BUILDINGENERGY BOSTON

Moving the ‘Masses’ toward Taller Timber Construction: Codes, Design Steps & Environmental Impacts

August 13, 2020 · 9:15-10:45am

Presenters:

Ricky McLain (WoodWorks), Alexandra Davis (Thornton Tomasetti), & Matthew Tonello (Consigli Construction)

BUILDINGENERGY BOSTON

Ricky McLain

WoodWorks
WOOD PRODUCTS COUNCIL

Alexandra Davis

Thornton
Tomasetti

Matthew Tonello

CONSIGLI

Learning Objectives

- **Understand** benefits and potential uses of mass timber for high performance buildings
- **Compare** the environmental impact of mass timber construction as opposed to traditional concrete or steel, and the principles of procurement to harvest this resource sustainably
- **Discuss** barriers to mass timber construction in the Northeast and the tactics to overcome them
- **Identify** key stakeholders, organizations, and commitments which others have taken on to encourage the development of sustainable mass timber applications in the Northeast region

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WoodWorks
WOOD PRODUCTS COUNCIL

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Tall Timber Construction: New Code Provisions and Design Steps

Ricky McLain, PE, SE, Senior Technical Director – Tall Wood, WoodWorks – Wood Products Council

Photo: Kaiser+Path

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WHAT IS MASS TIMBER?

Heavy Timber
Photo: Benjamin Benschneider

Mass Timber
Photo: John Stamets

GLULAM

Photos: APA

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: WoodWorks

Photo: LEVER Architecture

DECKING

Photo: Bernard André Photography

Office

Wythe Ave Buildings, NY | Flank Architecture + Development

Hospitality

Lark Hotel, Bozeman | Thinktank Design | Photo: Dan Armstrong

Multi-family

Carbon 12, Portland | Path Architecture | Photo: Andrew Pogue

Industrial

StructureCraft Plant, Abbotsford, BC

Mass Timber Projects In Design and Constructed in the US (June 2020)

Stage	Mass Timber	# of Projects
Construction Started / Built	CLT	163
	DLT	7
	Heavy Timber Decking	82
	NLT	96
	Post & Beam	136
	Total	384
In Design	CLT	312
	DLT	4
	Heavy Timber Decking	54
	NLT	12
	Post & Beam	155
	Total	537
Grand Total		921

State	Stage	
AK	In Design	1
AL	Construction Started / Built	3
	In Design	10
AR	Construction Started / Built	3
	In Design	7
AZ	In Design	2
CA	Construction Started / Built	85
	In Design	89
CO	Construction Started / Built	15
	In Design	15
CT	Construction Started / Built	4
	In Design	3
DC	Construction Started / Built	3
	In Design	3
DE	In Design	2
FL	Construction Started / Built	17
	In Design	28
GA	Construction Started / Built	8
	In Design	17
HI	Construction Started / Built	1
	In Design	1
IA	Construction Started / Built	3
	In Design	4
ID	Construction Started / Built	4
	In Design	4
IL	Construction Started / Built	11
	In Design	12
IN	Construction Started / Built	3
	In Design	7
KS	Construction Started / Built	2
	In Design	3
KY	Construction Started / Built	2
	In Design	4
LA	In Design	4
MA	Construction Started / Built	21
	In Design	27
MD	Construction Started / Built	3
	In Design	8
ME	Construction Started / Built	2
	In Design	14
MI	Construction Started / Built	7
	In Design	8
MN	Construction Started / Built	9
	In Design	2
MO	Construction Started / Built	7
	In Design	8

State	Stage	
MS	In Design	1
MT	Construction Started / Built	1
	In Design	4
NC	Construction Started / Built	18
	In Design	26
ND	In Design	1
NE	Construction Started / Built	1
	In Design	1
NH	Construction Started / Built	1
	In Design	2
NJ	Construction Started / Built	1
	In Design	1
NM	Construction Started / Built	1
	In Design	1
NV	In Design	1
NY	Construction Started / Built	8
	In Design	22
OH	Construction Started / Built	4
	In Design	9
OK	Construction Started / Built	1
	In Design	2
OR	Construction Started / Built	40
	In Design	29
PA	Construction Started / Built	4
	In Design	4
RI	Construction Started / Built	1
	In Design	1
SC	Construction Started / Built	13
	In Design	12
TN	Construction Started / Built	1
	In Design	4
TX	Construction Started / Built	22
	In Design	44
UT	Construction Started / Built	5
	In Design	1
VA	Construction Started / Built	7
	In Design	9
VT	Construction Started / Built	1
	In Design	3
WA	Construction Started / Built	40
	In Design	46
WI	Construction Started / Built	11
	In Design	10
WV	Construction Started / Built	1
WY	Construction Started / Built	1

380+ Built

530+ In Design

Considering mass timber for a project? Ask us anything.

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help@woodworks.org
woodworks.org/project-assistance

Photo: Nordic Structures

JOHN W. OLVER DESIGN BUILDING| UNIVERSITY OF MASSACHUSETTS, AMHERST, MA

Image: Fennick McCredie Architecture

MASSACHUSETTS REGIONAL AIRPORTS | VARIOUS LOCATIONS, MA

Image: Fennick McCredie Architecture

MASSACHUSETTS REGIONAL AIRPORTS | VARIOUS LOCATIONS, MA

Image: LineSync Architects

MOUNT SNOW BASE LODGE | WEST DOVER, VT

Photo Credit: David Sundberg and Gray Organschi Architecture

COMMON GROUND HIGH SCHOOL | NEW HAVEN, CT

COMMON GROUND HIGH SCHOOL | NEW HAVEN, CT

Photo Credit: DeStafano & Chamberlain, Inc.

PORTLAND INTERNATIONAL JETPORT | PORTLAND, ME

RHODE ISLAND SCHOOL OF DESIGN – NORTH HALL | PROVIDENCE, RI

Photo Credit: John Horner

RHODE ISLAND SCHOOL OF DESIGN – NORTH HALL | PROVIDENCE, RI

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PEASE ARBORETUM| NEWINGTON, NH

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STAMFORD MEDIA CENTER | STAMFORD, CT

