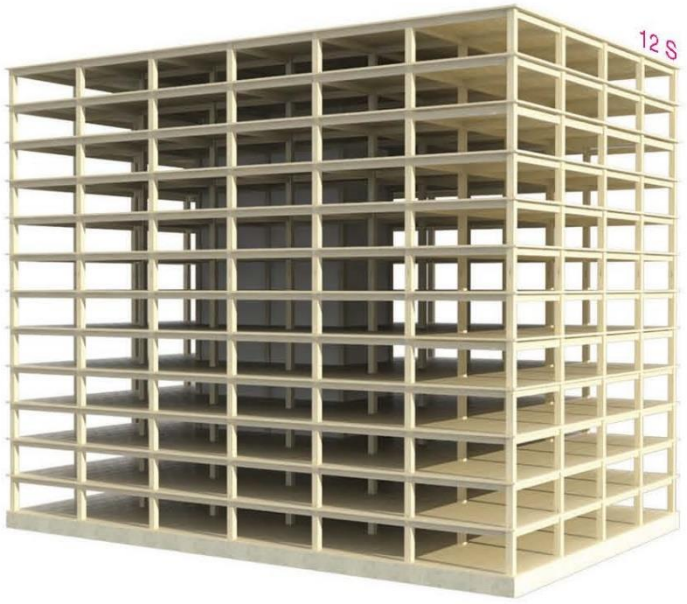
Credit: Susan Jones, atelierjones

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

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

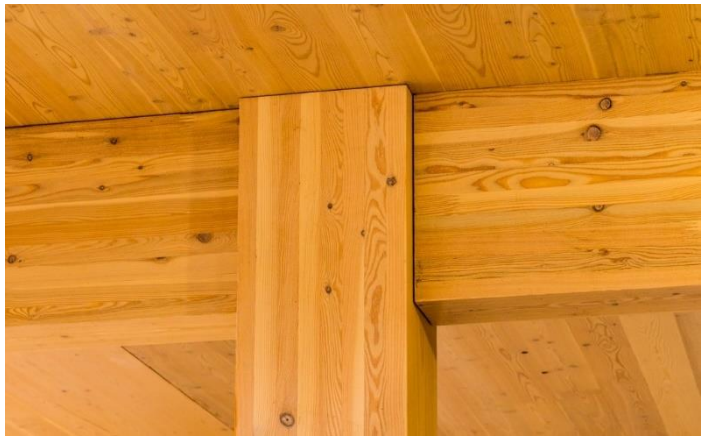
Type IV-B area = 2 * Type IV-HT area

Type IV-C

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

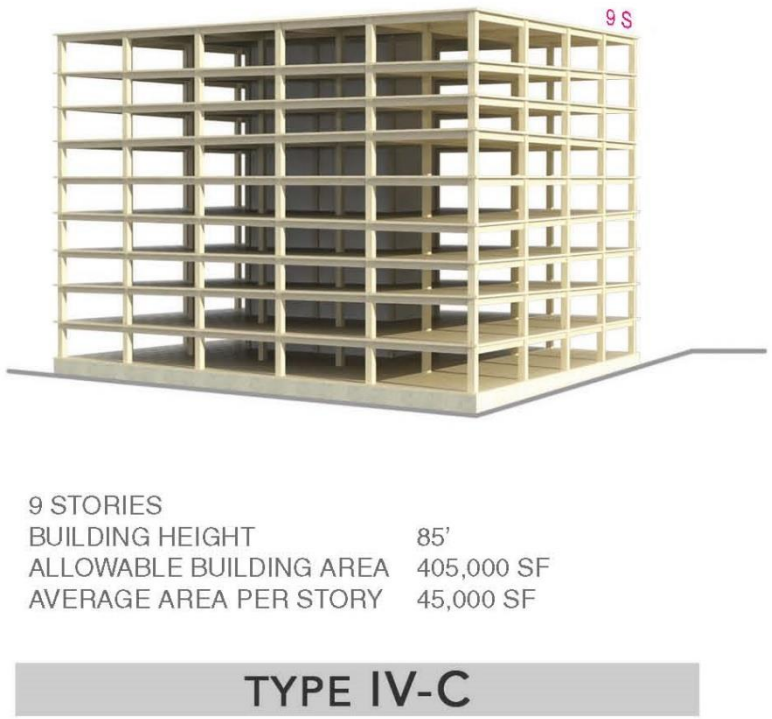
TYPE IV-C

Credit: Susan Jones, atelierjones



Photos: Baumberger Studio/PATH Architecture/Marcus Kauffman

Type IV-C Protection vs. Exposed



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

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

Credit: Susan Jones, atelierjones

Tall Wood Building Size Limits

	Construction Type (All Sprinklered Values)						
	I-A	I-B	**IV-A**	**IV-B**	**IV-C**	IV-HT	III-A
Occupancies	**Allowable Building Height above Grade Plane, Feet (IBC Table 504.3)**						
A, B, R	Unlimited	180	**270**	**180**	**85**	85	85
	Allowable Number of Stories above Grade Plane (IBC Table 505.4)						
A-2, A-3, A-4	Unlimited	12	**18**	**12**	**6**	4	4
B	Unlimited	12	**18**	**12**	**9**	6	6
R-2	Unlimited	12	**18**	**12**	**8**	5	5
	Allowable Area Factor (At) for SM, Feet^2 (IBC Table 506.2)						
A-2, A-3, A-4	Unlimited	Unlimited	**135,000**	**90,000**	**56,250**	45,000	42,000
B	Unlimited	Unlimited	**324,000**	**216,000**	**135,000**	108,000	85,500
R-2	Unlimited	Unlimited	**184,500**	**123,000**	**76,875**	61,500	72,000

Tall Wood Fire Resistance Ratings (FRR)

	IV-A	IV-B	IV-C
Primary Frame or Brng Wall FRR	3 HR (2 HR at Roof)	2 HR (1 HR at Roof)	2 HR (1 HR at Roof)
Floor Construction FRR	2 HR	2 HR	2 HR
Roof Construction FRR	1.5 HR	1 HR	1 HR
Floor Surface Protection	1 inch of NC protection	1 inch of NC protection	No protection req'd
Roof Construction Protection	2 layers 5/8" type X gyp on inside face	2 layers 5/8" type X gyp on inside face	No protection req'd unless concealed space

