

# Exploring Tall Timber Building Design

May 2025

**Presented by**  
Laura Cullen, PE  
WoodWorks



Image: 11 E Lenox, Monte French Design Studio, H+O Structural Engineers, Photo Jane Messinger



# What is Tall Mass Timber?



Photo: WoodWorks  
Architect/Developer: oWOW

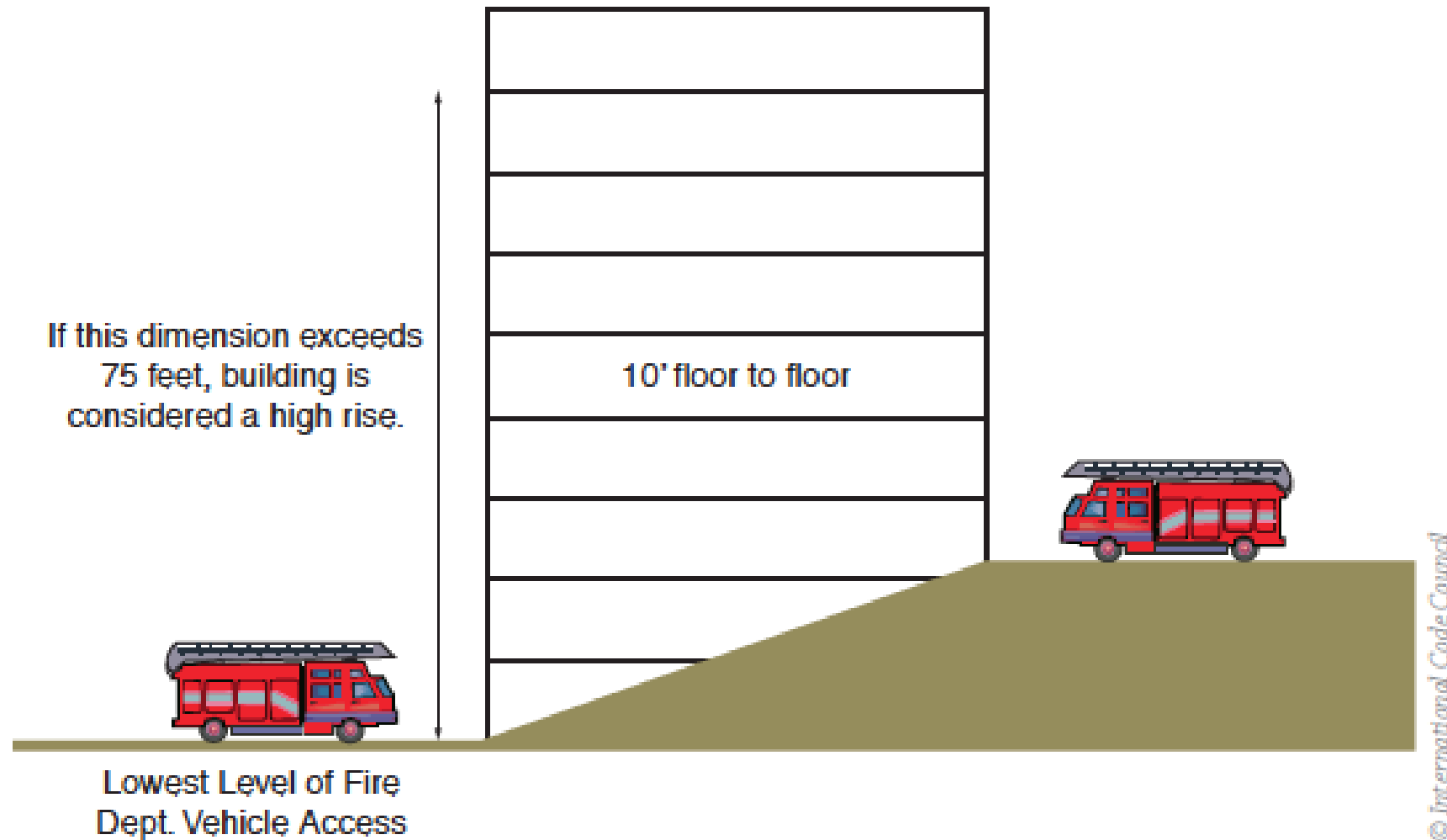


# Does Tall Wood = High Rise?



Photo: Ema Peter

# Mid-Rise vs. High-Rise

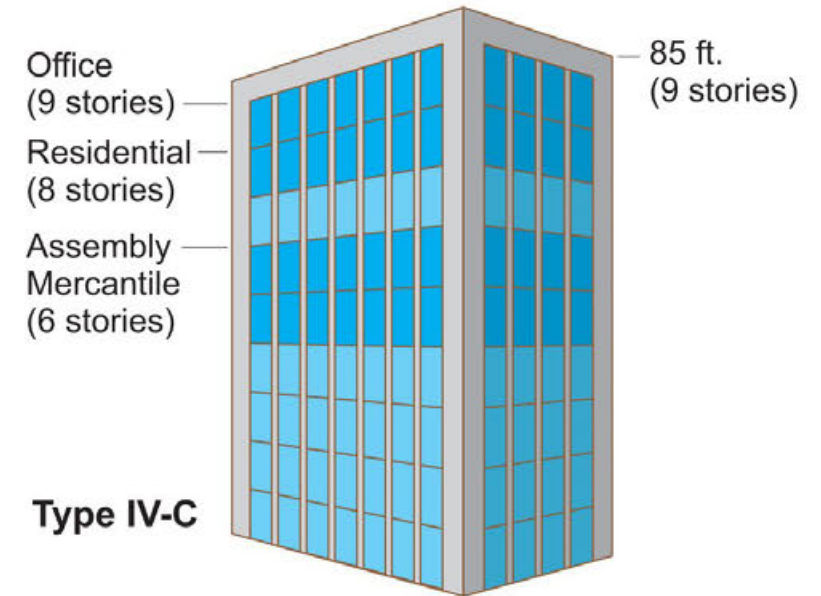
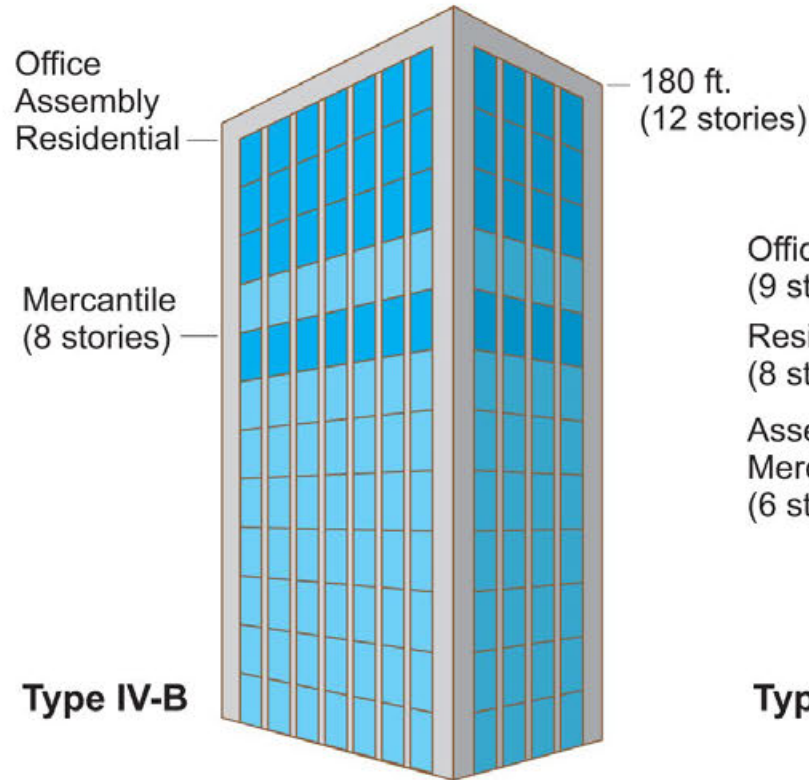
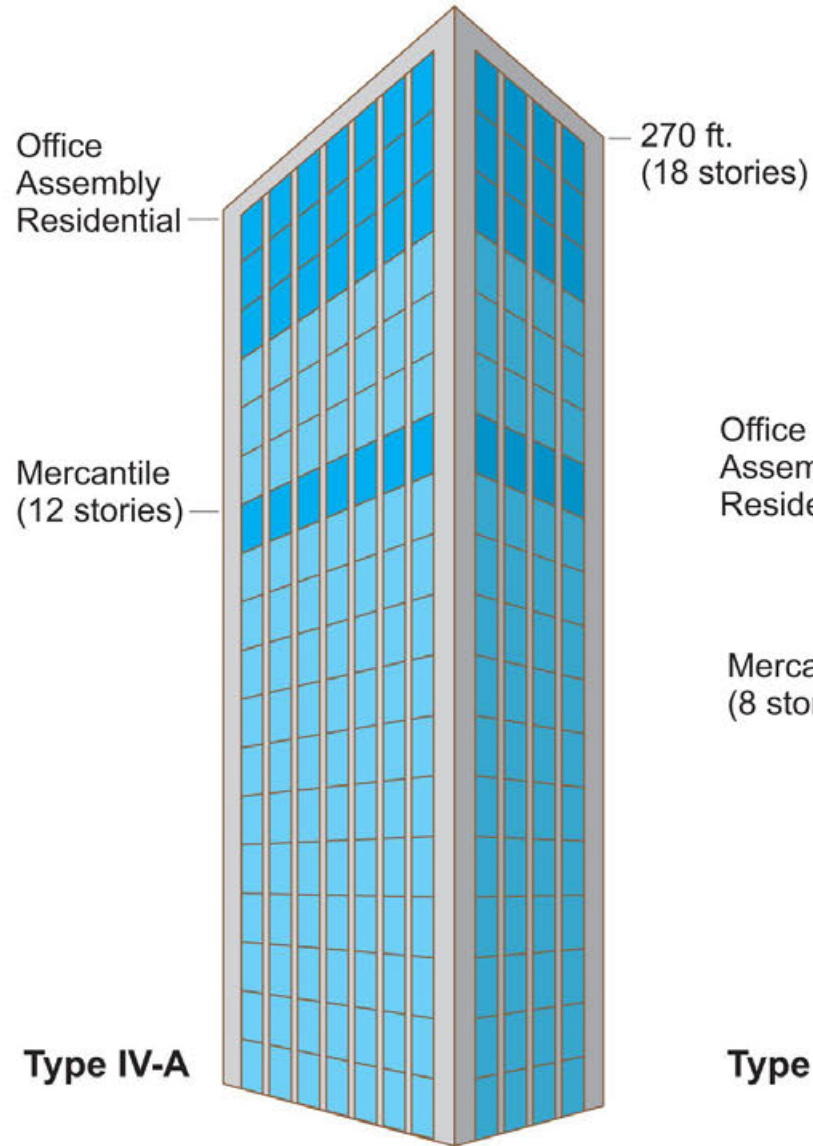


**FIGURE 6-6** Determination of high-rise building



# Tall Mass Timber

Projects which exceed the height and/or story limits of the 2018 (or previous versions) of the IBC



# Tall Mass Timber

2021 IBC Introduces 3 new tall wood construction types:

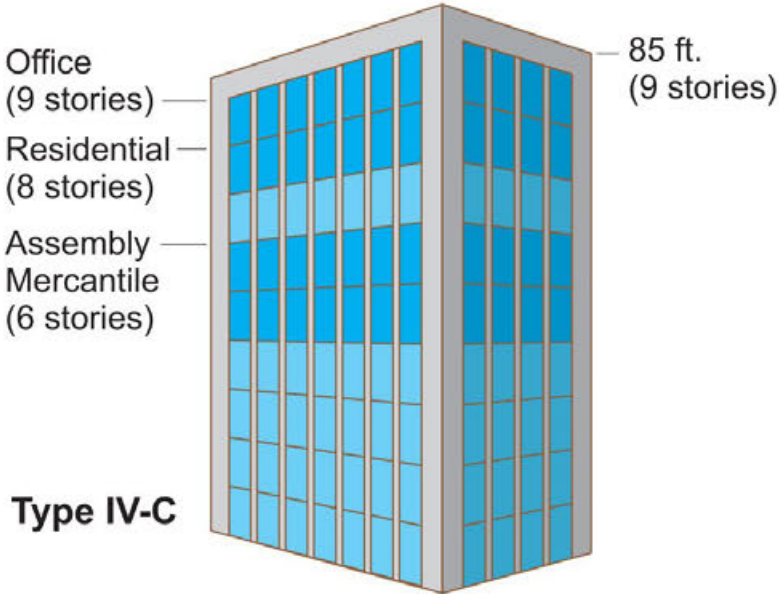
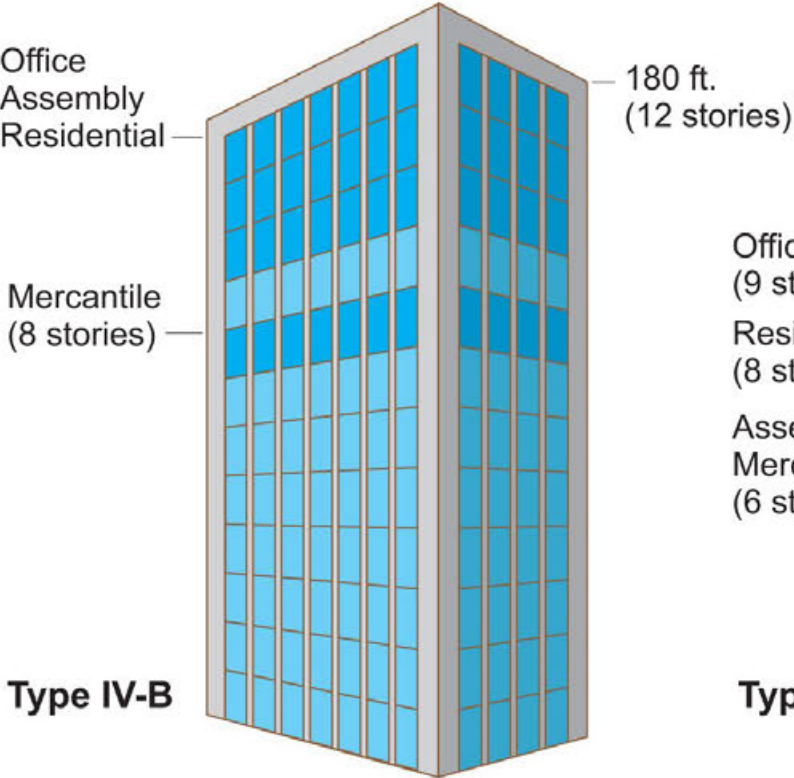
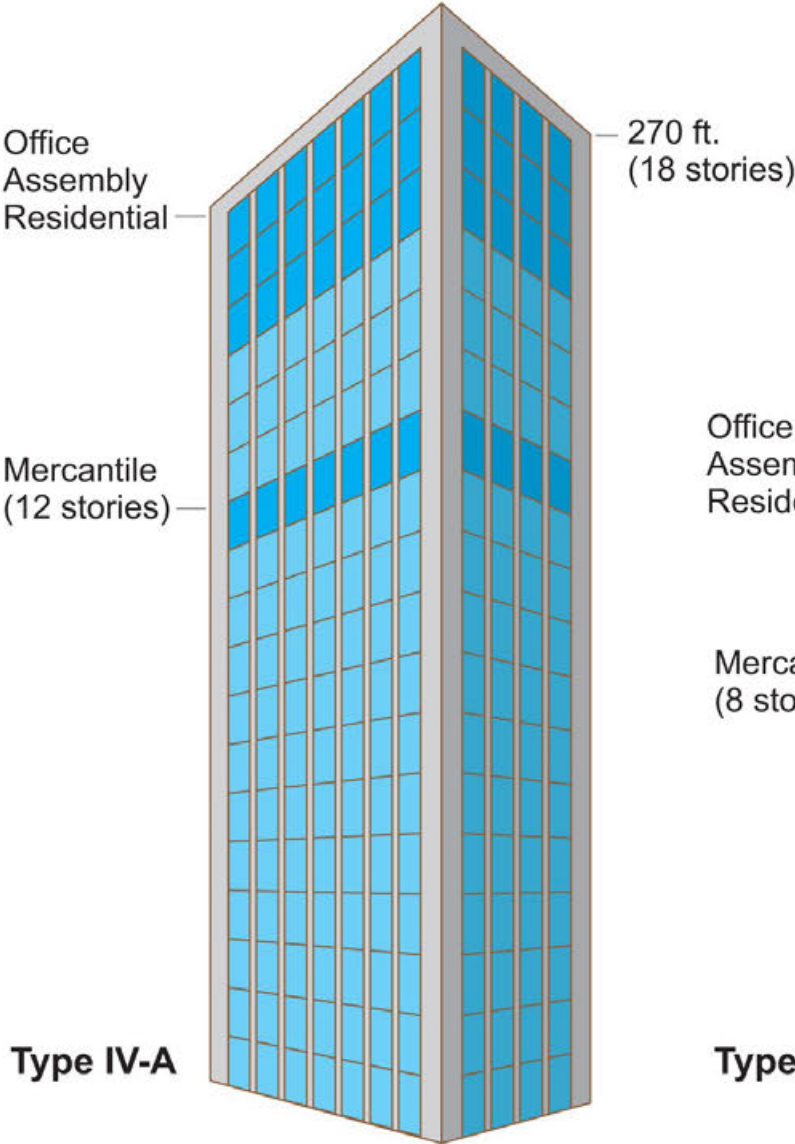
- » IV-A
- » IV-B
- » IV-C
- » Previous type IV renamed type IV-HT