GLOBAL TALL WOOD CIRCA 2019

18-24 STORIES

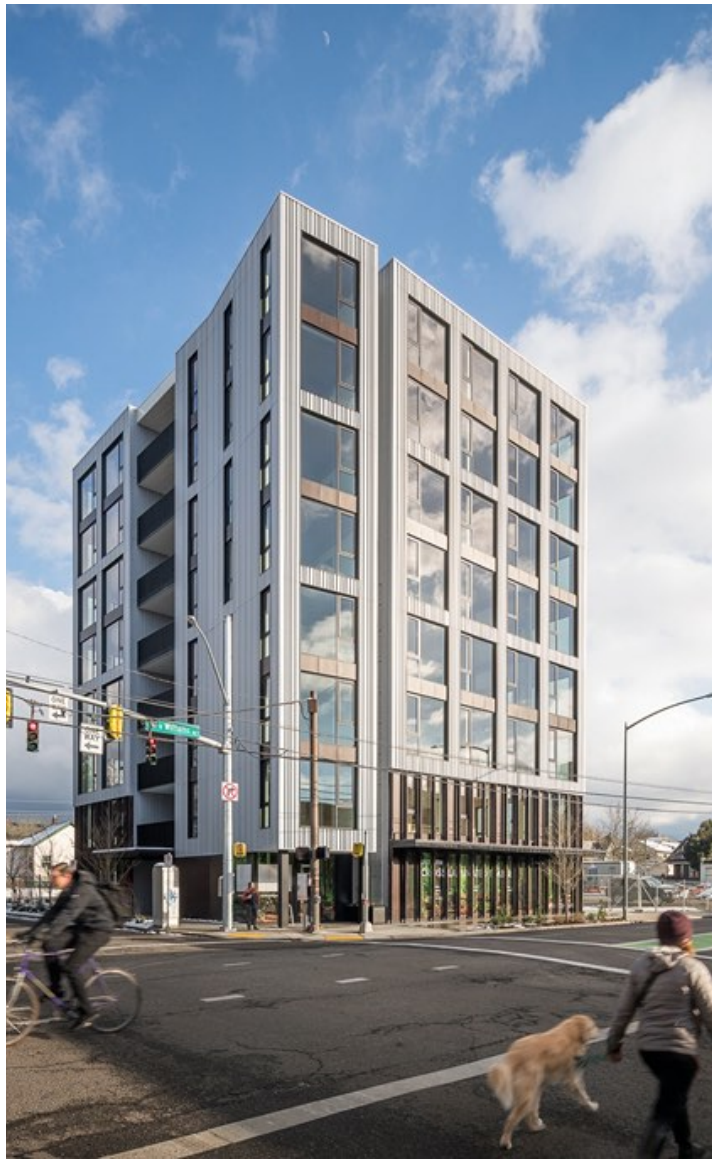

Photo: Moelven Limtre

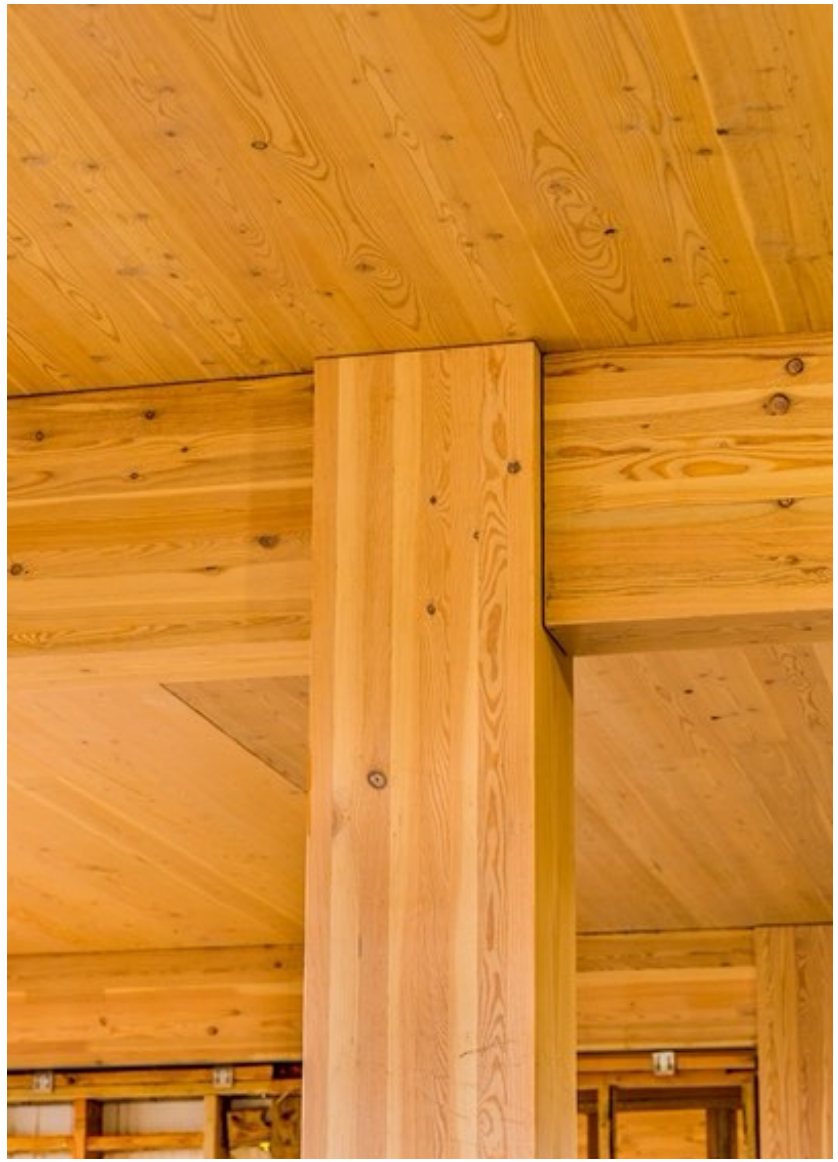

Photo: naturally:wood


Photo: Rudiger Lainer + Partner

TALL WOOD IN THE US CIRCA 2019

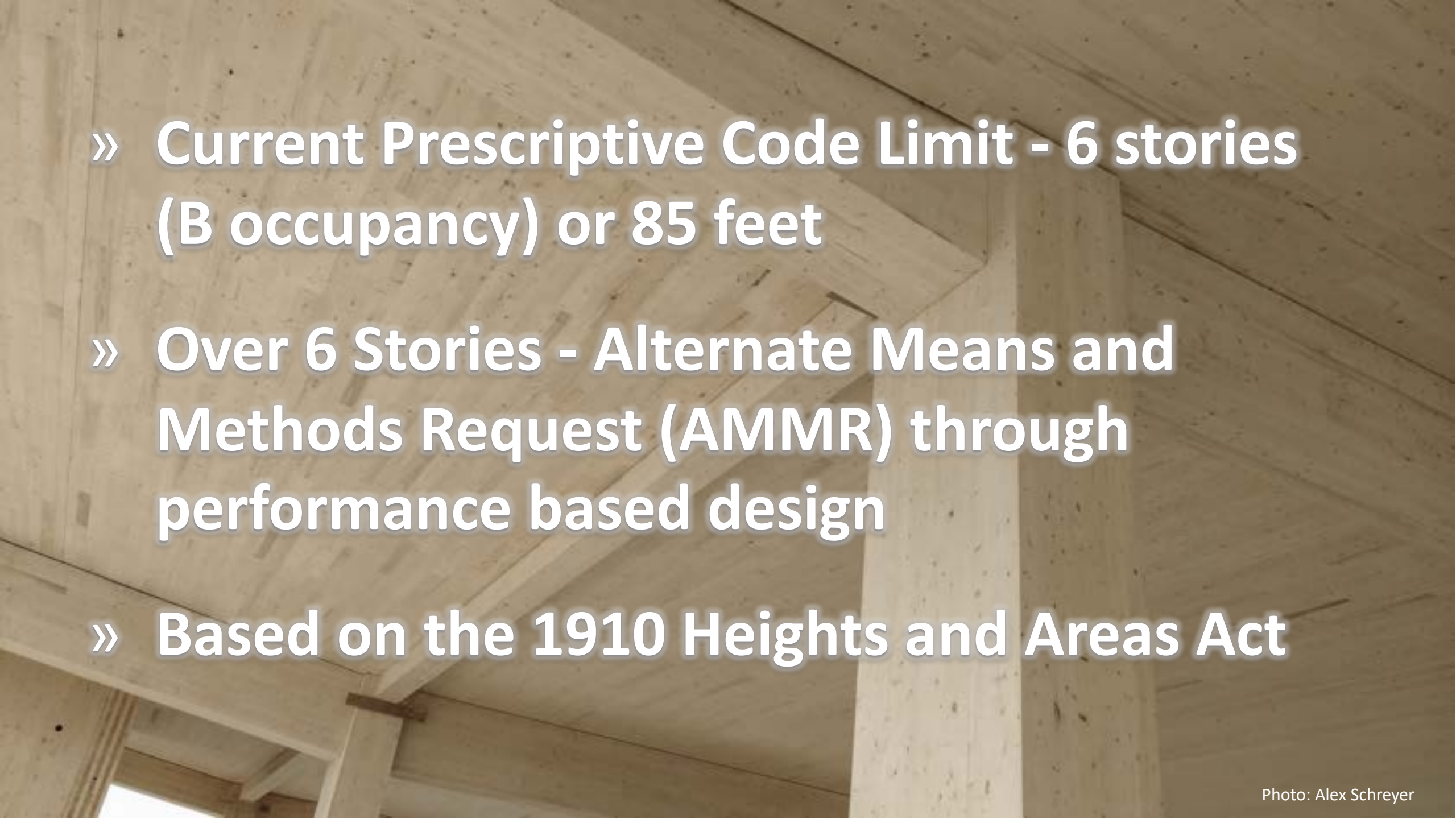
8 STORIES





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

TALL WOOD IN THE U.S.



- Current 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

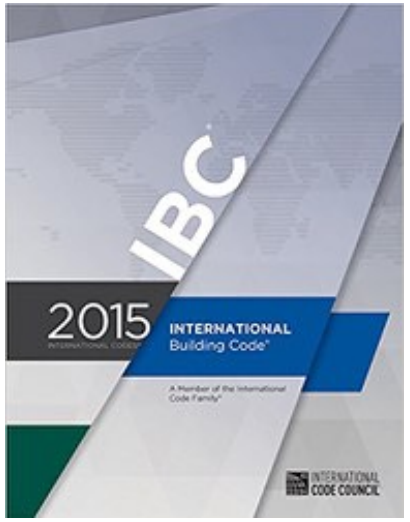
Photo: Blaine Brownell

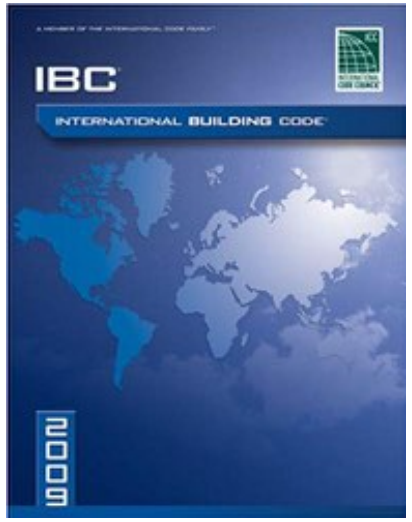
Photo: Christian Columbres

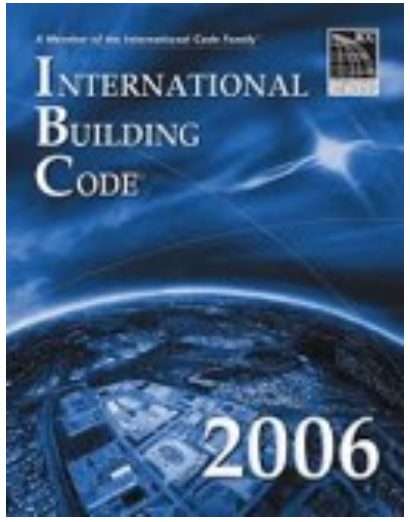
ICE Block I, RMW Architecture & Interiors, Buehler Engineering, Bernard André Photography