Tall Wood Materials & Protection

	IV-A	IV-B	IV-C
Exterior Walls	Mass Timber, exterior surface protected with 1 layer 5/8” type X gyp		
Structural Materials	Mass Timber or NC		
Concealed Spaces	Permitted, requires NC protection on MT surfaces		
Gypsum Protection	All MT is protected 3 HR: 3 layers 5/8” type X gyp 2 HR or less: 2 layers 5/8” type X gyp	Same as IV-A for protected MT. Limited exposed MT permitted, FRR still applies	All MT permitted may be exposed except as noted

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

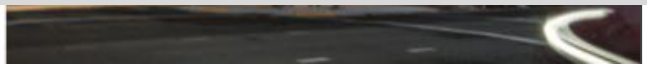
In January 2019, the International Code Council (ICC) approved a set of proposals to allow tall wood buildings as part of the 2021 International Building Code (IBC). Based on these proposals, the 2021 IBC will include three new construction types—Type IV-A, IV-B and IV-C—allowing the use of mass timber 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

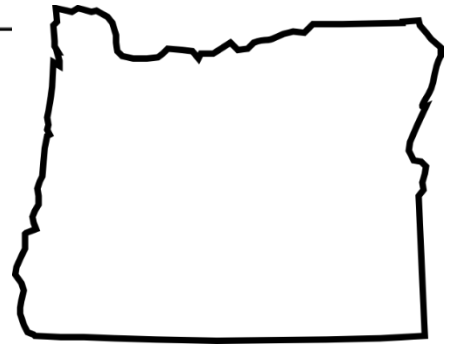


WoodWorks Tall Wood Design Resource

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

EARLY TALL WOOD CODE ADOPTION

State of Oregon
Building Codes Division
Better Buildings for Oregon



Statewide Alternate Method No. 18-01 Tall Wood Buildings – Background

Statewide Alternate Method (SAM) Number 18-01 provides prescriptive path elements for Tall Wood Buildings of mass timber construction. This alternate path includes scientific conclusions established by the International Code Council's Ad Hoc Committee on Tall Wood Buildings that were incorporated into fourteen national proposals and utilizes concrete, steel or masonry for the vertical elements of the seismic force-resisting system.

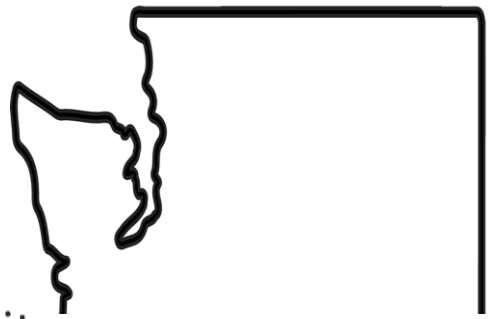
The provisions detailed in the SAM are crafted to coincide with the *2014 Oregon Structural Specialty Code* (OSSC) when selected for use.