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



# Tall Mass Timber

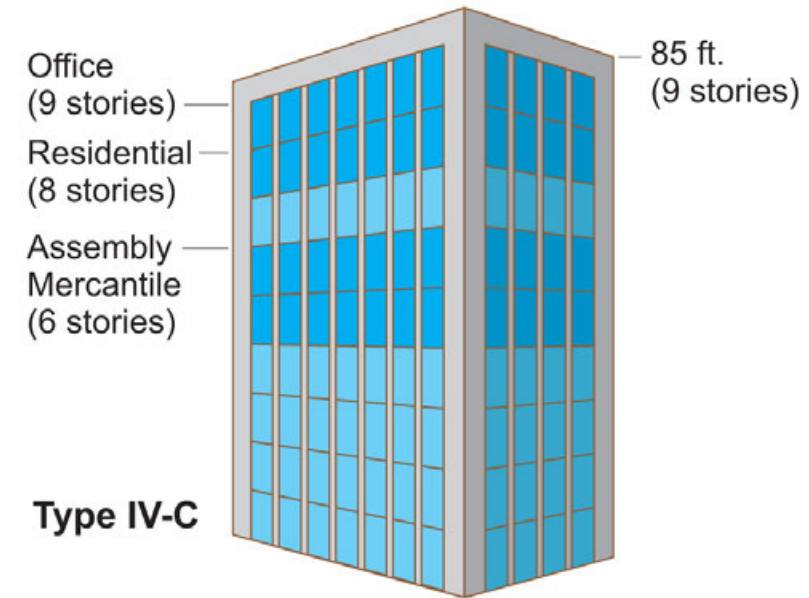
## 2021 IBC: 3 New Tall Mass Timber Construction Types



# Type IV-C



Monte French Design Studio  
Photos: Jane Messinger





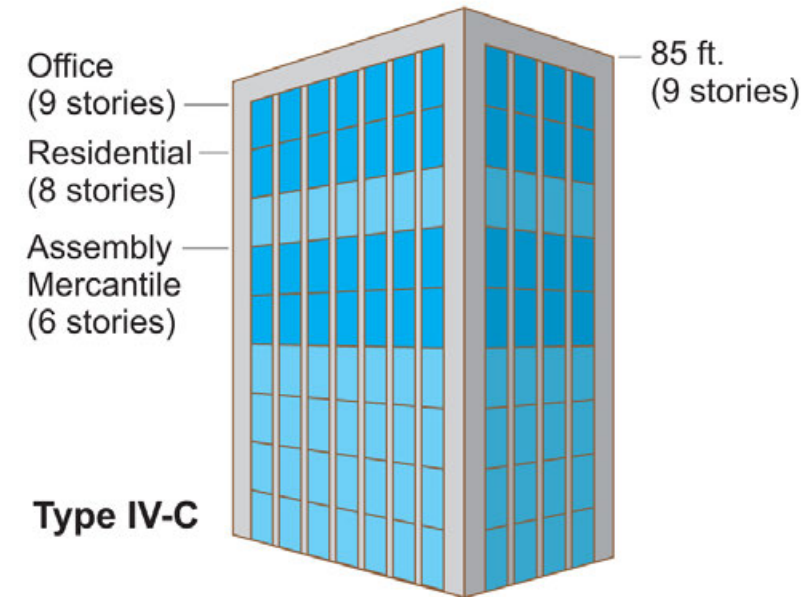
# Type IV-C Exposure Limits

All Mass Timber surfaces may be exposed

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



Monte French Design Studio  
Photo: Jane Messinger



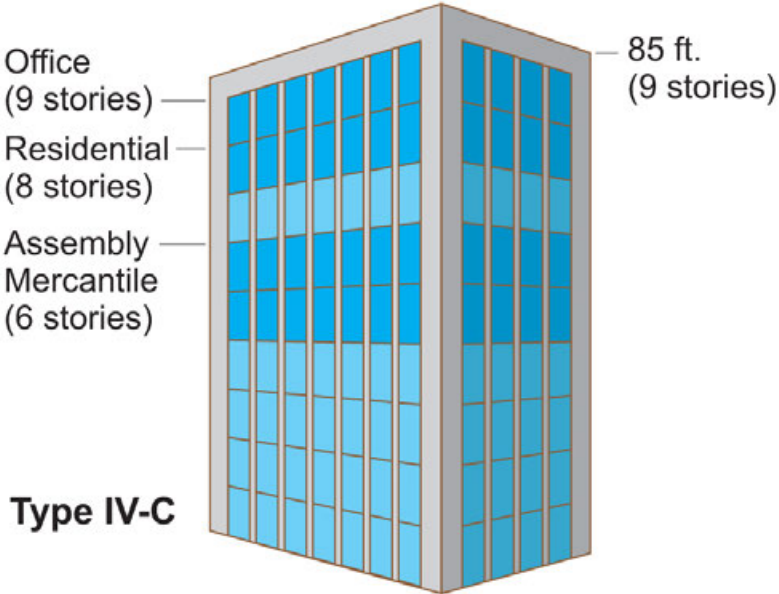
# Type IV-C Building Size Limits

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

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

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





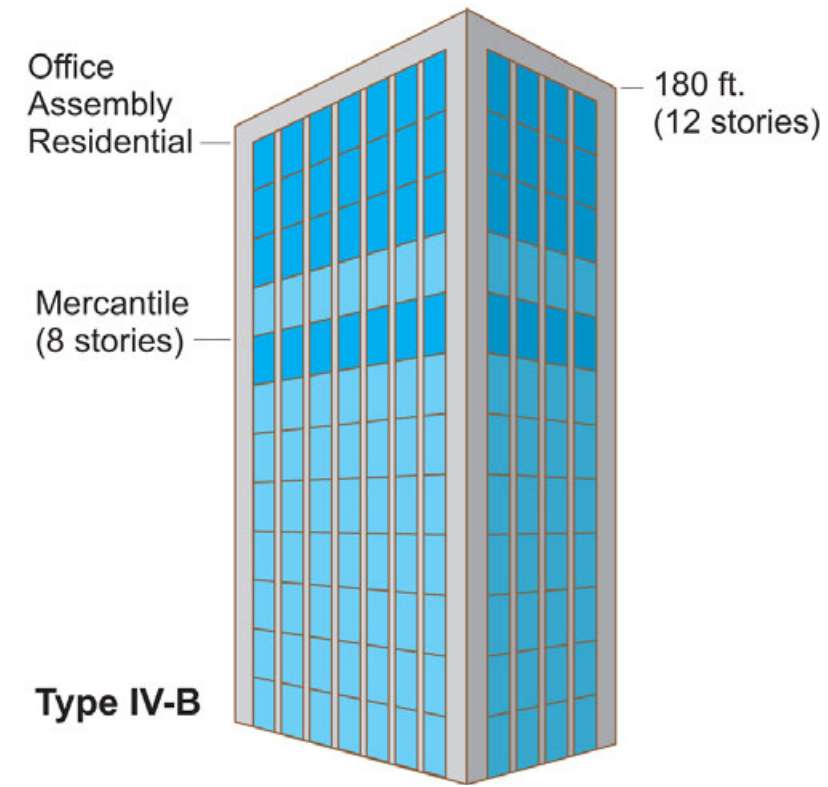
# Type IV-B



Photo: ©Prakash Patel



Photos: Nick Johnson, Tour D Space



# Type IV-B Exposure Limits

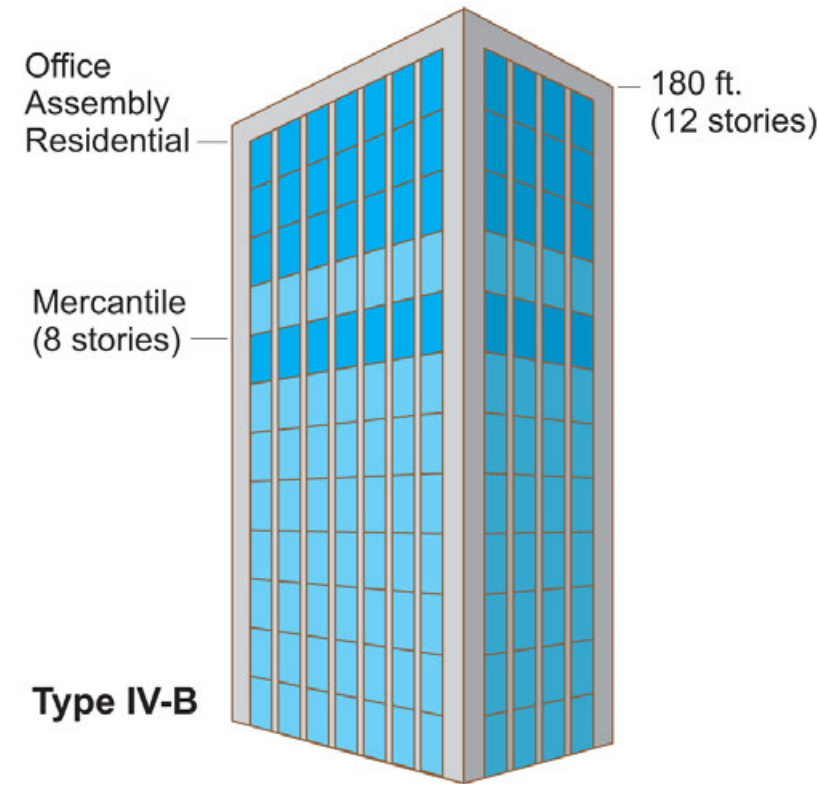
NC protection on some surfaces of Mass Timber

2021 IBC: 20% of ceilings or 40% of walls can be exposed

2024 IBC: 100% of ceilings or 40% of walls can be exposed



Photo: Nick Johnson, Tour D Space





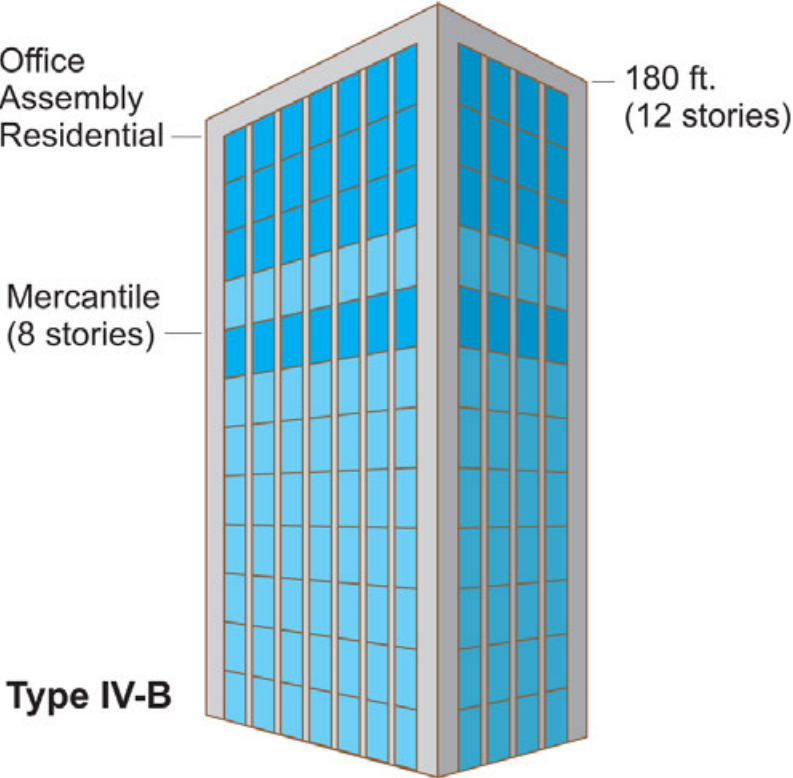
# Type IV-B Building Size Limits

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

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

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



# Type IV-A



Office  
Assembly  
Residential

Mercantile  
(12 stories)

— 270 ft.  
(18 stories)

**Type IV-A**

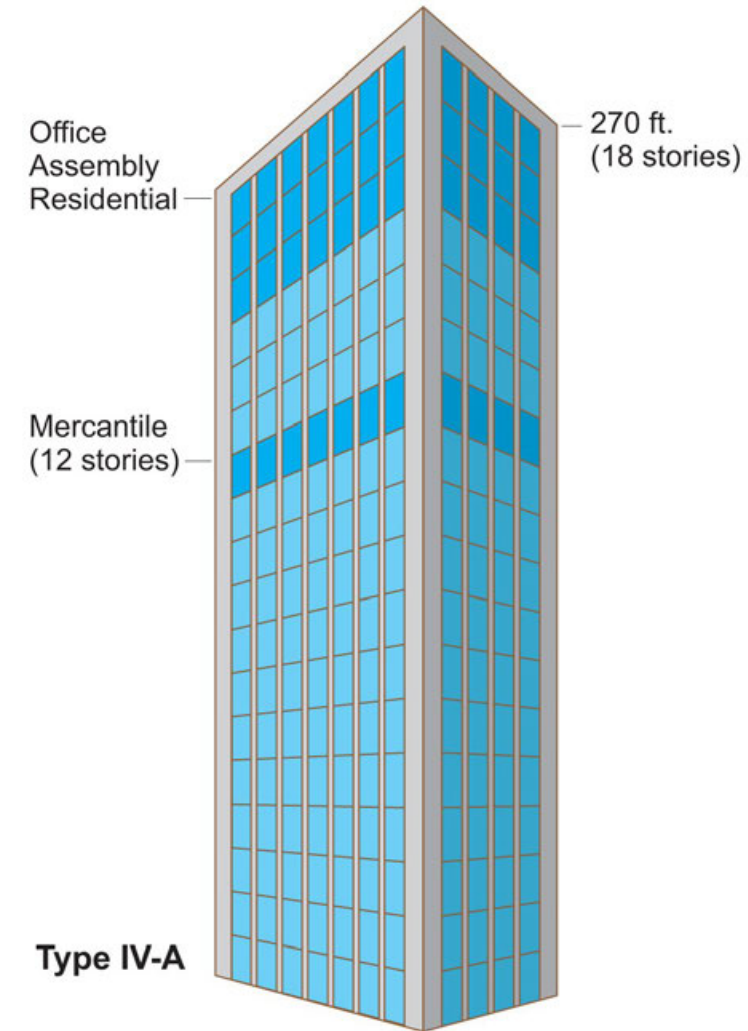
Photos: Flor Projects

# Type IV-A Exposure Limits

100% NC protection on all surfaces of Mass Timber



Photo: Flor Projects





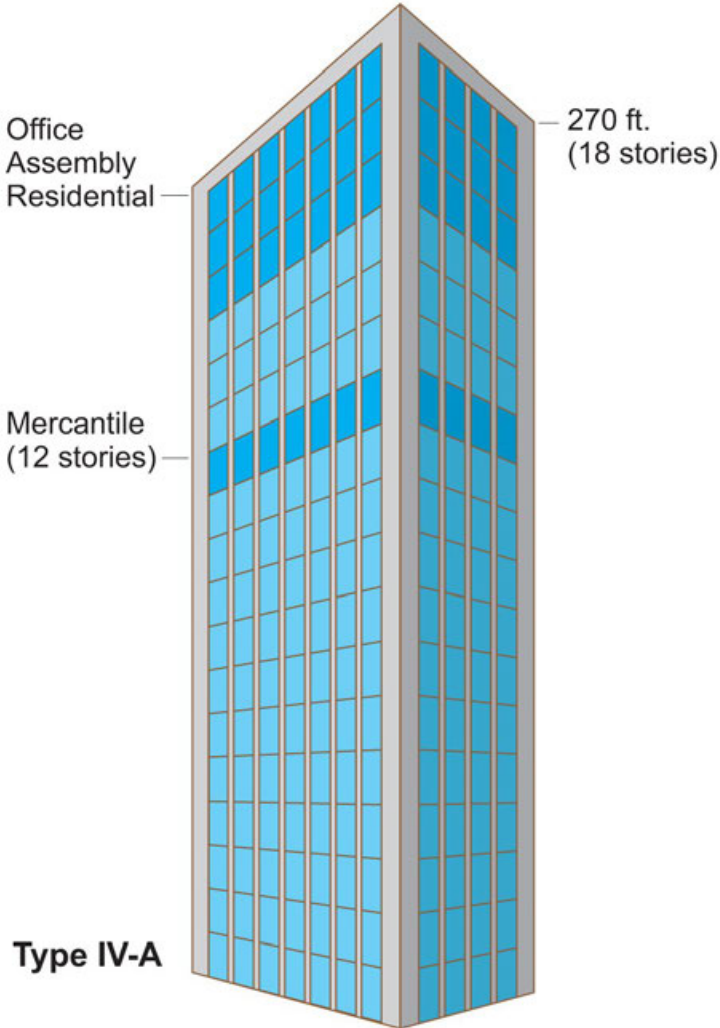
# Type IV-A Building Size Limits

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

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



# Tall Mass Timber in the U.S.

## HOW DID WE ARRIVE HERE?



INTRO, Cleveland, OH | Architect: Hartshorne Plunkard Architecture | Image Courtesy Harbor Bay Real Estate Advisors, Image Fiction