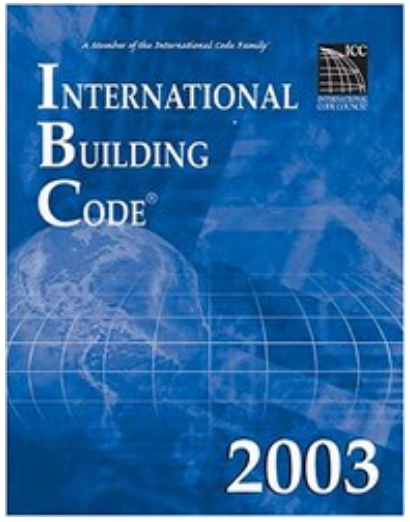
Photo: Swinerton

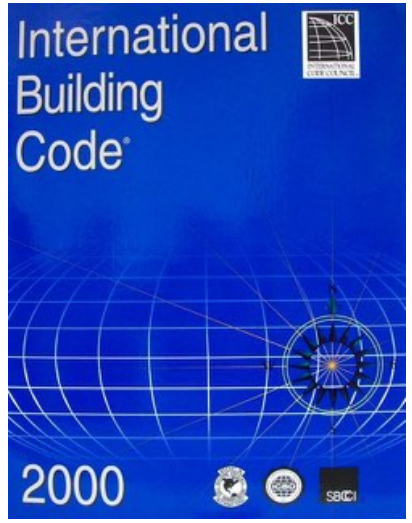
3 YEAR CODE CYCLE











Source: ICC

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

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.

Photo: LendLease

Photo: LendLease

Photo: LendLease

Photo: LendLease

Photo: LendLease

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

Credit: AWC/ICC

SO WHAT'S CHANGED??

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

Credit: ICC

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

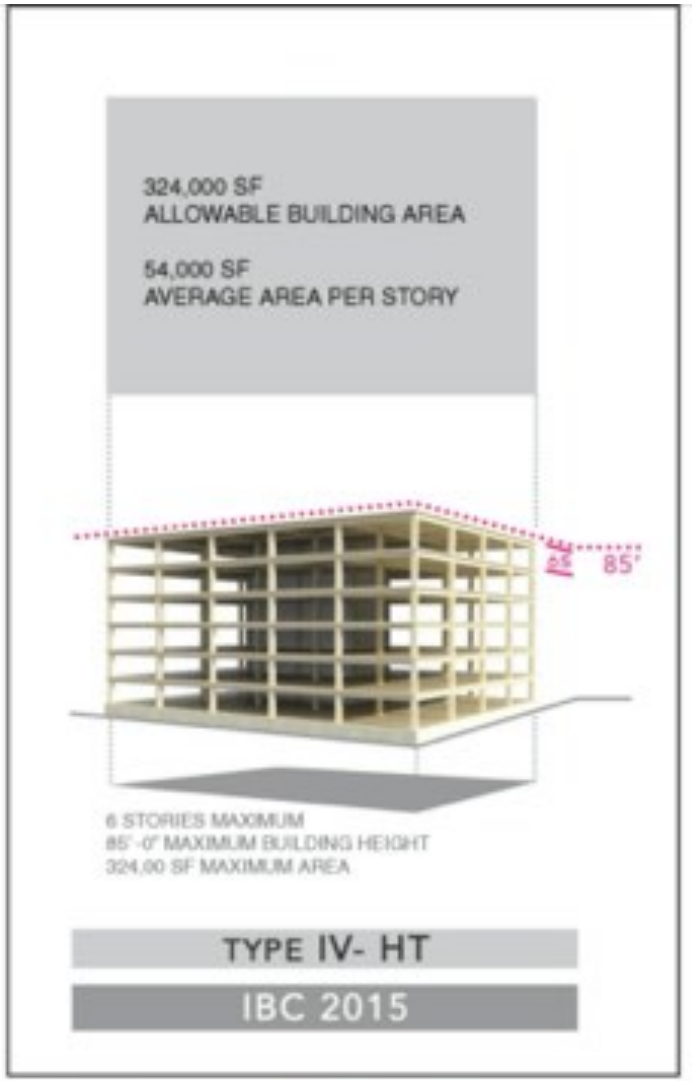
18 STORIES
BUILDING HEIGHT 270'
ALLOWABLE BUILDING AREA 972,000 SF
AVERAGE AREA PER STORY 54,000SF