Three new types of construction are introduced under this method, all three of which are organized under Type IV construction, typically referred to as heavy timber.

The new types of construction are:

- Type IV A
- Type IV B
- Type IV C

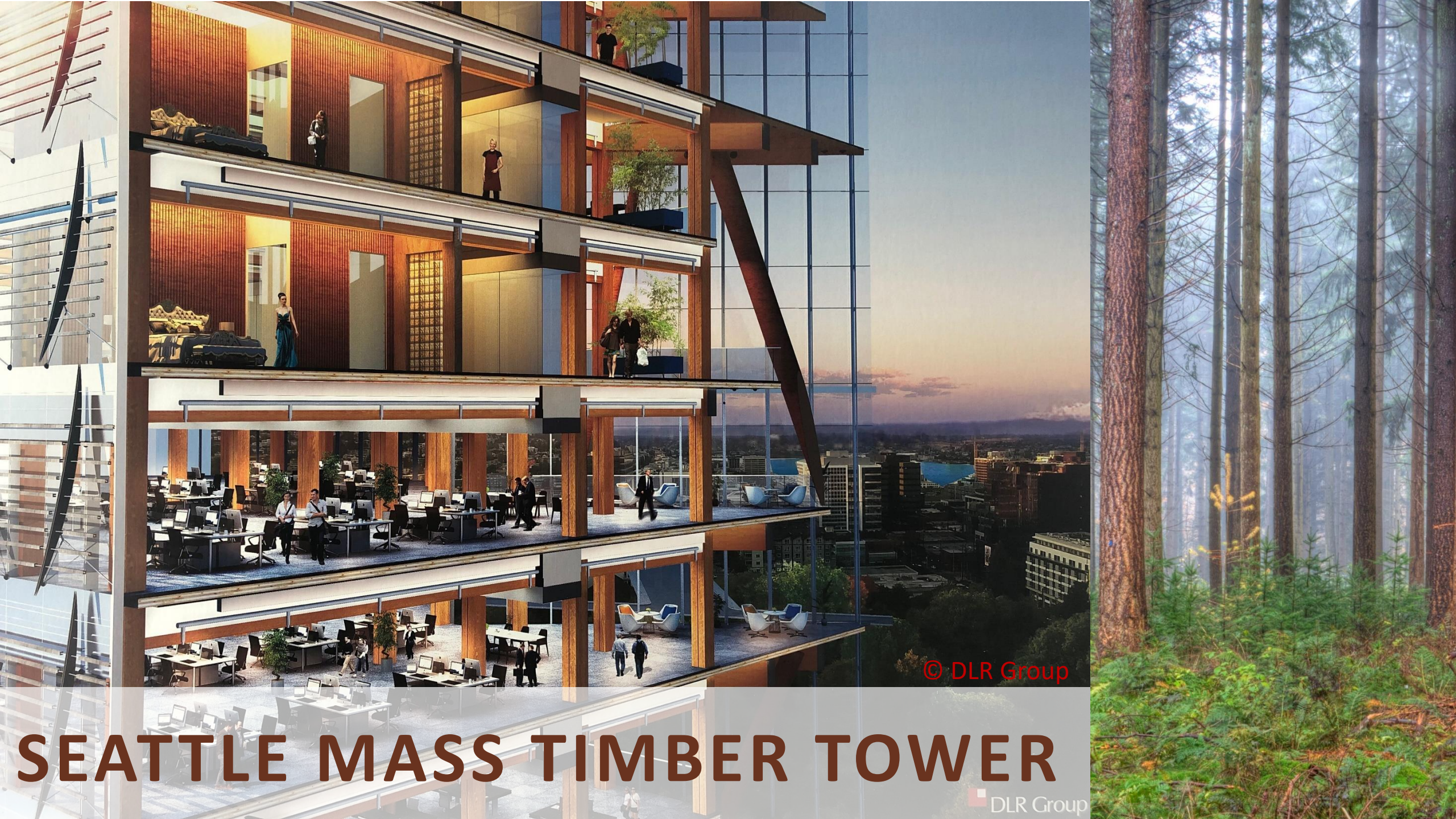
Washington state to allow mid and high-rise mass-timber buildings



State is first in the nation to alter building codes in support of a new generation of engineered wooden building materials with exciting properties of strength, durability and beauty. With mass timber, architects and builders acquire a new material to create with and rural areas gain the prospect of new high-skilled, high-paid jobs.