# 2008 – 2015: International Inspiration

## 8-18-STORY PROJECTS IN EUROPE, CANADA, AUSTRALIA





# 2015-2018: Domestic Innovation

TALL WOOD BUILDING COMPETITION, 8-STORY CARBON 12 IN PORTLAND, OR

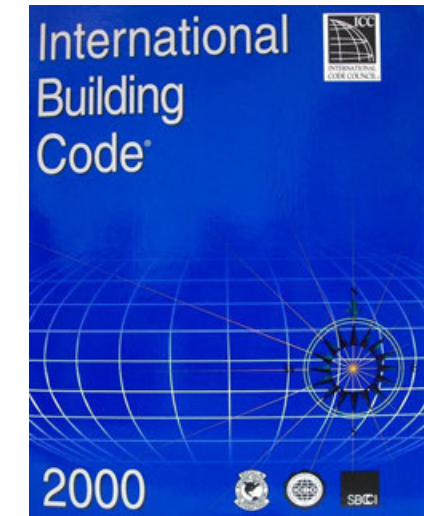
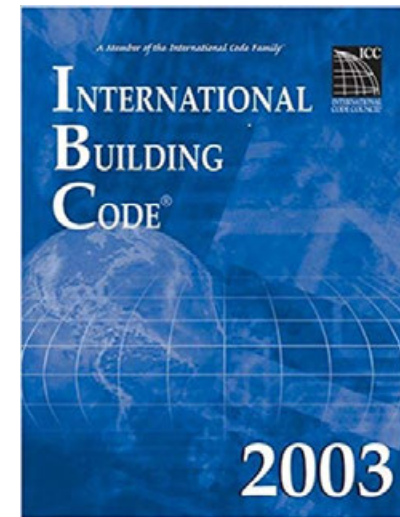
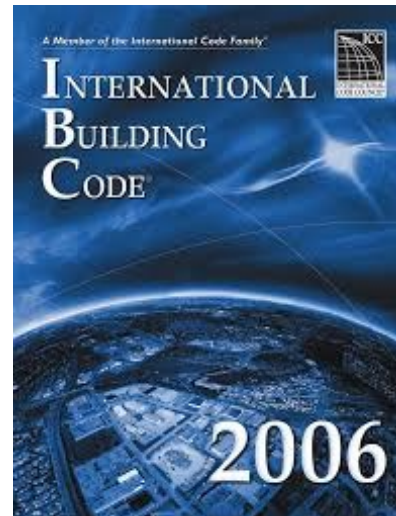
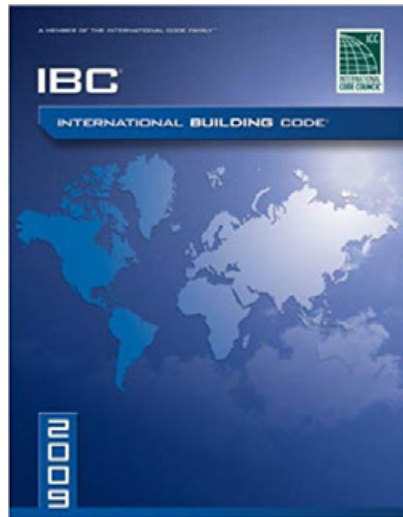
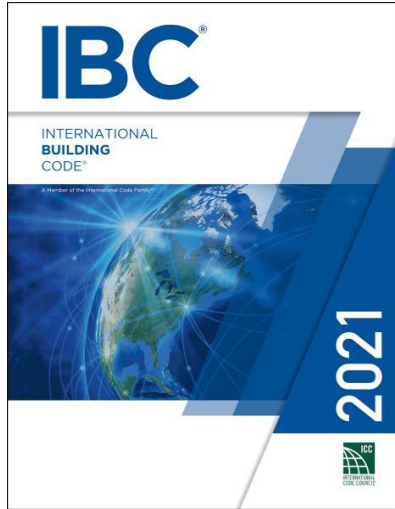


# 2015-2018: Building a Code Roadmap





# 2015-2018: Building a Code Roadmap





# 2015-2018: Building a Code Roadmap





# 2015-2018: Building a Code Roadmap





# 2015-2018: Building a Code Roadmap





# 2015-2018: Building a Code Roadmap



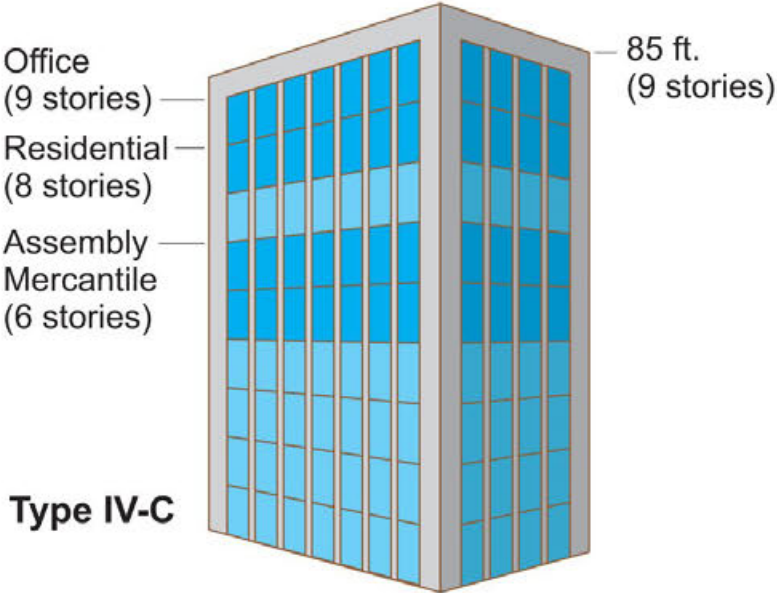
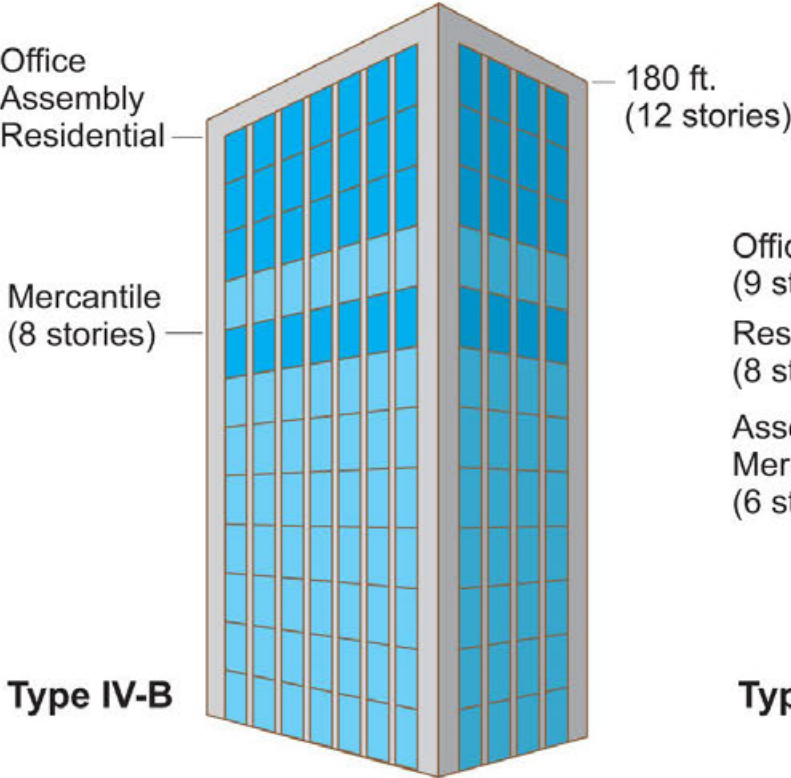
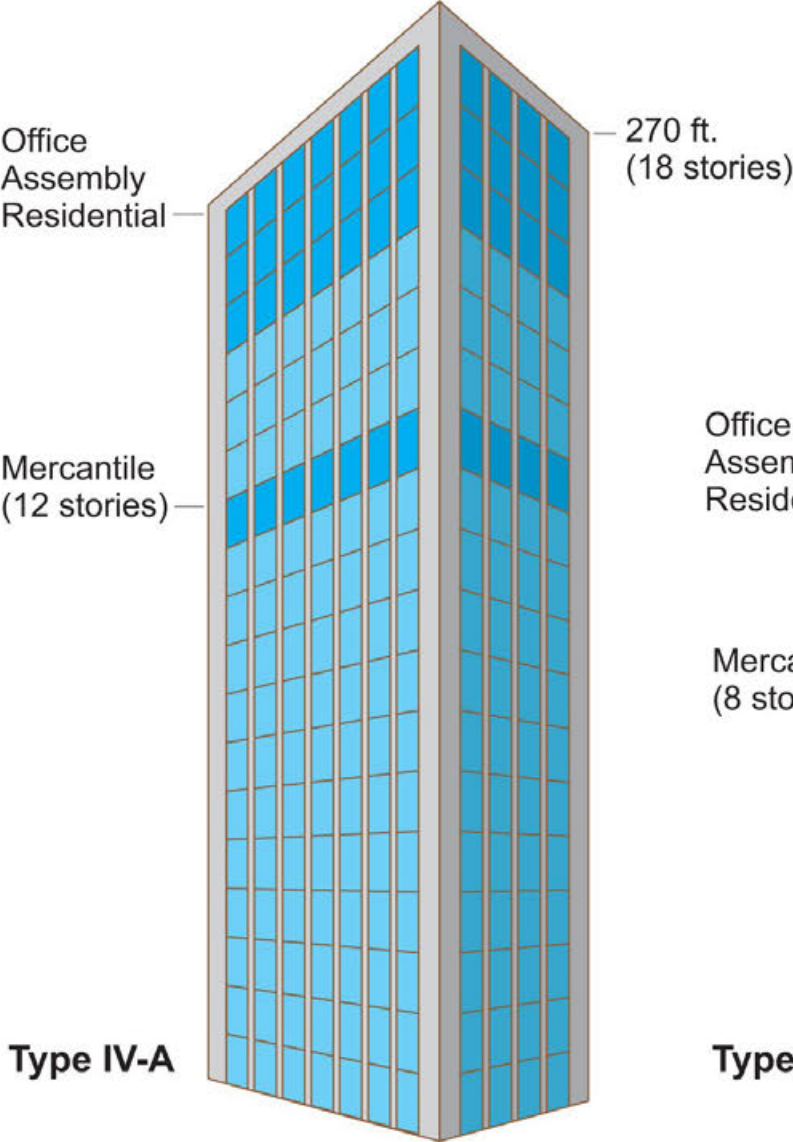
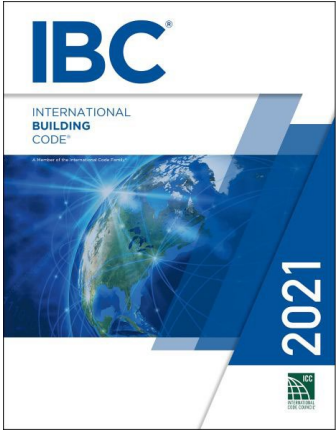


# 2015-2018: Building a Code Roadmap



# 2018-2021: Rollout of a New Code Path

## 2021 IBC





# 2019-2022: REFINING THE CODE ROADMAP



## Fire Safe Implementation of Mass Timber In Tall Buildings

**Research of the fire performance of CLT and Glued Laminated Timber buildings, with visible wood surfaces.**

The main aim of this research project was to identify safe limits of exposed mass timber surface areas that correspond with performance criteria used for previous U.S. Building Code Changes.

Source: RISE

# 2019-2022: REFINING THE CODE ROADMAP



United States Department of Agriculture

## Compartment Fire Testing of a Two-Story Mass Timber Building

Samuel L. Zelinka  
Laura E. Hasburgh  
Keith J. Bourne  
David R. Tucholski  
Jason P. Ouellette



## Conservatism: ATF lab tests based on older generation CLT adhesives

← 2018 ATF tests were initiated before the 2018 version of ANSI/APA PRG 320 was published and the tested CLT was not compliant with the new product standard.