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

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

TYPE IV-A | TYPE IV-B | TYPE IV-C

IBC 2021



TYPE IV- HT

IBC 2015

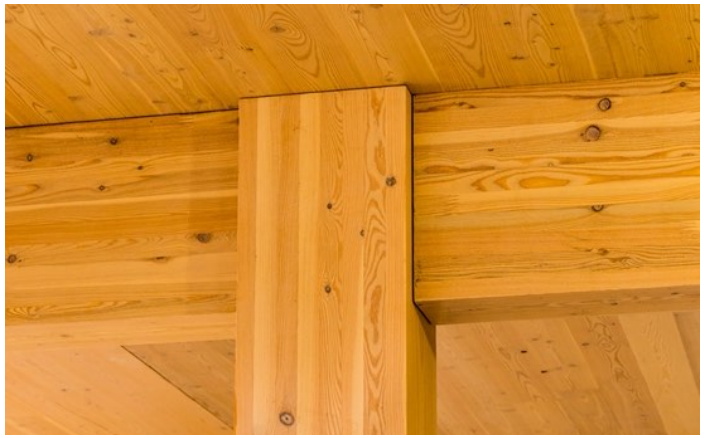
BUSINESS OCCUPANCY [GROUP B]

*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

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

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

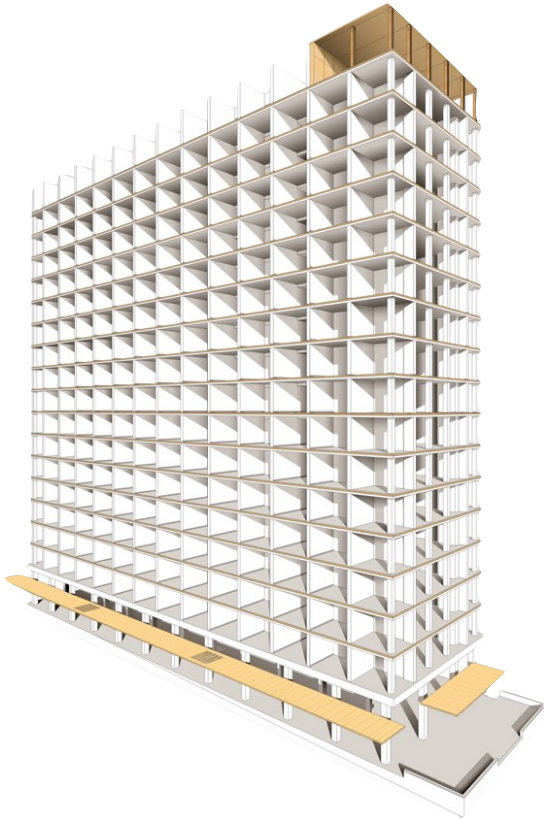
TYPE IV-A

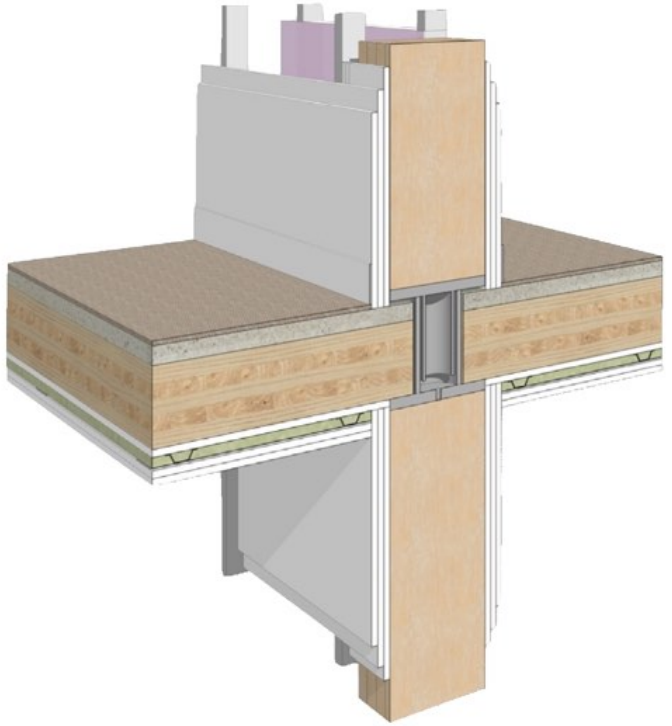
Credit: Susan Jones, atelierjones

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

Credit: Susan Jones, atelierjones

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 Fire Resistance Ratings (FRR)

FRR Requirements for Tall Mass Timber Structures (hours)

Building Element	IV-A	IV-B	IV-C
Primary Frame	3	2	2
Exterior Bearing Walls	3	2	2
Interior Bearing Walls	3	2	2
Roof Construction	1.5	1	1
Primary Frame at Roof	2	1	1
Floor Construction	2	2	2

Source: 2021 IBC Table 601

Noncombustible Protection (NC)

Where timber is required to be protected, NC must contribute at least 2/3 FRR

Required Noncombustible Contribution to FRR

FRR of Building Element (hours)	Minimum from Noncombustible Protection (minutes)
1	40
2	80
3 or more	120

Source: 2021 IBC Section 722.7

MT Fire Resistance Ratings (FRR)

IBC 722.7

The fire resistance rating of the mass timber elements shall consist of the fire resistance of the unprotected element (MT) added to the protection time of the noncombustible (NC) protection.