NEWS PROVIDED BY
Washington Forest Protection Association →, Forterra →
Dec 05, 2018, 10:07 ET

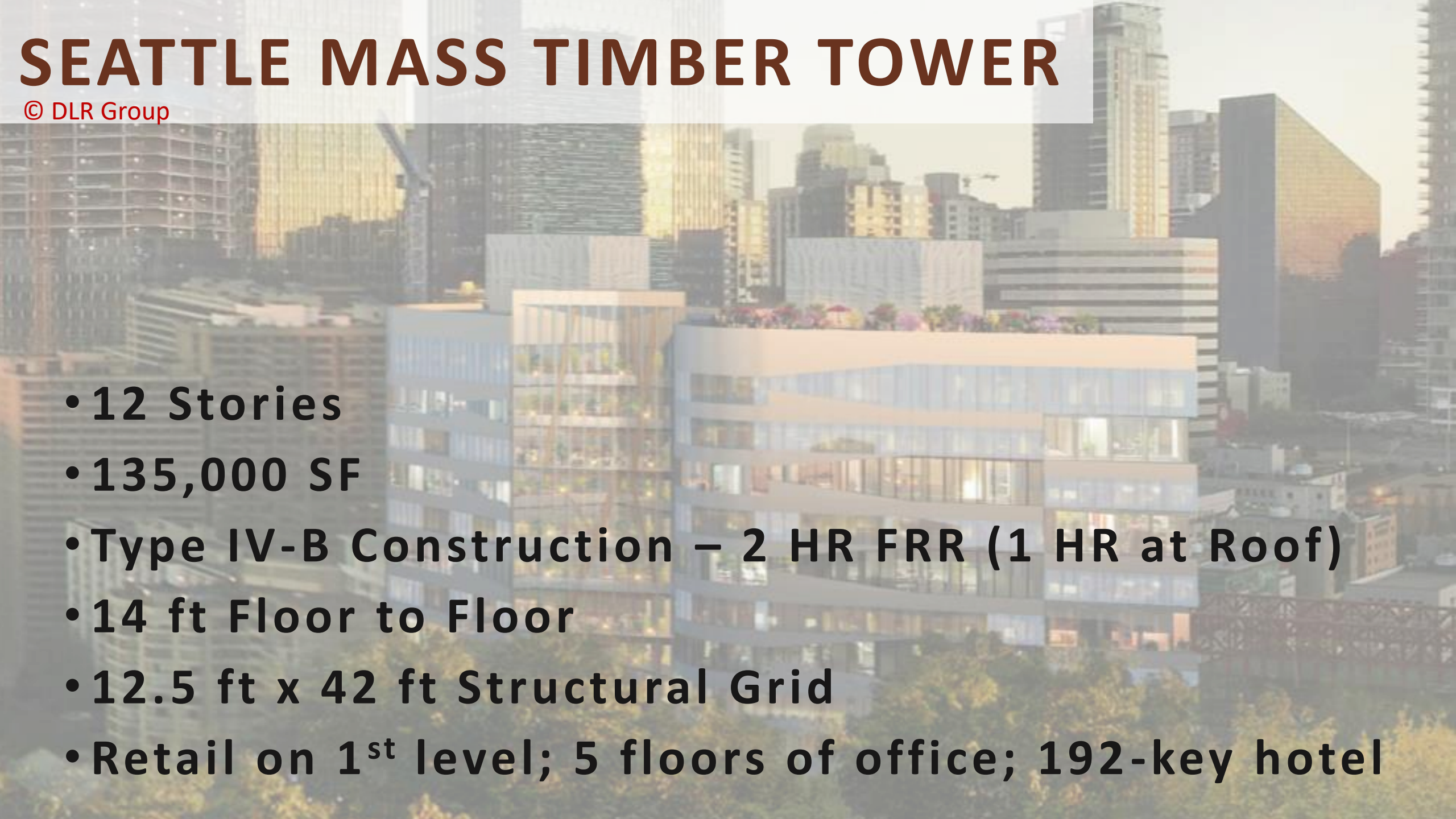
SEATTLE, Dec. 5, 2018 /PRNewswire/ -- The Washington State Building Code Council (SBCC) has approved code changes that will allow for the structural use of mass timber in buildings as tall as 18 stories. This makes Washington the first state in the nation to allow tall mass timber buildings into its building code, without pursuing an alternate method.



SEATTLE MASS TIMBER TOWER

DLR Group

SEATTLE MASS TIMBER TOWER



- 12 Stories
- 135,000 SF
- Type IV-B Construction – 2 HR FRR (1 HR at Roof)
- 14 ft Floor to Floor
- 12.5 ft x 42 ft Structural Grid
- Retail on 1st level; 5 floors of office; 192-key hotel

QUESTIONS?

This concludes The American Institute of Architects Continuing Education Systems Course

Mark Bartlett, PE

WoodWorks

mark.bartlett@woodworks.org

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