Forest Service

Forest Products Laboratory

General Technical Report  
FPL-GTR-247

May  
2018

Source: RISE, USDA FS FPL & AWC



# 2019-2022: REFINING THE CODE ROADMAP

**In tall buildings, preventing fire re-growth is key.**

**Fire re-growth is a phenomenon in which the heat-release rate of a fire intensifies following a decay phase. Fire re-growth can be initiated when delamination occurs, as this exposes un-charred wood surfaces, thereby resulting in an influx of fuel available for consumption by the fire.**



Photo: Urban One

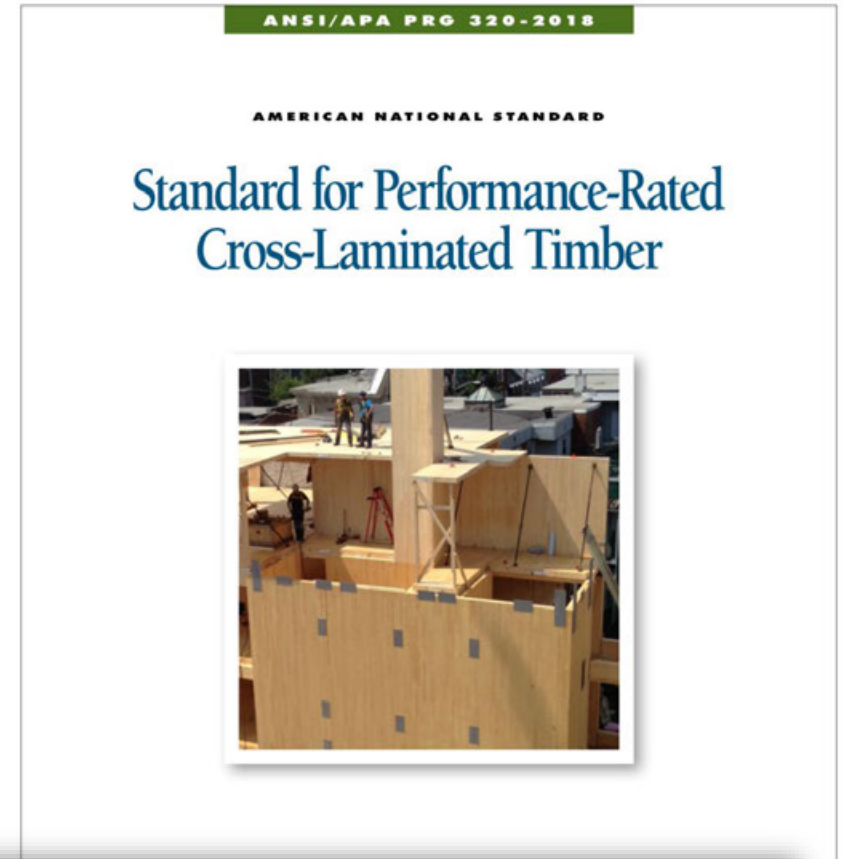


Photo: ARUP

# 2019-2022: REFINING THE CODE ROADMAP

PRG 320 is manufacturing & performance standard for CLT

2019 edition (referenced in 2021 IBC) added new elevated temperature adhesive performance requirements validated by full-scale and medium-scale qualification testing to ensure CLT does not exhibit fire re-growth



**ANNEX B. PRACTICE FOR EVALUATING ELEVATED TEMPERATURE PERFORMANCE OF ADHESIVES USED IN CROSS-LAMINATED TIMBER (MANDATORY)**



# 2019-2022: REFINING THE CODE ROADMAP



# 2019-2022: REFINING THE CODE ROADMAP

## Change to 2024 IBC: IV-B Ceiling Exposure



### 602.4.2.2.2 Protected area.

Interior faces of *mass timber* elements, including the inside face of exterior *mass timber walls* and *mass timber roofs*, shall be protected in accordance with Section 602.4.2.2.1.

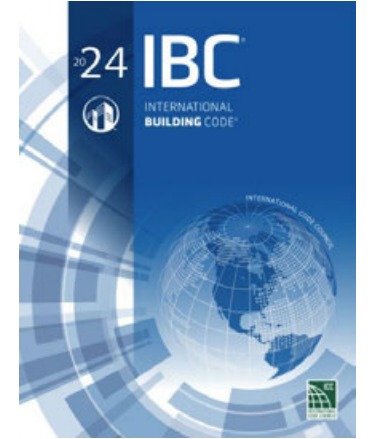
**Exceptions:** Unprotected portions of *mass timber* ceilings and walls complying with Section 602.4.2.2.4 and the following:

1. Unprotected portions of *mass timber* ceilings and walls complying with one of the following:
  - 1.1. Unprotected portions of *mass timber* ceilings, including attached beams, limited to an area less than or equal to 100 percent of the floor area in any *dwelling unit* within a story or fire area within a story.
  - 1.2. Unprotected portions of *mass timber* walls, including attached columns, limited to an area less than or equal to 40 percent of the floor area in any *dwelling unit* within a story or fire area within a story.
  - 1.3. Unprotected portions of both walls and ceilings of *mass timber*, including attached columns and beams, in any *dwelling unit* or fire area and in compliance with Section 602.4.2.2.3.
2. *Mass timber* columns and beams that are not an integral portion of walls or ceilings, respectively, without restriction of either aggregate area or separation from one another.



# 2019-2022: REFINING THE CODE ROADMAP

## Change to 2024 IBC: IV-B Exposure Separation



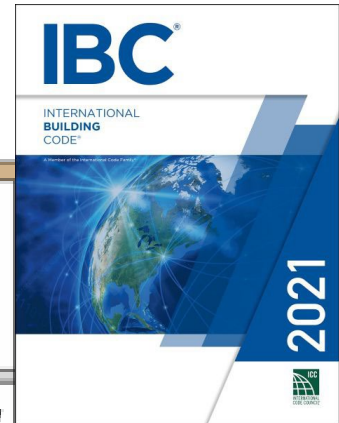
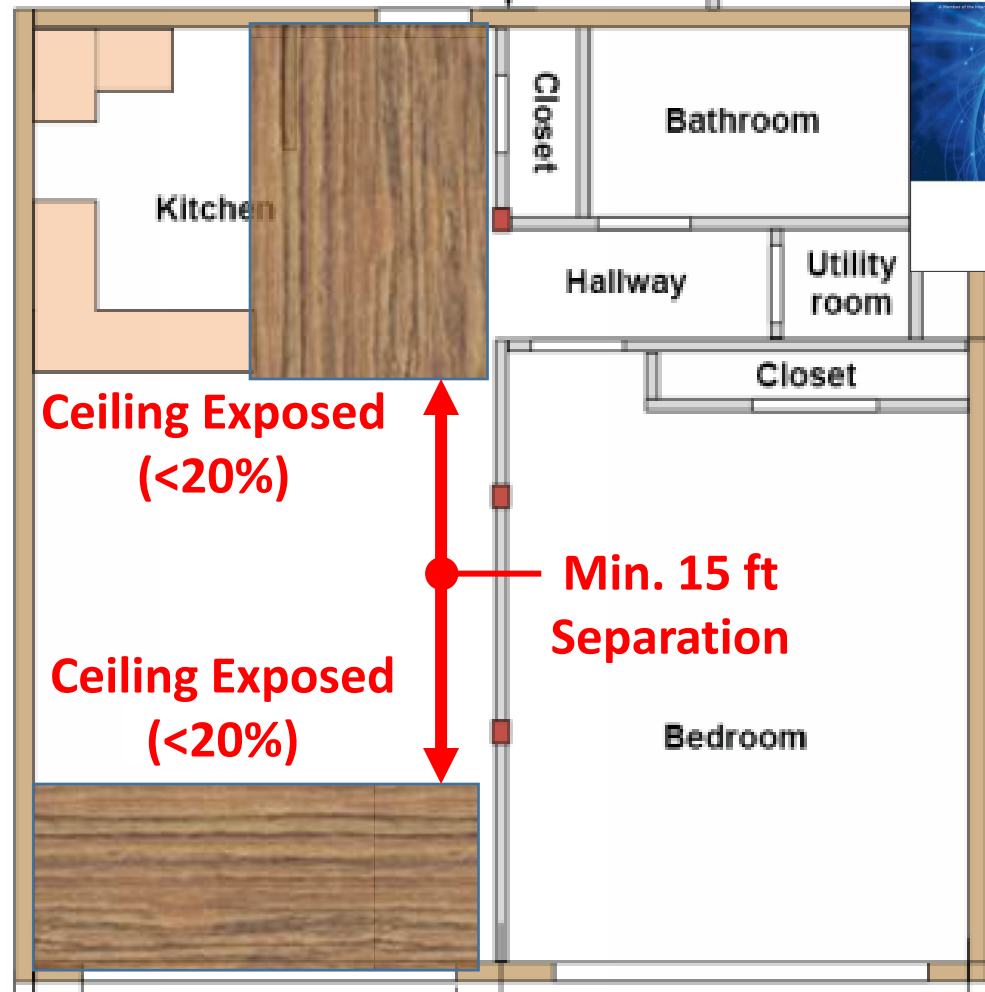
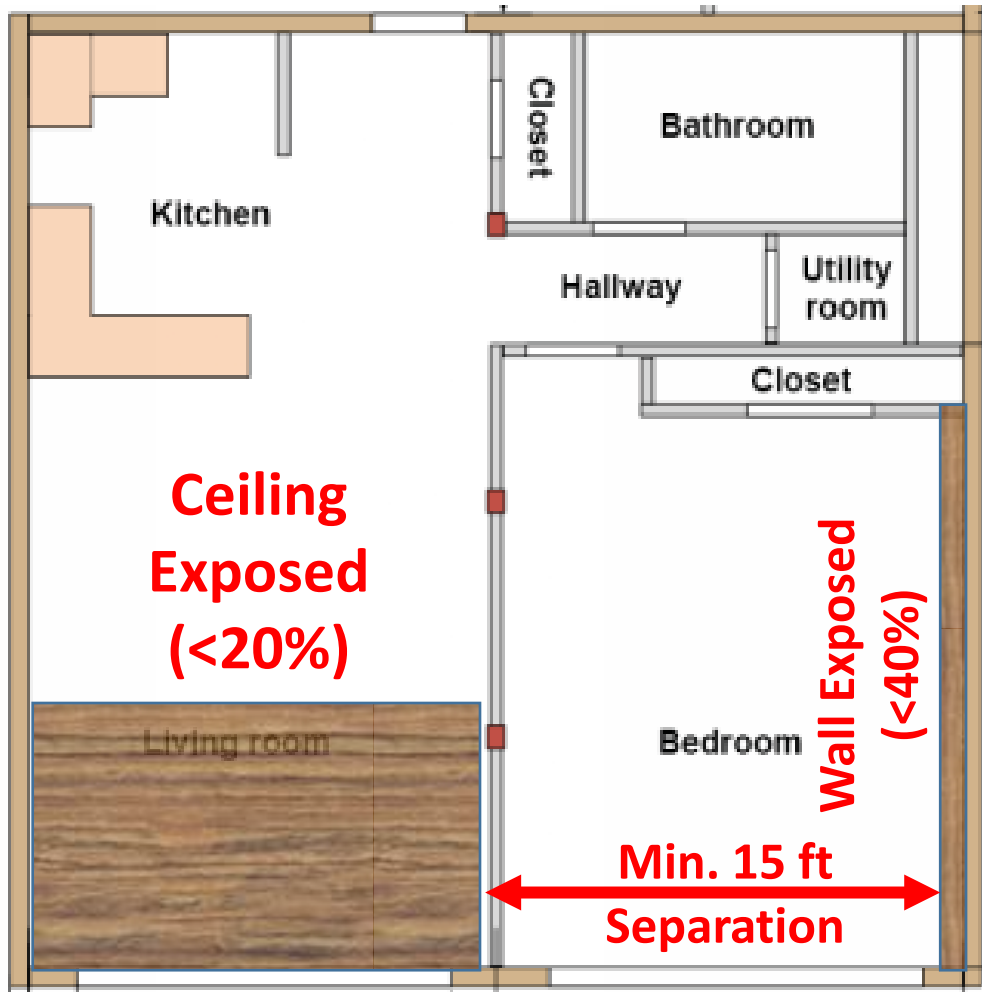
**602.4.2.2.4 Separation distance between unprotected *mass timber* elements.**

In each *dwelling unit* or *fire area*, unprotected portions of *mass timber* walls shall be not less than 15 feet (4572 mm) from unprotected portions of other walls measured horizontally along the floor.

2024 IBC eliminates need for 15 ft separation between exposed walls and ceilings, and between portions of exposed ceilings

# 2019-2022: REFINING THE CODE ROADMAP

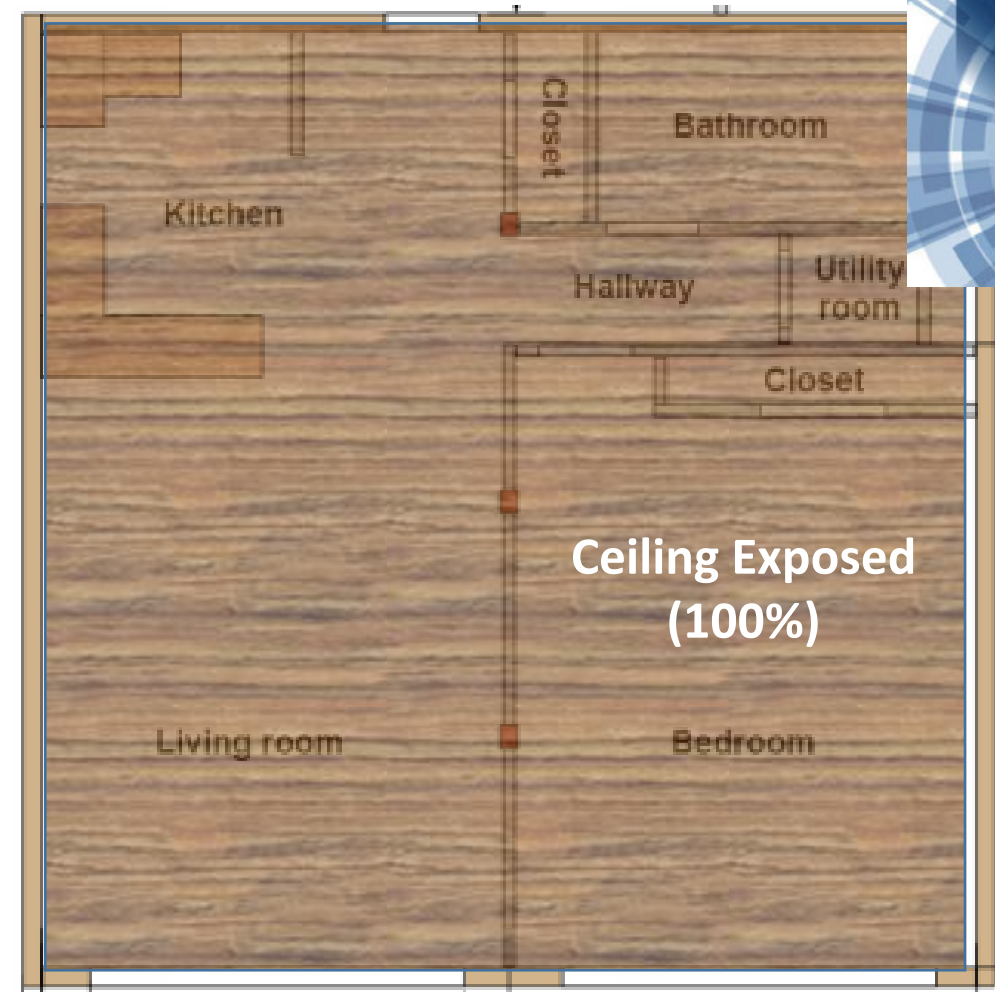
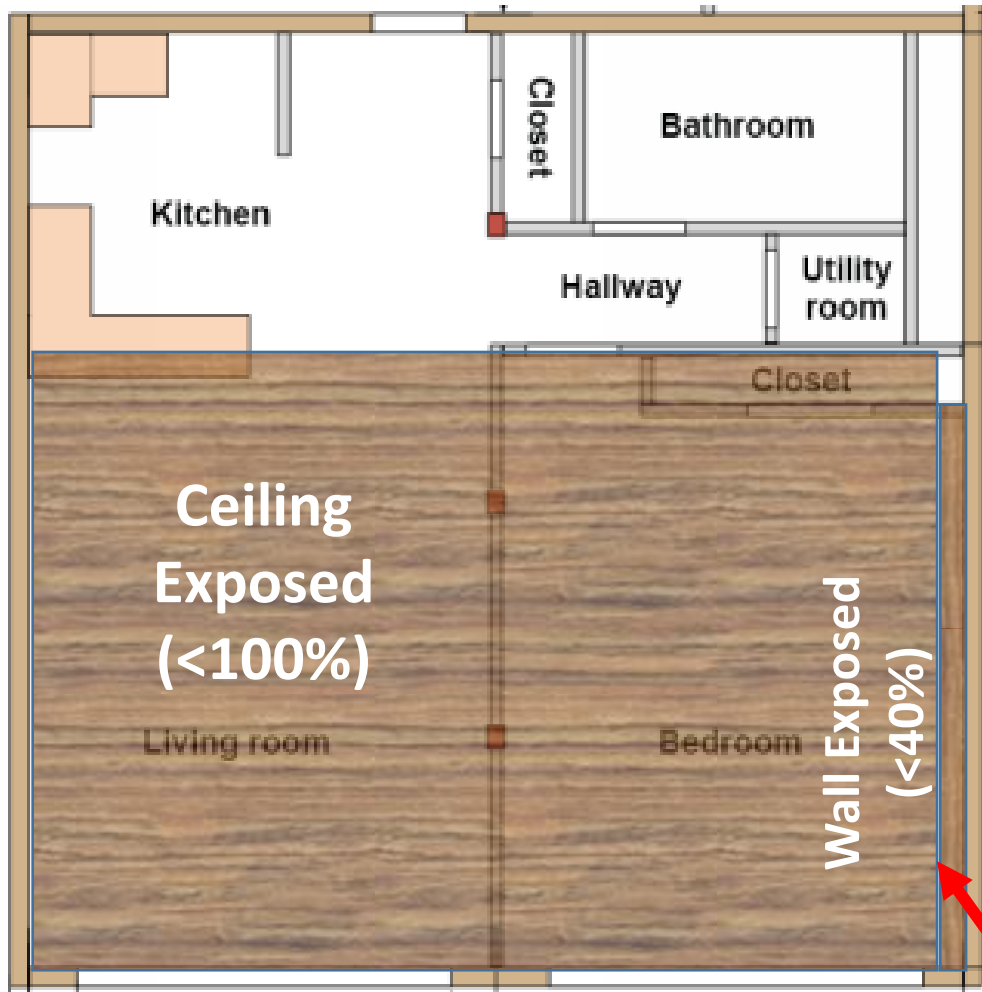
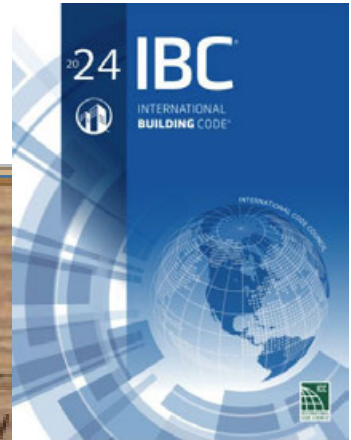
## 2021 IBC Allowances