+

= FRR

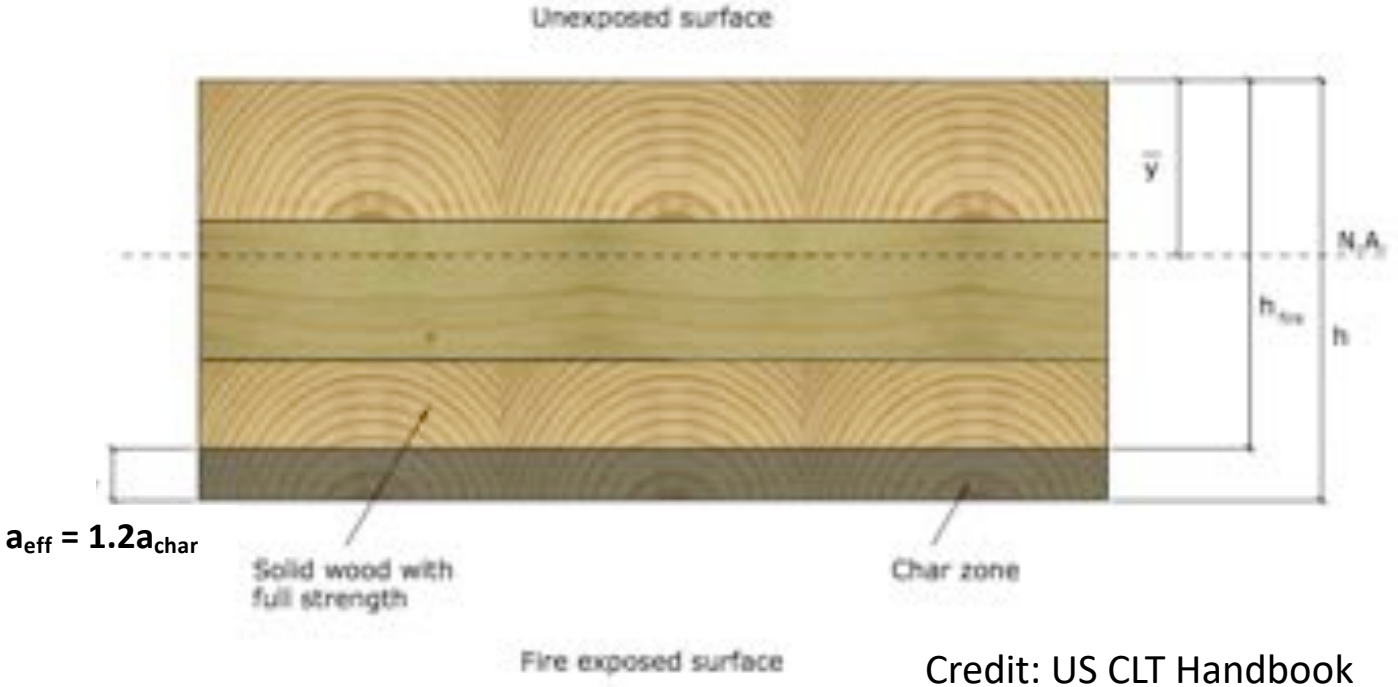
MT Fire Resistance Ratings (FRR)

How do you determine FRR of MT?

2 Options:

1. **Calculations in Accordance with IBC 722 → NDS Chapter 16**
2. **Tests in Accordance with ASTM E119**

Credit: Urban One



Credit: US CLT Handbook

Type IV-B Fire Resistance Ratings (FRR)

IV-B

Primary Frame (2-hr) + Floor Panel (2-hr)

Minimum 1" noncombustible material

Mass timber floor panel

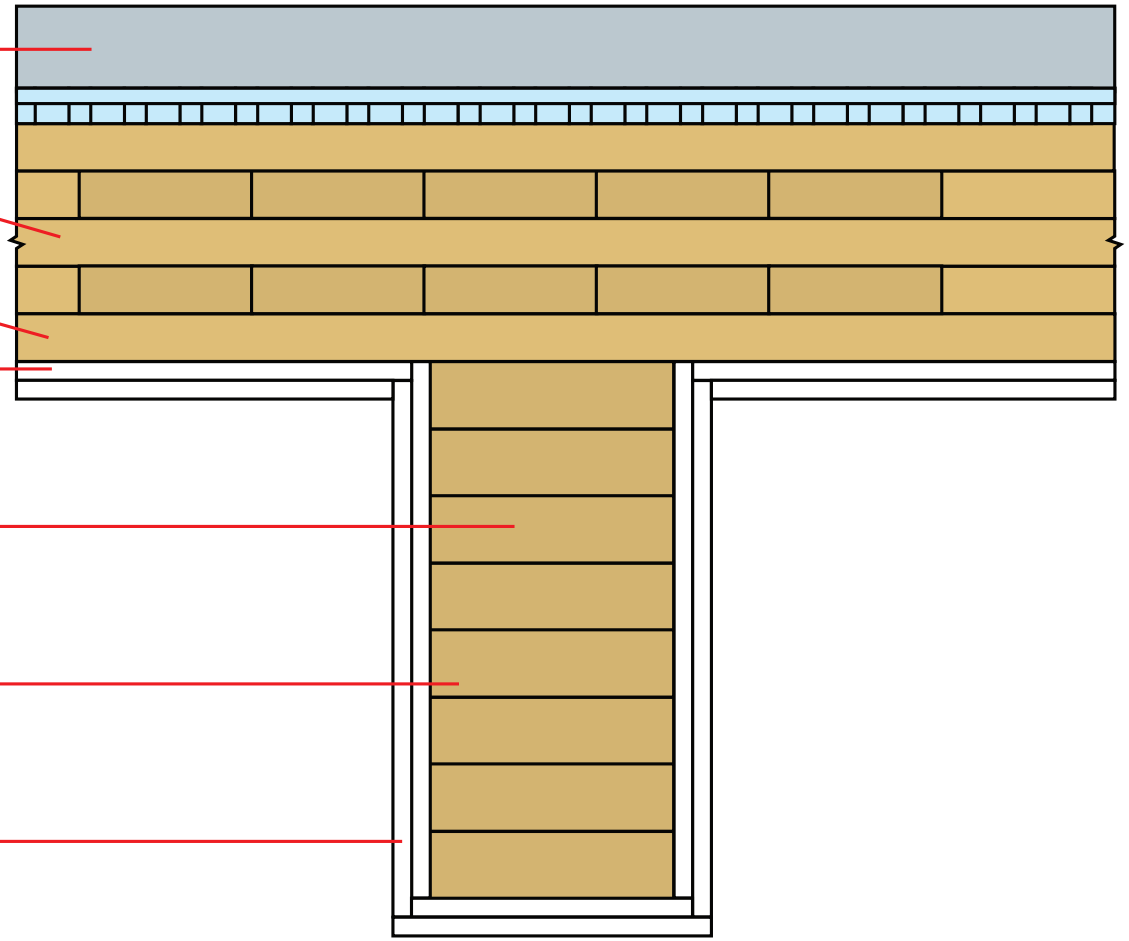
40 minutes of MT FRR

2 layers 5/8" Type X gypsum

Glulam beam (primary structural frame)

40 minutes of MT FRR

Two layers 5/8" Type X gypsum



Type IV-B Fire Resistance Ratings (FRR)

IV-B

Primary Frame (2-hr) + Floor Panel Example (2-hr)