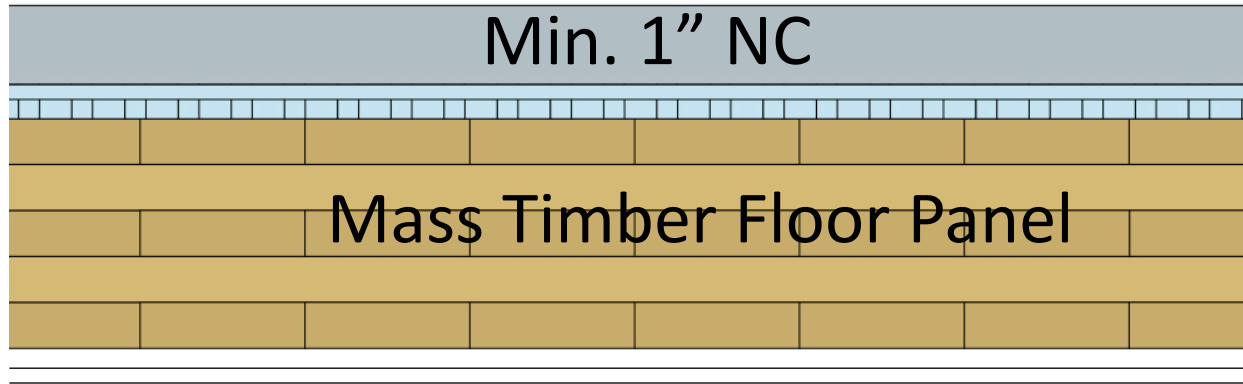
# 2019-2022: REFINING THE CODE ROADMAP

## 2024 IBC Allowances

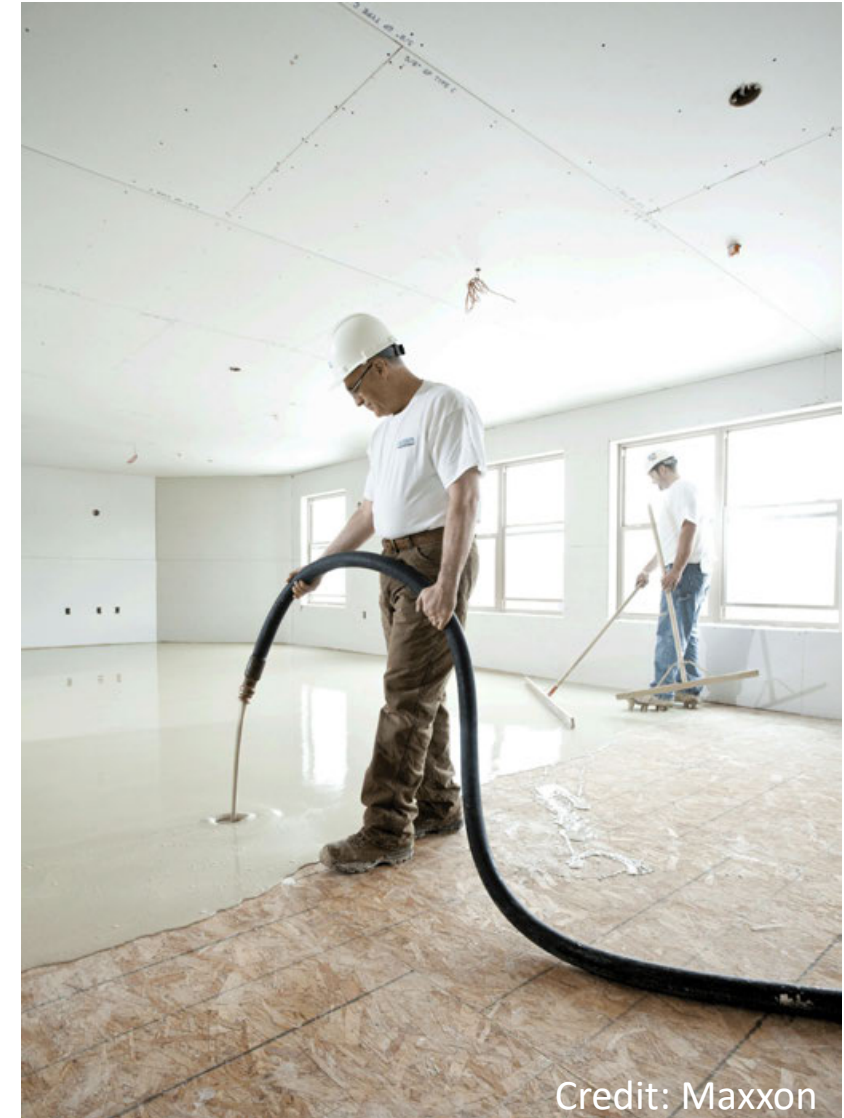


**No separation req'd between wall & ceiling**

# 2019-2022: REFINING THE CODE ROADMAP



**Min. 1" thick NC protection required  
on mass timber floors in IV-A and IV-B.  
Not required in IV-C**





# 2019-2022: REFINING THE CODE ROADMAP

## F174-21

IFC: 3303.5

**Proponents:** David Tyree, representing AWC (dtyree@awc.org); Raymond O'Brocki, AWC, representing AWC (robrocki@awc.org)

## Change to 2024 IBC: Sequencing of NC topping install

### 2021 International Fire Code

Revise as follows:

**3303.5 Fire safety requirements for buildings of Types IV-A, IV-B and IV-C construction.** Buildings of Types IV-A, IV-B and IV-C construction designed to be greater than six stories above *grade plane* shall comply with the following requirements during construction unless otherwise *approved by the fire code official*.

1. Standpipes shall be provided in accordance with Section 3313.
2. A water supply for fire department operations, as *approved by the fire code official and the fire chief*.
3. Where building construction exceeds six stories above *grade plane* and noncombustible protection is required by Section 602.4 of the *International Building Code*, at least one layer of noncombustible protection shall be installed on all building elements on floor levels, including mezzanines, more than four levels below active mass timber construction before additional floor levels can be erected.

#### **Exception- Exceptions:**

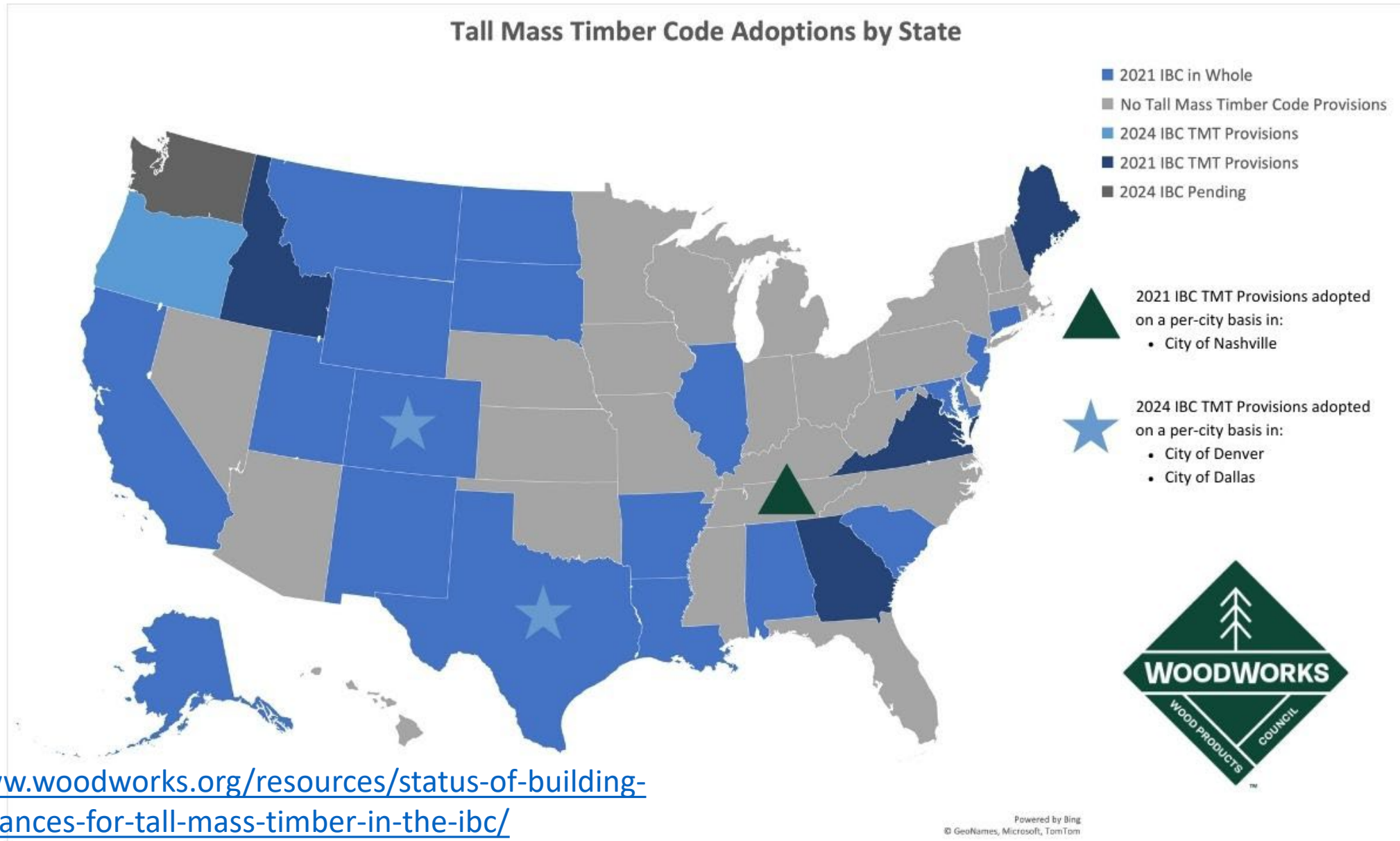
1. Shafts and vertical exit enclosures shall not be considered part of the active mass timber construction.
2. Noncombustible material on the top of mass timber floor assemblies shall not be required before erecting additional floor levels.

4. Where building construction exceeds six stories above *grade plane*, required exterior wall coverings shall be installed on floor levels, including mezzanines, more than four levels below active mass timber construction before additional floor levels can be erected.

**Exception:** Shafts and vertical exit enclosures shall not be considered part of the active mass timber construction.

Credit: ICC

# TALL MASS TIMBER CODE ADOPTIONS



<https://www.woodworks.org/resources/status-of-building-code-allowances-for-tall-mass-timber-in-the-ibc/>



# WHY ALL OF THE INTEREST?



Photo: WoodWorks  
Architect/Developer: oWOW



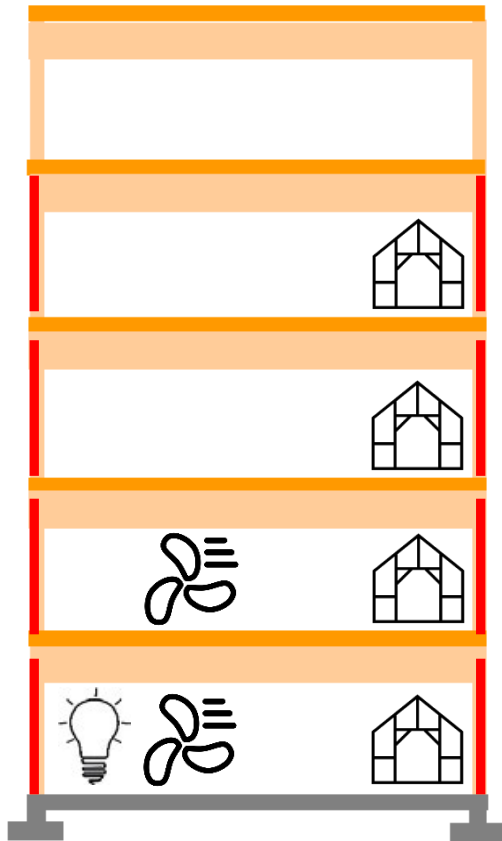
# Mass Timber: Structural Warmth is a Value-Add



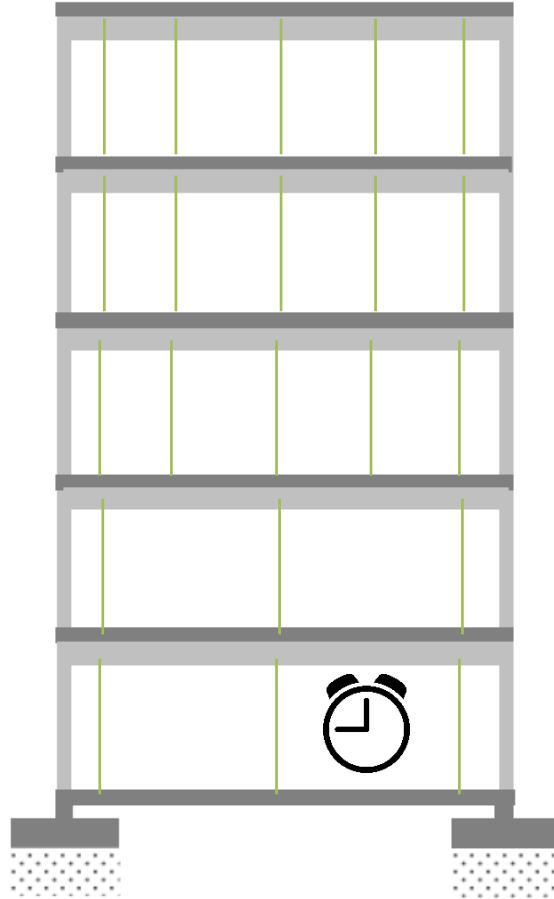


# Schedule Savings for Rough-In Trades

## Fast Construction



NO curing  
(mass timber)