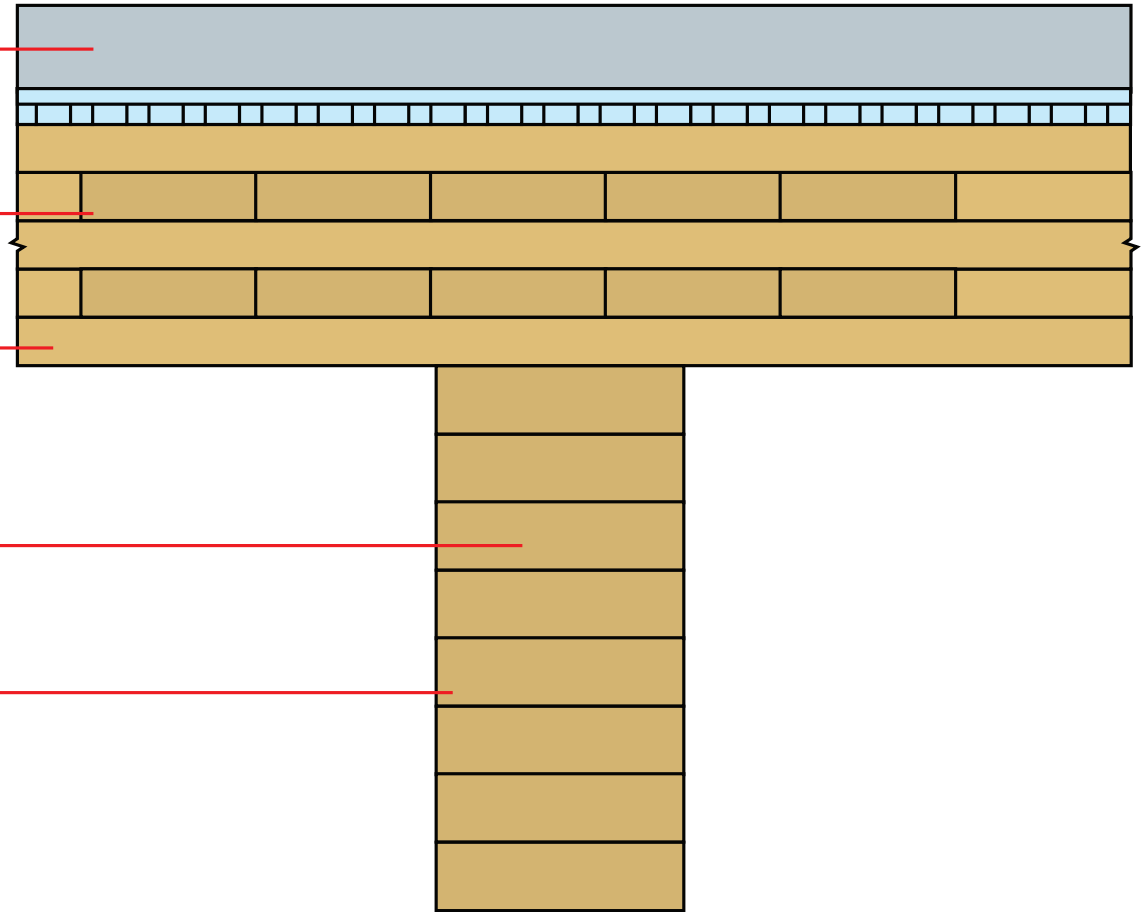
Minimum 1" noncombustible material

Mass timber floor panel

2-hr of MT FRR;
noncombustible material not required

Glulam beam (primary structural frame)

2-hr of MT FRR;
Noncombustible material not required



MT Fire Resistance Ratings (FRR)

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Fire-Resistive Design of Mass Timber Members

Code Applications, Construction Types and Fire Ratings

For many years, exposed heavy timber framing elements have been permitted in U.S. buildings due to their inherent fire-resistance properties. The predictability of wood's char rate has been well-established for decades and has long been recognized in building codes and standards.

Today, one of the exciting trends in building design is the growing use of mass timber—i.e., large solid wood panel products such as cross-laminated timber (CLT) and nail-laminated timber (NLT)—for floor, wall and roof construction. Like heavy timber, mass timber products have inherent fire resistance that allows them to be left exposed and still achieve a fire-resistance rating. Because of their strength and dimensional stability, these products also offer a low-carbon alternative to steel, concrete, and masonry for many applications. It is this combination of exposed structure and strength that developers and designers across the country are leveraging to create innovative designs with a warm yet modern aesthetic, often for projects that go beyond traditional norms of wood design.

This paper has been written to support architects and engineers exploring the use of mass timber for commercial and multi-family construction. It focuses on how to meet fire-resistance requirements in the International Building Code (IBC), including calculation and testing-based methods. Unless otherwise noted, references refer to the 2018 IBC.

Mass Timber & Construction Type

Before demonstrating fire-resistance ratings of exposed mass timber elements, it's important to understand under what circumstances the code currently allows the use of mass timber in commercial and multi-family construction.

A building's assigned construction type is the main indicator of where and when all wood systems can be used. IBC Section 602 defines five main options (Type I through V) with all but Type IV having subcategories A and B. Types III and V permit the use of wood framing throughout much of the structure and both are used extensively for modern mass timber buildings.

Type III (IBC 602.3) – Timber elements can be used in floors, roofs and interior walls. Fire-retardant-treated wood (FRTW) framing is permitted in exterior walls with a fire-resistance rating of 2 hours or less.

Type V (IBC 602.5) – Timber elements can be used throughout the structure, including floors, roofs and both interior and exterior walls.

Type IV (IBC 602.4) – Commonly referred to as 'Heavy Timber' construction, this option

Carbon12 | Portland, Oregon
Kaiser Group I | Path Architecture
Murphy Structural Engineering

Mass Timber Fire Design Resource

- **Code compliance options for demonstrating FRR**
- **Updated as new tests are completed**
- **Free download at woodworks.org**

Credit: WoodWorks

MT Fire Resistance Ratings (FRR)

Inventory of Fire Tested MT Assemblies

Table 1: North American Fire Resistance Tests of Mass Timber Floor / Roof Assemblies

WoodWorks
WOOD PRODUCTS COUNCIL

CLT Panel	Manufacturer	CLT Grade or Major x Minor Grade	Ceiling Protection	Panel Connection in Test	Floor Topping	Load Rating	Fire Resistance Achieved (Hours)	Source	Testing Lab
3-ply CLT (114mm 4.49 in)	Nordic	SPF 1650 Fb 1.5E MSR x SPF #3	2 layers 1/2" Type X gypsum	Half-Lap	None	Reduced 36% Moment Capacity	1	1 (Test 1)	NRC Fire Laboratory
3-ply CLT (105mm 4.13 in)	Structurlam	SPF #1/#2 x SPF #1/#2	1 layer 5/8" Type X gypsum	Half-Lap	None	Reduced 75% Moment Capacity	1	1 (Test 5)	NRC Fire Laboratory
5-ply CLT (175mm 6.875")	Nordic	E1	None	Topside Spline	2 staggered layers of 1/2" cement boards	Loaded, See Manufacturer	2	2	NRC Fire Laboratory March 2016
5-ply CLT (175mm 6.875")	Nordic	E1	1 layer of 5/8" Type X gypsum soffit at Z-channels and furring strips with 5 5/8"	Topside Spline	2 staggered layers of 1/2" cement boards	Loaded, See Manufacturer	2	5	NRC Fire Laboratory Nov 2014
5-ply CLT (175mm 6.875")	Nordic	E1	None	Topside Spline	3/4 in. proprietary gypcrete over Maxxon acoustical mat	Reduced 50% Moment Capacity	1.5	3	UL
5-ply CLT (175mm 6.875")	Nordic	E1	1 layer 5/8" normal gypsum	Topside Spline	3/4 in. proprietary gypcrete over Maxxon acoustical mat or proprietary sound board	Reduced 50% Moment Capacity	2	4	UL
5-ply CLT (175mm 6.875")	Nordic	E1	1 layer 5/8" Type X Gyp under Resilient Channel under 7 7/8" I-Joists with 1-1/2" Mineral Wool between Joists	Half-Lap	None	Loaded, See Manufacturer	2	21	Intertek 8/24/2012
5-ply CLT (175mm 6.875")	Structurlam	E1/M3 MSR 2100 x SPF #2	None	Topside Spline	1-1/2" Maxxon CypCrete 2500 over Maxxon Reinforcing Mesh	Loaded, See Manufacturer	2.5	6	Intertek, 2/22/2016
5-ply CLT (175mm 6.875")	DR Johnson	V1	None	Half-Lap & Topside Spline	2" gypsum topping	Loaded, See Manufacturer	2	7	SwRI (May 2016)
5-ply CLT (175mm 6.875")	Nordic	SPF 1950 Fb MSR x SPF #3	None	Half-Lap	None	Reduced 59% Moment Capacity	1.5	1 (Test 3)	NRC Fire Laboratory
5-ply CLT (175mm 6.875")	Structurlam	SPF #1/#2 x SPF #1/#2	1 layer 5/8" Type X gypsum	Half-Lap	None	Unreduced 100% Moment Capacity	2	1 (Test 4)	NRC Fire Laboratory
7-ply CLT (245mm 9.65")	Structurlam	SPF #1/#2 x SPF #1/#2	None	Half-Lap	None	Unreduced 100% Moment Capacity	2.5	1 (Test 7)	NRC Fire Laboratory
5-ply CLT (175mm 6.875")	SmartLam	SL-V4	None	Half-Lap	nominal 1/2" plywood with 8d nails	Loaded, See Manufacturer	2	12 (Test 4)	Western Fire Center 10/26/2016
5-ply CLT (175mm 6.875")	SmartLam	V1	None	Half-Lap	nominal 1/2" plywood with 8d nails	Loaded, See Manufacturer	2	12 (Test 5)	Western Fire Center 10/28/2016
5-ply CLT (175mm 6.875")	DR Johnson	V1	None	Half-Lap	nominal 1/2" plywood with 8d nails	Loaded, See Manufacturer	2	12 (Test 6)	Western Fire Center 11/01/2016
5-ply CLT (140mm 5.5")	KLH	CV1M1	None	Half-Lap & Topside Spline	None	Loaded, See Manufacturer	1	18	SwRI