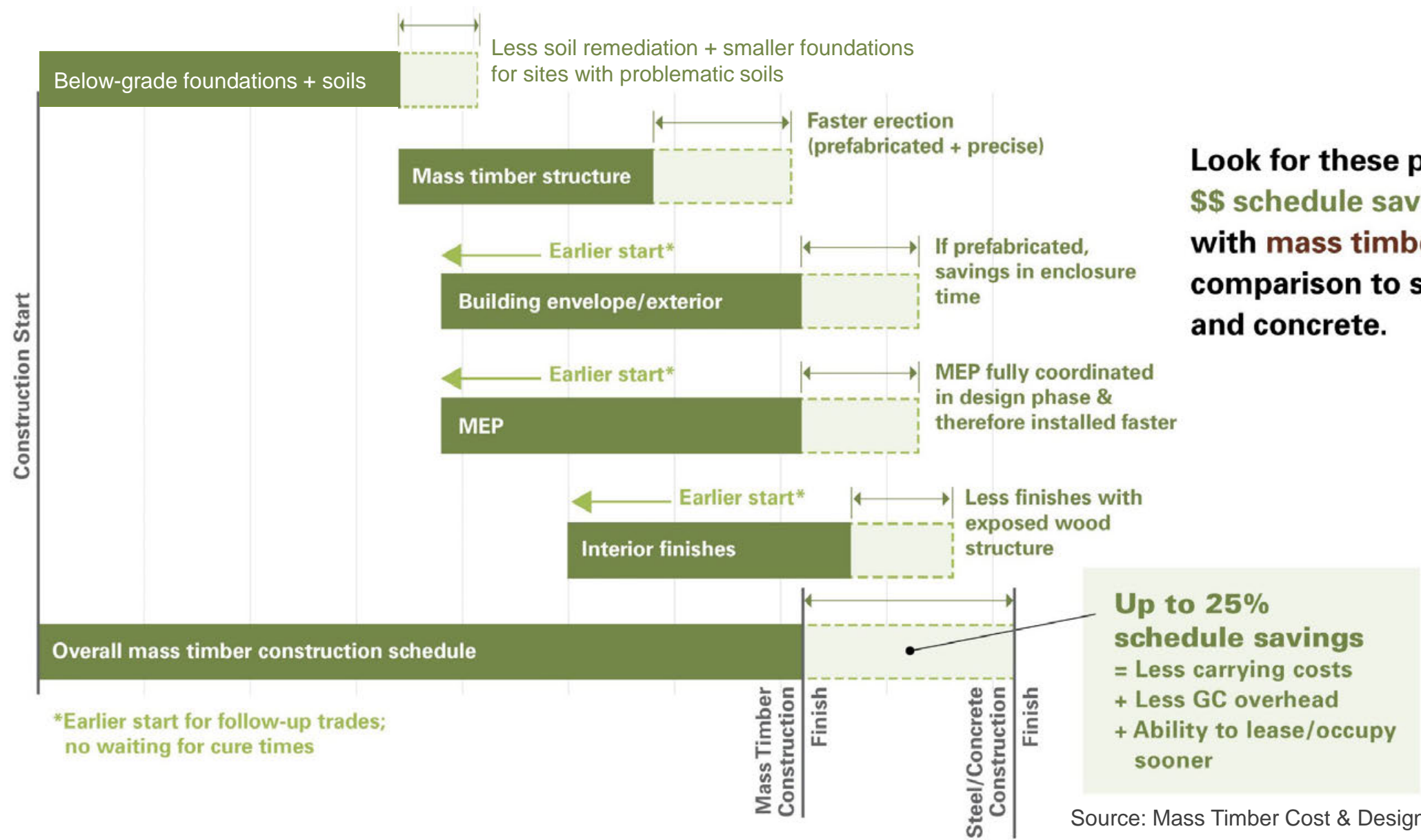
Curing & maze of  
shores (concrete)



Photo: WoodWorks

# Compressing the Typical Schedule

## Fast Construction





# Construction Impacts: Labor Availability



Photo: Lendlease



But is it cost competitive?





# Need to Consider Holistic Costs, Not Structure Only



\$/SF



\$/SF

*Image: GBD Architects*

# Risk Mitigation: Total Project Cost Analysis

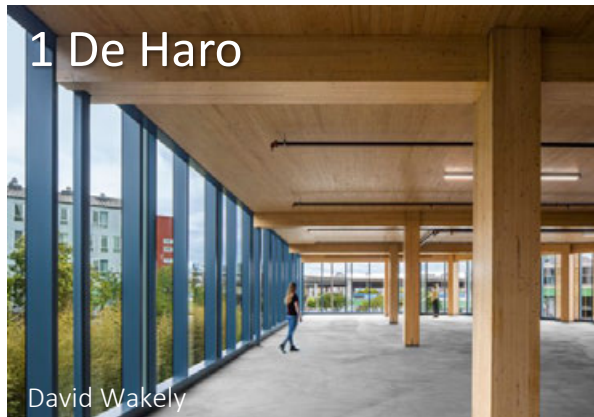
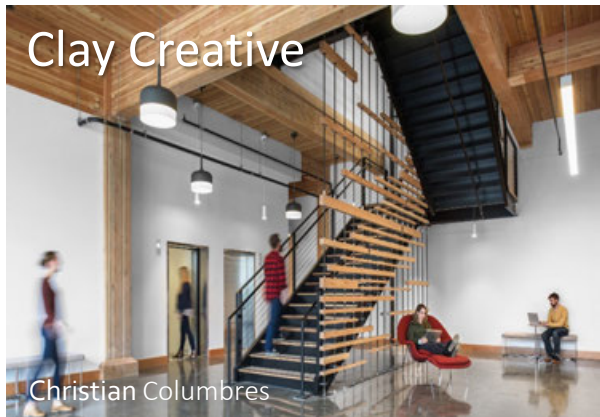
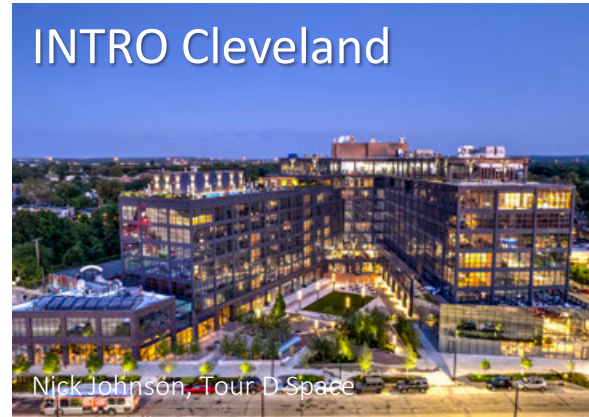
## CONSIDERATIONS:

- Ceiling Treatment
- Floor Topping
- HVAC System & Route
- Foundation Size
- Soil Improvements
- Exterior Skin Coordination
- Value of Time





# Mass Timber Business Case Studies



\$ Costs + \$ Returns  
Challenges,  
Lessons Learned, Successes

Scan code here  
to download the  
current package





# INTRO, Cleveland

CLEVELAND, OH



Nick Johnson, Tour D Space



## Mass Timber Business Case Study





# INTRO

Cleveland, OH

Building Facts 115 ft tall, 9 stories total (8 mass timber)

Type IV-B

Multi-Family Mixed-Use

Completed 2022

Developer Harbor Bay Ventures

Architect Hartshorne Plunkard Architecture

Engineer Forefront Engineering, Fast + Epp

General Contractor Panzica Construction

## Development Overview

- 9-story, 115' tall building
- 8 stories of CLT & glulam construction over a podium
- Strategy:
  - Create Cleveland's best, most distinctive urban living experience; a new level and bespoke brand
  - Combine best-in-city amenity package and contemporary interiors to appeal to health/wellness & entertainment-focused young professionals

### Property Information

Property timing	Completed Feb 2022
Submarket	Cleveland's Ohio City neighborhood
Construction Type	4-B over 1-A retail & parking
Site size	2.1 acres (FAR 5.5)
Gross building area	512,000 SF
Net rentable area (total)	279,000 SF



Nick Johnson, Tour D Space



# Quantitative Overview

Costs				
Total project cost		\$147,000,000		
		\$494,950/ unit		
Land Cost		\$10,450,000	@ appraised value	
		Market Standard*	Pro Forma	Realized**
Construction costs		\$212 / GSF	\$200 / GSF	\$215 / GSF
NOI				
Apartment		Market	Realized	
Rental rates				
	Studio	\$1,279	\$1,500 - \$1,750 (P.H. \$2,000)	~26% higher
	1-BR	\$1,631	\$1,675 - \$2,500 (P.H. \$5,700)	~28% higher
	2-BR	\$2,301	\$2,500 - \$5,200 (P.H. \$7,800)	~67% higher
	3-BR	\$3,334	\$8,800 - \$19,500 P.H.	~324% higher
Occupancy at stabilization		91%	98%	~7% higher
Parking Revenue		Market	Pro Forma	Realized**
Included or in addition to lease?		Additional	Additional	Additional
Rate		\$175 / lot / month	\$185 - \$200 / lot / month	\$225 - \$375 / lot / month
Retail		Market	Pro Forma	Realized**
Retail rental rates		\$30 - \$40 / RSF/YR	\$45 / RSF/YR	\$45 / RSF/YR
Rent type (e.g., NNN)		NNN & Gross	NNN	NNN
Expenses		\$7 - \$10 / RSF/YR	\$8 / RSF/YR	\$8 / RSF/YR
Tenant improvement allowance		\$40 - \$50 / RSF	\$150 / RSF	\$150 / RSF
Occupancy after 12 months		60% - 70%	90%	75%

\*Market standard costs refer to normal cost to build for subject's use, irrespective of structural approach.

\*\*Realized metrics at stabilization

\*\*\*Conversations with local building officials were held concurrent to land use entitlement approvals processes such that the overall building code review process was only slightly longer. This concurrent approach was essential given that Ohio was not adopting the 2021 IBC, so the Type 4 code path was performance-based, albeit a mirror of what other states have adopted.

Return Performance				
	Market	Pro Forma	Realized**	
Yield on cost – untrended	6.25%	7.00%	7.35%	
Cap rate	4.75%	4.50%	TBD	
Value/rentable SF	\$550 / RSF	\$717 / RSF	TBD (\$800+ / RSF)	
Leverage	65%	65%	N/A	

Timeline		
	Date	Context/Comment
Date of conception (first dollar spent)	Mid 2018	Mid-cycle
Date underwriting finalized (go/no-go decision)	Mid 2019	Mid-cycle
Date equity capital secured	N/A	Developer is equity
Permitting duration***	3 + 6 mo.	Demolition permit first, then building permit
GMP in place	Feb/March 2020	COVID
Construction start	April 2020	
Duration of construction	24 months	Faster by about 2 months
Construction completed	April 2022	Early-cycle
Date stabilized (80% occupancy, NOI, or at pro forma or refinanced)	June 2022	Faster

Project Context	
Unparalleled leasing velocities at significant premiums	
<ul style="list-style-type: none"> <li>The project was 90% leased 4 months after completion</li> <li>The premium product drives both velocity and rates with rents significantly higher than market counterparts</li> <li>Leasing velocity allowed refinancing activities to start 3 months after completion</li> </ul>	

## Unparalleled leasing velocities at significant premiums

**Disclaimer:** Information herein was provided by the developer and verified for reasonableness by a third-party expert. Market data and figures have been reviewed by an independent third party utilizing industry standard resources. For additional sources and disclaimers, see the *Basis of Information* page for this case study and the *Disclosures, Disclaimers and Confidentiality* page at the end of this case study package.

## Mass Timber Business Case Study

# Exceptional Leasing Velocity and Premiums

## Lessons Learned

- **Schedule Savings:** Anticipated schedule savings not fully achieved - subcontractors had not shifted approaches
- **Critical paths:** Exterior cladding system required multiple subcontractors & erection did not keep up w/ speed of timber structure; faster (unitized) skin would be better

## Challenges

- **International shipping:** Issues during COVID delayed delivery; assurances compromised by lowest cost bid
- **Moisture Protection:** Laborious repairs required due to insufficient water management

## Successes

- **Fast lease-up:** 60% pre-leased & stabilized after 4 months
- **Premiums:** Achieved rent premiums in market



Nick Johnson, Tour D Space



# What's the 'Sweet Spot' for Tall Mass Timber?

Depends on many factors:

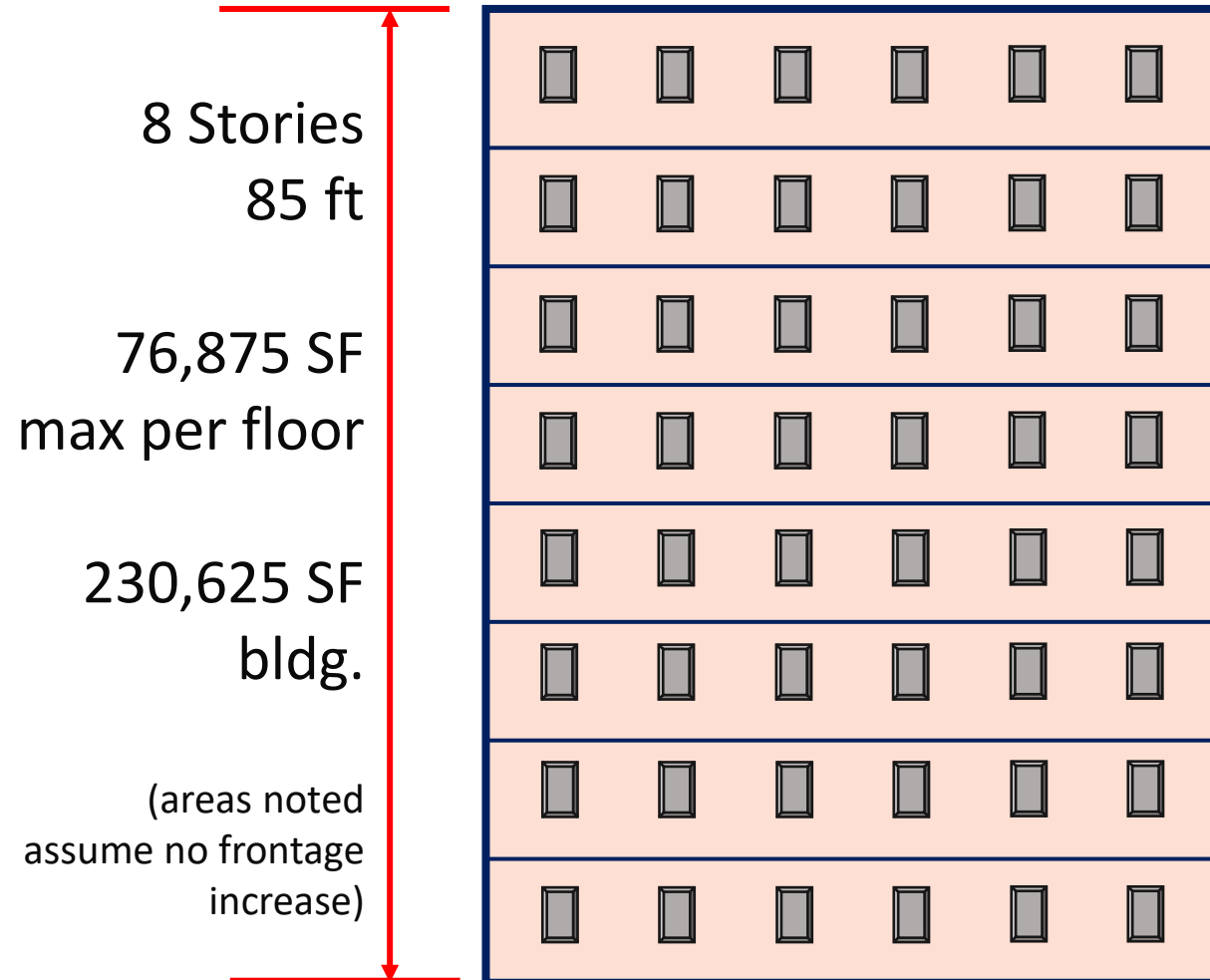
- Project Use
- Site Constraints
- Local Zoning & FAR Limitations
- Budget
- Client Objectives for Sustainability, Exposed Timber
- And More...

But Some General Trends Could Be:

80 M Street, SE, Washington, DC  
Photo: Hickok Cole | Architect: Hickok Cole

# Type IV-C Tall Mass Timber

## Example R-2, Type IV-C Building



Not Likely to Utilize Podium Due to Overall Building Height Limit (85 ft) Relative to # of Timber Stories (8)

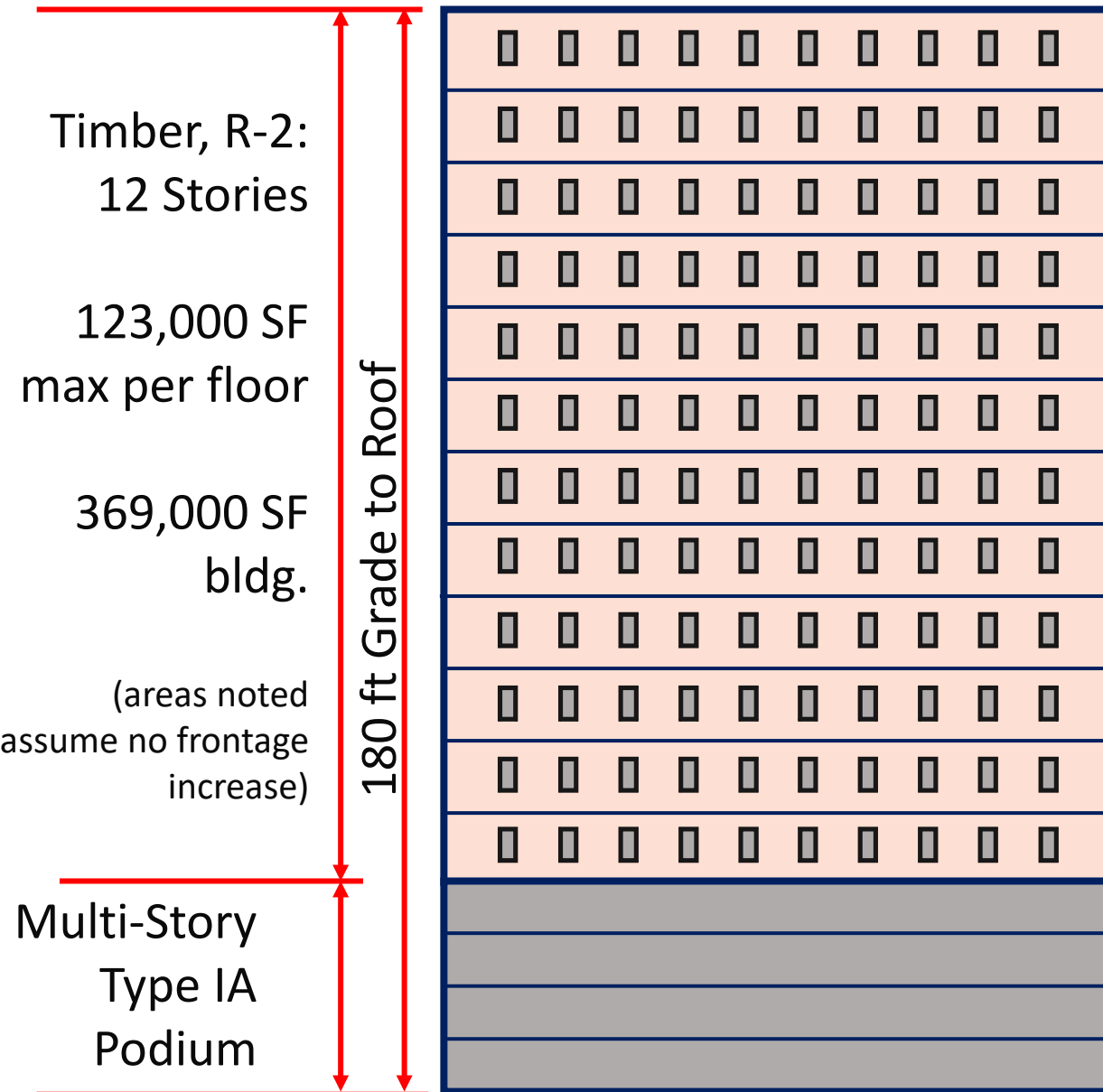
Same Overall Building Height Limit as IV-HT (85 ft) but higher Fire-Resistance Ratings Req'd

3 Additional Stories Permitted Compared to IV-HT

All Timber Exposed



# Type IV-B Tall Mass Timber



## Example Mixed-Use, Type IV-B Building

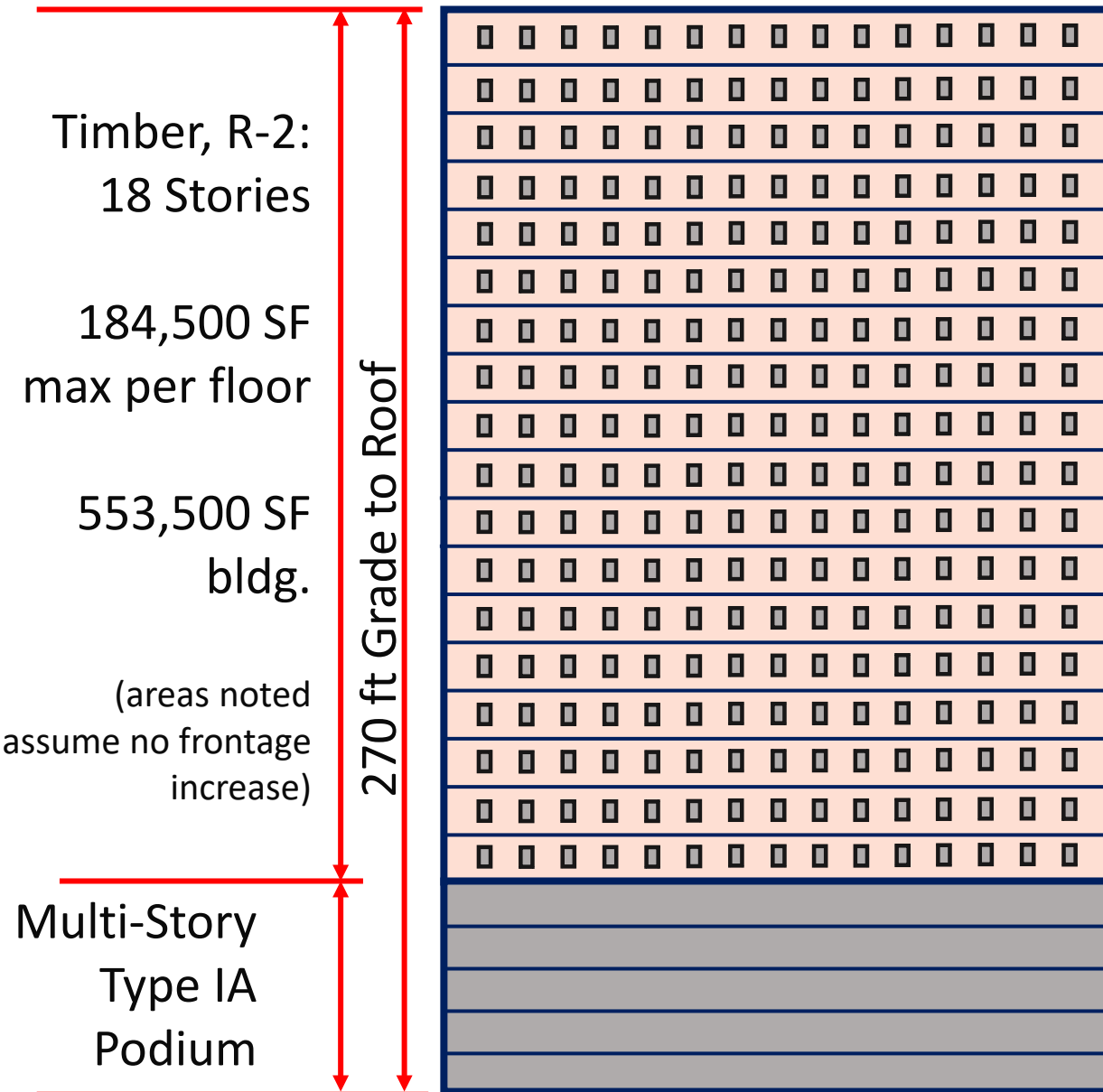
Likely to Utilize Podium Due to Overall Building Height Limit (180 ft) Relative to # of Timber Stories (12)

Same Fire-Resistance Ratings Req'd as IV-C But Limitations on Timber Exposed

4 Additional Stories Permitted Compared to IV-C

Limited Timber Exposed

# Type IV-A Tall Mass Timber



## Example Mixed-Use, Type IV-A Building

Likely to Utilize Podium Due to Overall Building Height Limit (270 ft) Relative to # of Timber Stories (18)

Higher Fire-Resistance Ratings Req'd than IV-B For Primary Frame

6 Additional Stories Permitted Compared to IV-B

No Exposed Timber Permitted



# 2022 AND BEYOND: PROJECTS RISING



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



# TALL WOOD

## LEGEND :

STORIES OF WOOD /  
MASS TIMBER

TOTAL STORIES  
OF BUILDING

# / #



WoodWorks is supporting 222 tall wood projects in design and 16 projects under construction or built.



2016

2019

2020

2022

2023

2024

2025



# 11 E Lenox

Boston, MA

Monte French Design Studio  
H+O Structural Engineers  
Photo Jane Messinger







# 11 E Lenox

Boston, MA

43,000 sf, 7 stories wood

Type III-A with code modifications

Multi-Family

Completed 2023



Monte French Design Studio  
H+O Structural Engineers  
Photo Jane Messinger





# Heartwood

Seattle, WA

atelierjones LLC  
DCI Engineers  
Image: atelierjones LLC





# Heartwood

Seattle, WA

atelierjones LLC  
DCI Engineers  
Image: atelierjones LLC

66,000 sf, 8 stories

Type IV-C

Workforce Housing

MT / CLT

Wood construction: 1 day per floor

Completed 2023





# BAKERS PLACE

## MADISON, WI

Angus-Young  
Michael Green Architecture  
Equilibrium Consulting  
Photo Michael Green Architecture





# Bakers Place

Madison, WI

304,800 sf,

15 stories total (12 mass timber)

Type IV-B

Multi-Family

Passive House



Angus-Young  
Michael Green Architecture  
Equilibrium Consulting  
Photo Michael Green  
Architecture





# 1510 Webster

Oakland, CA

oWow  
DCI Engineers  
Photo: Flor Projects



# 1510 Webster

Oakland, CA

- » 16 stories mass timber, 1 level steel over two-level concrete
- » Designed with Tall Wood code provisions in the 2021 IBC
- » Mass timber with concrete cores and staircases



Photos: Flor Projects

oWow  
DCI Engineers



# Ascent

## Milwaukee, WI

Korb + Associates Architects  
Thronton Tomasetti  
Photo: C.D. Smith Construction







# Ascent

Milwaukee, WI

493,000 sf, 25 stories total (19 mass timber)

Type IV-HT with code modifications

Multi-Family

Completed 2022



Korb + Associates Architects  
Thronton Tomasetti  
Photo: VRX Media Group

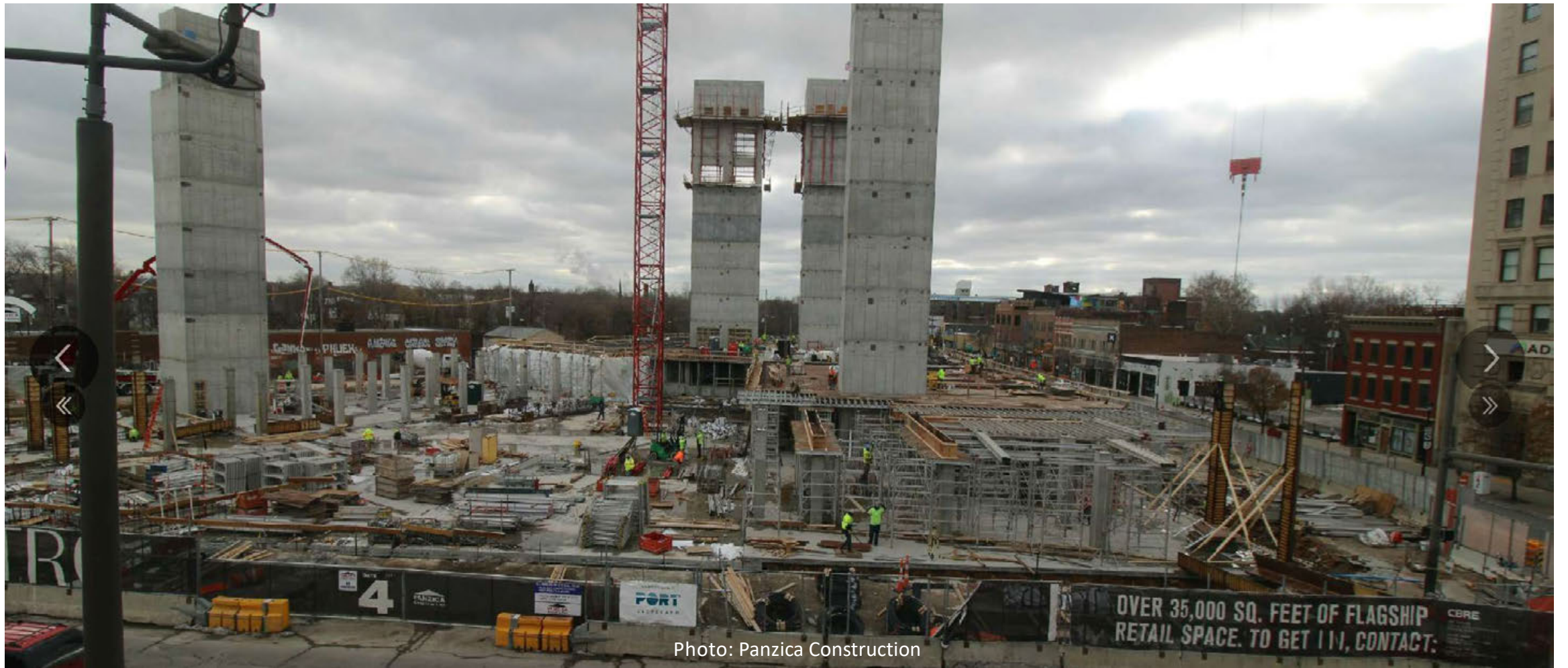


# Outline

- » Tall Wood Introduction
- Lateral Systems in Tall Wood
- » Connections in Tall Wood
- » Penetrations in Tall Wood
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- » Joints and Intersecting Elements
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- » Acoustical Design