Credit: WoodWorks

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

Scott Breneman, Ph.D., SE, WoodWorks – Wood Products Council • Mark 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

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WOOD PRODUCTS COUNCIL

TECHNICAL BRIEF

Demonstrating Fire-Resistance Ratings for Mass Timber Elements in Tall Wood Structures

Richard McLain, PE, SE • Senior Technical Director – Tall Wood, WoodWorks

Changes to the 2021 International Building Code (IBC) have created opportunities for wood buildings that are much larger and taller than prescriptively allowed in past versions of the code. Occupant safety, and the need to ensure fire performance in particular, was a fundamental consideration as the changes were developed and approved. The result is three new construction types—Type IV-A, IV-B and IV-C—which are based on the previous Heavy Timber construction type (renamed Type IV-HT), but with additional fire protection requirements.

One of the main ways to demonstrate that a building will meet the required level of passive fire protection, regardless of structural materials, is through hourly fire-resistance ratings (FRRs) of its elements and assemblies. The IBC defines an FRR as *the period of time a building element, component or assembly maintains the ability to confine a fire, continues to perform a given structural function, or both, as determined by the tests, or the methods based on tests, prescribed in Section 703.*

FRRs for the new construction types are similar to those required for Type I construction, which is primarily steel and concrete.[1] (See Table 1.) They are found in IBC Table 601, which includes FRR requirements for all construction types and building elements; however, other code sections should be checked for overriding provisions (e.g., occupancy separation, shaft enclosures, etc.) that may alter the requirement.

Image: Korb + Associates Architects

Ascent | Milwaukee, WI
Architect: Korb + Associates Architects
Structural Engineer: Thornton Tomasetti

TABLE 1:
FRR Requirements (Hours) for Tall Mass Timber Construction Types and Existing Type I

Building Element	I-A *Unlimited stories,*	IV-A *Max. 18 stories,*	I-B *Max. 12 stories,*	IV-B *Max. 12 stories,*	IV-C *Max. 9 stories,*
Interior Bearing Walls	3	3	2	2	2

Tall Timber Fire-Resistance Design

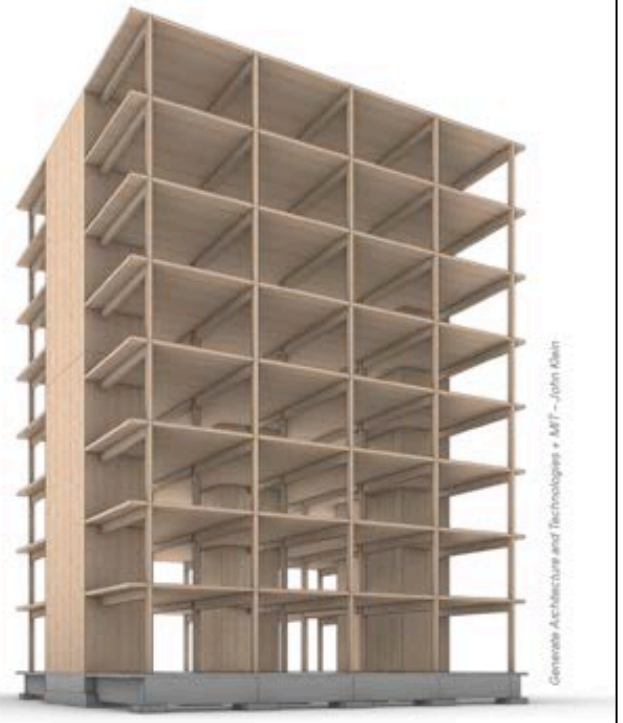
WoodWorks™
WOOD PRODUCTS COUNCIL

TECHNICAL BRIEF

Shaft Wall Requirements in Tall Mass Timber Buildings

Richard McLain, PE, SE • Senior Technical Director • Tall Wood, WoodWorks

The 2021 International Building Code (IBC) introduced three new construction types—Type IV-A, IV-B and IV-C—which allow tall mass timber buildings. For details on the new types and their requirements, see the WoodWorks paper, *Tall Wood Buildings in the 2021 IBC – Up to 18 Stories of Mass Timber.*[1] This paper builds on that document with an in-depth look at the requirements for shaft walls, including when and where wood can be used.



Generate Architecture and Technologies + MIT – John Klein

Shaft Enclosure Requirements in the 2021 IBC

A shaft is defined in Section 202 of the 2021 IBC as *"an enclosed space extending through one or more stories of a building, connecting vertical openings in successive floors, or floors and roof."* Therefore, shaft enclosure requirements apply to stairs, elevators, and mechanical/electrical/plumbing (MEP) chases in multi-story buildings. While these applications may be similar in their fire design requirements, they tend to differ in terms of their assemblies, detailing, and construction constraints.

Shaft enclosures are specifically addressed in IBC Section 713. However, because shaft enclosure walls must be constructed as fire barriers per Section 713.2, many shaft wall requirements reference provisions for fire barriers found in Section 707.

Allowable Shaft Wall Materials

Provisions addressing materials permitted in shaft wall

A relatively new category of wood products, mass timber can

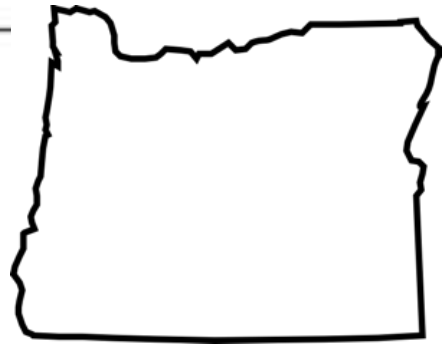
utilizing construction Types IV-A, IV-B, or IV-C is that they

Structural elements of Type IV construction primarily of

Shaft Enclosure Design in Tall Timber

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

Credit: State of Oregon

WASHINGTON STATE BUILDING CODE

CHAPTER 51-50 WAC

INTERNATIONAL BUILDING CODE 2015 Edition

Includes adoption of and amendments to the 2015 International Existing Building Code and ICC/ANSI A117.1-2009

TABLE 504.3
ALLOWABLE BUILDING HEIGHT IN FEET ABOVE GRADE PLANE[a]

Occupancy Classification	See Footnotes	Type of Construction									
		Type I		Type II		Type III		Type IV			
		A	B	A	B	A	B	A	B	C	HT
A, B, E, F, M, S, U	NS[b]	UL	160	65	55	65	55	65	65	65	65
	S	UL	180	85	75	85	75	270	180	85	85
H-1, H-2, H-3, H-5	NS[c,d]	UL	160	65	55	65	55	120	90	65	65
	S										
H-4	NS[c,d]	UL	160	65	55	65	55	65	65	65	65
	S	UL	180	85	75	85	75	140	100	85	85
I-1 Condition 1, I-3	NS[d,e]	UL	160	65	55	65	55	65	65	65	65
	S	UL	180	85	75	85	75	180	120	85	85
I-1 Condition 2, I-2	NS[d,e,f]	UL	160	65	55	65	55	65	65	65	65
	S	UL	180	85							
I-4	NS[d,e]	UL	160	65	55	65	55	65	65	65	65
	S	UL	180	85	75	85	75	180	120	85	85
R	NS[d]	UL	160	65	55	65	55	65	65	65	65
	S13R	60	60	60	60	60	60	60	60	60	60
	S	UL	180	85	75	85	75	270	180	85	85

For SI: 1 foot = 304.8 mm

Credit: State of Washington

CONSTRUCTION DEVELOPMENT SUSTAINABILITY

Denver Adopts Tall Mass Timber Codes

milehighcre — January 6, 2020

On December 23, the City of Denver voted to adopt the 2019 Denver Building Code, which includes the tall mass timber code provisions approved for the 2021 International Building Code (IBC).

As part of the adoption of the new code, there will be a four-month period where new projects can use either the 2016 Denver Building Code or the newly-adopted 2019 version. After four months, all building and fire code permits will be processed under the 2019 Denver Building Code.

"We congratulate the City of Denver on incorporating mass timber into its building codes, and recognizing the potential of this new category of wood products to revolutionize the way America builds," said American Wood Council president & CEO Robert Glowinski. "Mass timber offers the strength of historic building materials with lower weight, and, in the rare event of a fire, has inherent fire resistance. Beyond the aesthetic qualities of mass timber that building owners and designers are seeking, wood is among the most energy-efficient and environmentally friendly of all construction materials, storing carbon from the atmosphere for long periods of time."

The adopted proposal to recognize mass timber in the new code was submitted by Dr. Gregory R. Kingsley on behalf of the Structural Engineers Association of Colorado. The American Wood Council provided technical assistance to the city in support of the proposal.

The 2019 Denver Building Code will now recognize three new types of construction that also are included in the 2021 IBC:

AMENDMENTS TO THE BUILDING AND FIRE CODE FOR THE CITY AND COUNTY OF DENVER

The 2019 Denver Building and Fire Code includes the following codes except as amended herein.

APPENDIX U
TALL WOOD BUILDINGS

SECTION U101
GENERAL

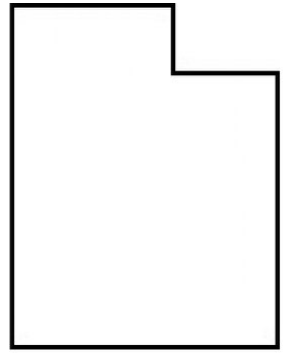
U101.1 Purpose. The purpose of this appendix is to provide criteria for three new mass timber construction types: Type IV-A, Type IV-B, and Type IV-C. These building types expand the allowable use of mass timber construction to larger areas and greater heights than allowed for Type IV-HT construction.

U101.2 Scope. The provisions in this appendix are in addition to or replace the sections in the 2018 *International Building Code* where Types IV-A, IV-B, and IV-C construction are used. Where building Types IV-A, IV-B, or IV-C are not used, this appendix does not apply.

SECTION U102
AMENDMENTS TO THE INTERNATIONAL BUILDING CODE

(Under use of this appendix chapter, the following sections shall be modified or added as follows and shall supersede the corresponding sections in the International Building Code or Denver amendments to the International Building Code)

Credit: City of Denver, Mile High CRE



UTAH STATE LEGISLATURE

Legislators Bills Code Committees Audits

Home 2020 General Session H.B. 54

H.B. 54 Building Construction Amendments

Bill Text **Status**

Enrolled **H.B. 54**

Printer Friendly

BUILDING CONSTRUCTION AMENDMENTS

2020 GENERAL SESSION

STATE OF UTAH

(5) "Utah Code" means the Utah Code Annotated (1953), as amended.

Section 2. Section **15A-2-101** is amended to read:

15A-2-101. Title -- Adoption of code.

(1) This chapter is known as the "Adoption of State Construction Code."

(2) In accordance with Chapter 1, Part 2, State Construction Code Administration Act, the Legislature repeals the State Construction Code in effect on July 1, 2010, and adopts the following as the State Construction Code:

(a) this chapter;

(b) Chapter 2a, Tall Wood Buildings of Mass Timber Construction Incorporated as Part of State Construction Code;

[~~(b)~~] (c) Chapter 3, Statewide Amendments Incorporated as Part of State Construction Code; [~~and~~]

[~~(c)~~] (d) Chapter 4, Local Amendments Incorporated as Part of State Construction Code[~~.~~]; and

(e) Chapter 6, Additional Construction Requirements.

Section 3. Section **15A-2-102** is amended to read:

15A-2-102. Definitions.

As used in this chapter [~~and~~], Chapter 2a, Tall Wood Buildings of Mass Timber Construction Incorporated as Part of State Construction Code, Chapter 3, Statewide Amendments Incorporated as Part of State Construction Code, and Chapter 4, Local Amendments Incorporated as Part of State Construction Code:

Credit: State of Utah

Commonwealth of Massachusetts
Division of Professional Licensure
Office of Public Safety & Inspections
1000 Washington Street, Suite 710- Boston MA 02118

Proposed Tenth Edition Building Code

Join Our List

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Ladies and Gentlemen -

This message is sent to inform you that members of the Board of Building Regulations and Standards (BBRS) have decided to take a different path with regard to the tenth edition building code.

Initially, BBRS members intended to use the 2018 International Codes as the basis for the tenth edition, targeting an implementation date of January, 2020. For numerous reasons, they have decided to redirect efforts and, instead, plan to develop the tenth edition code using the 2021 International Codes as a template, with an effective date of January 1, 2021.

This effort ***does not*** affect promulgation of new energy code requirements based on the 2018 International Energy Conservation Code (IECC) scheduled to become effective on January 1, 2020. *(Massachusetts General Law Chapter 143, Section 94(o) requires BBRS members to advance energy provisions on a particular cycle.)*

QUESTIONS?

Ricky McLain, PE, SE

Senior Technical Director - WoodWorks

Ricky.mclain@woodworks.org

(802)498-3310

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