# INTRO – Cleveland, OH

# Concrete Core Shear Walls





# Carbon12 – Portland, OR

## Buckling-Restrained Braced Frame



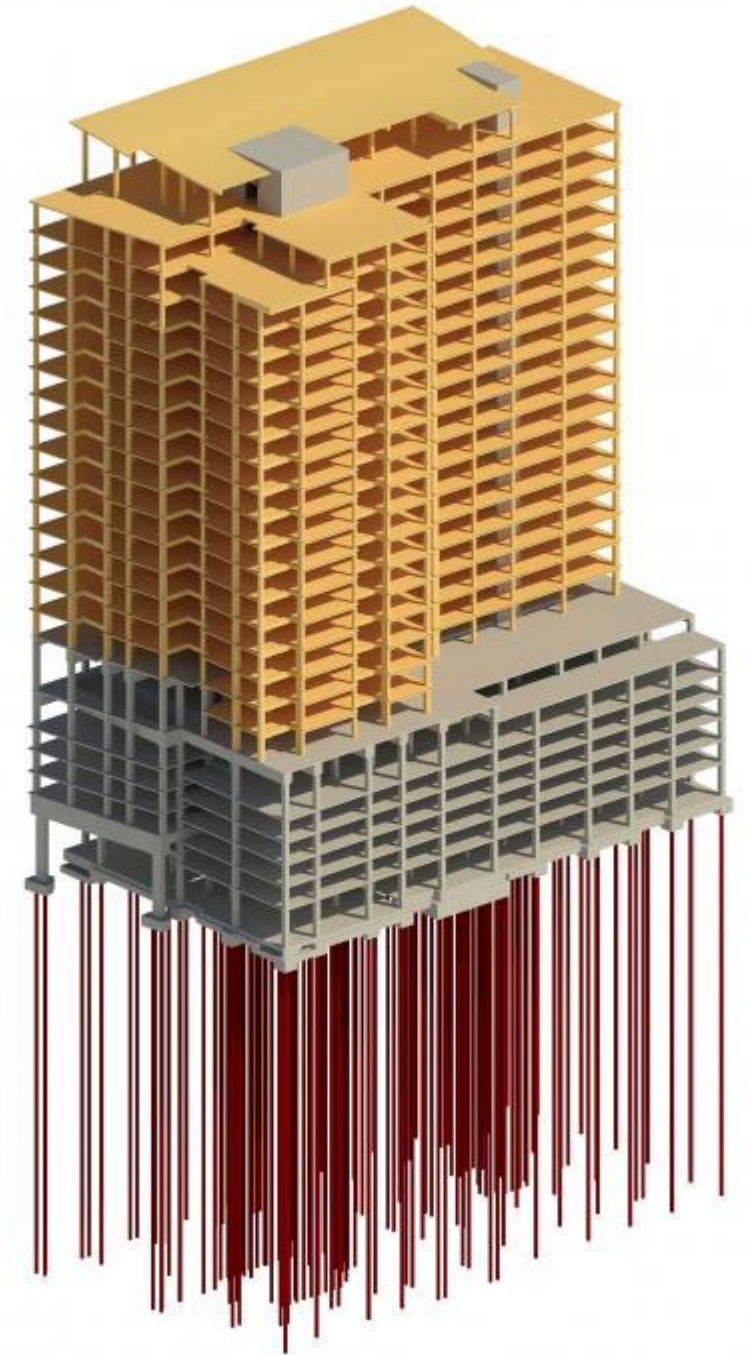


# Ascent – Milwaukee, WI

Concrete Core Shear Walls



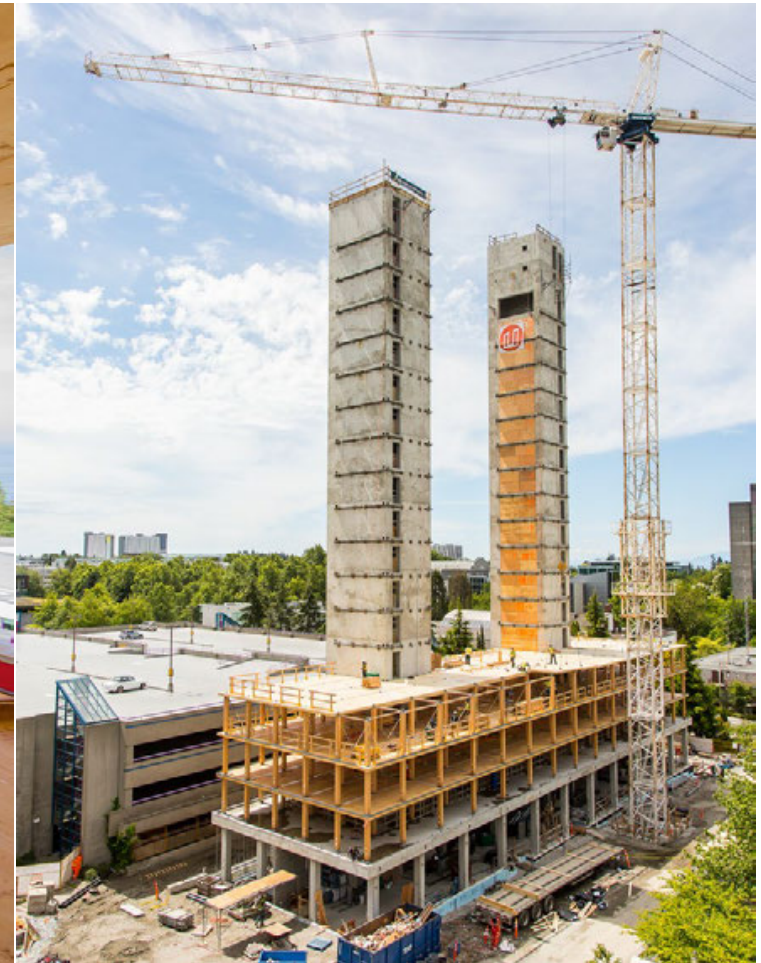
Photos: Korb + Associates, Thornton Tomasetti





# Brock Commons – Vancouver, BC

## Concrete Core Shear Walls



Photos: Acton Ostry Architects

# Future Potential Lateral System for Tall Wood

## Mass Timber Rocking Shear Walls

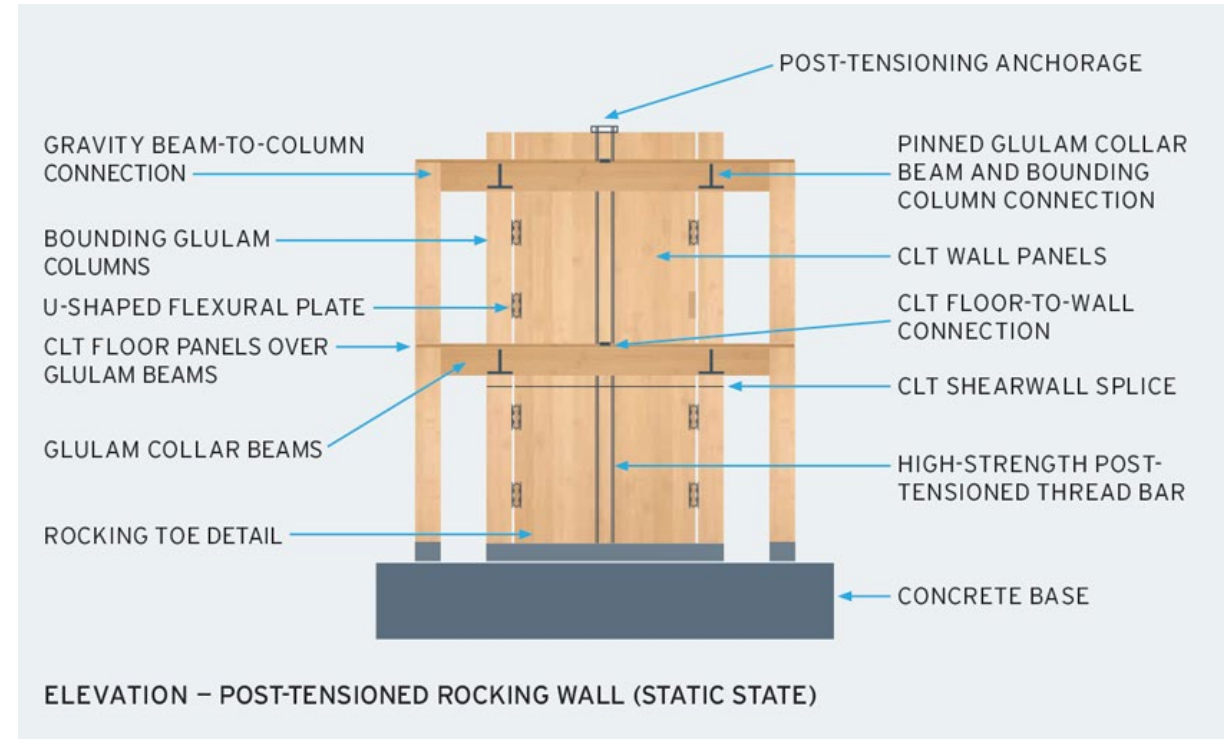


Image: KPFF



# Considerations for Lateral Systems

## Prescriptive Code Compliance

Concrete Shear Walls



Steel Braced Frames



CLT Shear Walls (65 ft max)



CLT Rocking Walls



2021 SDPWS  
ASCE 7-22

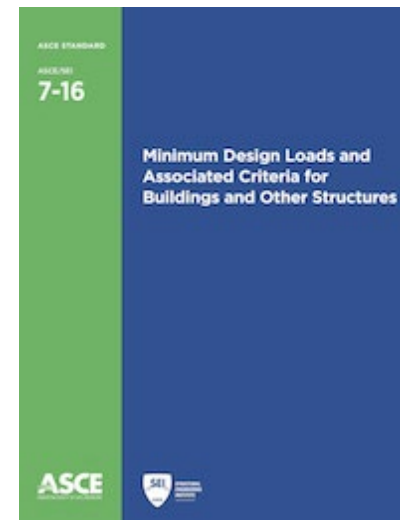
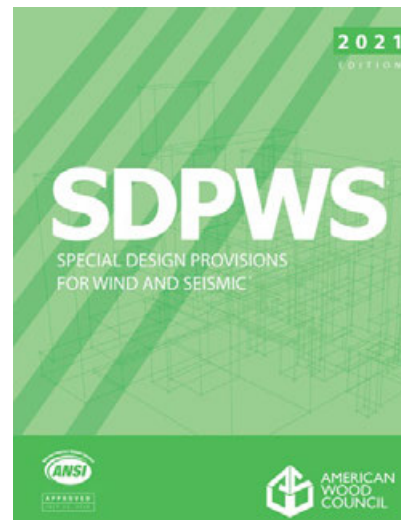


Photo: WoodWorks

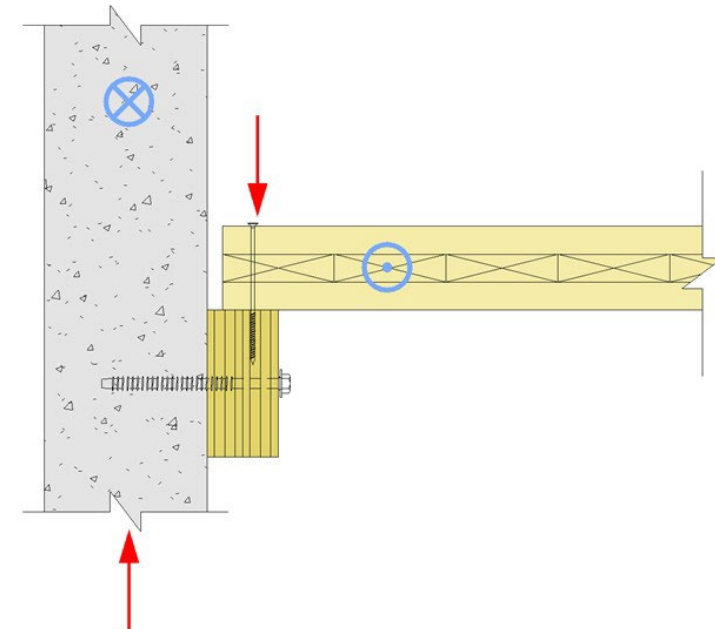
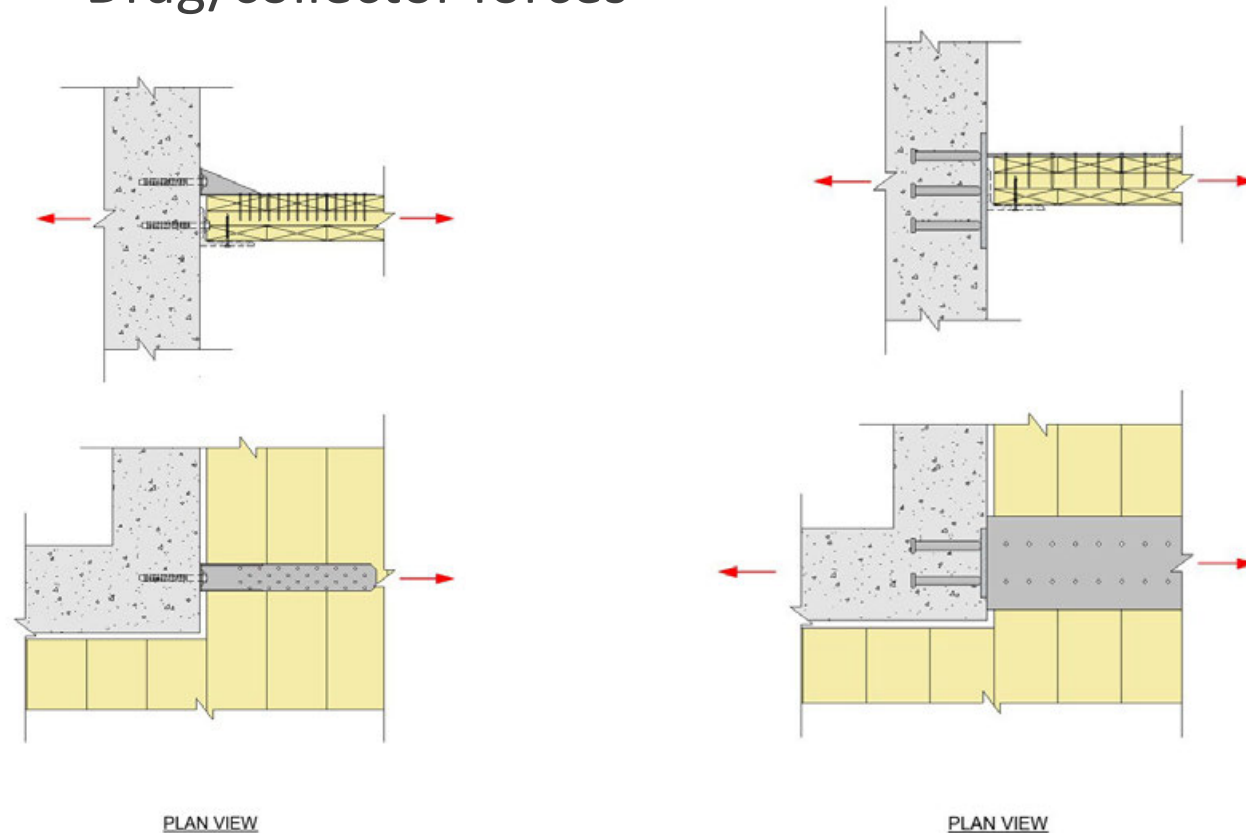


Photo: Acton Ostry Architects

# Considerations for Lateral Systems

Connections to concrete core

- » Tolerances & adjustability
- » Drag/collector forces





# Considerations for Lateral Systems

Connections to steel frame

- » Tolerances & adjustability
- » Ease of installation

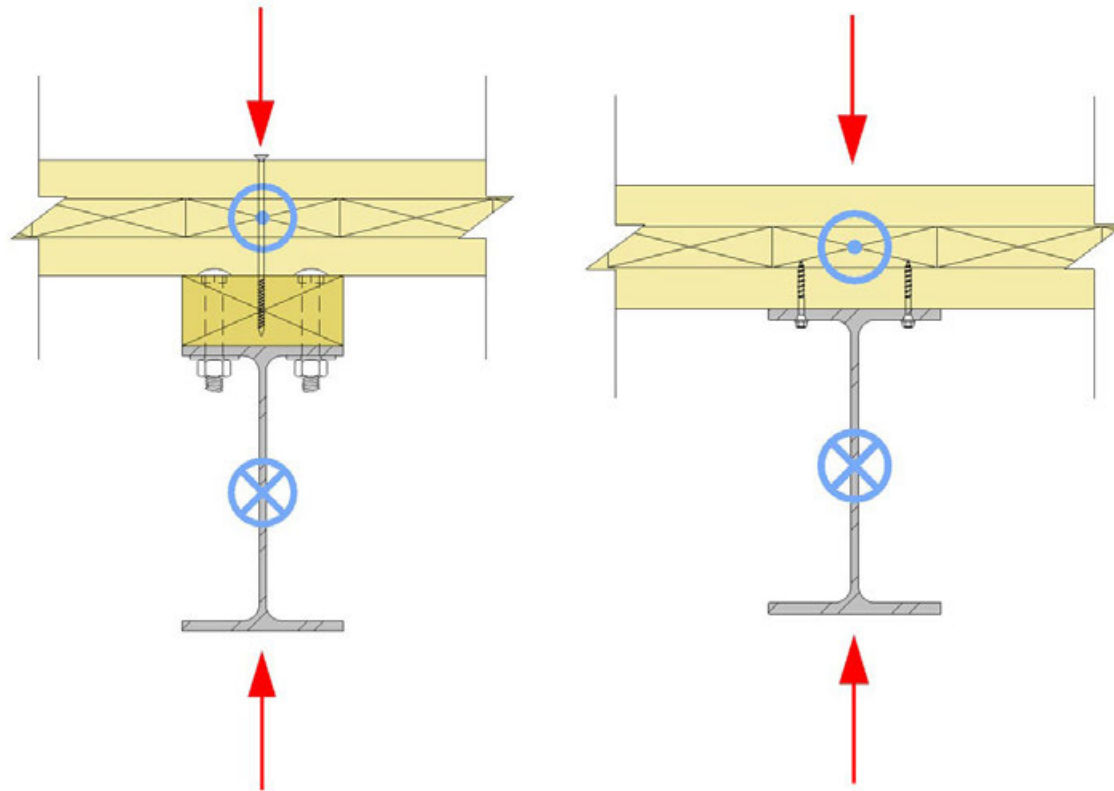
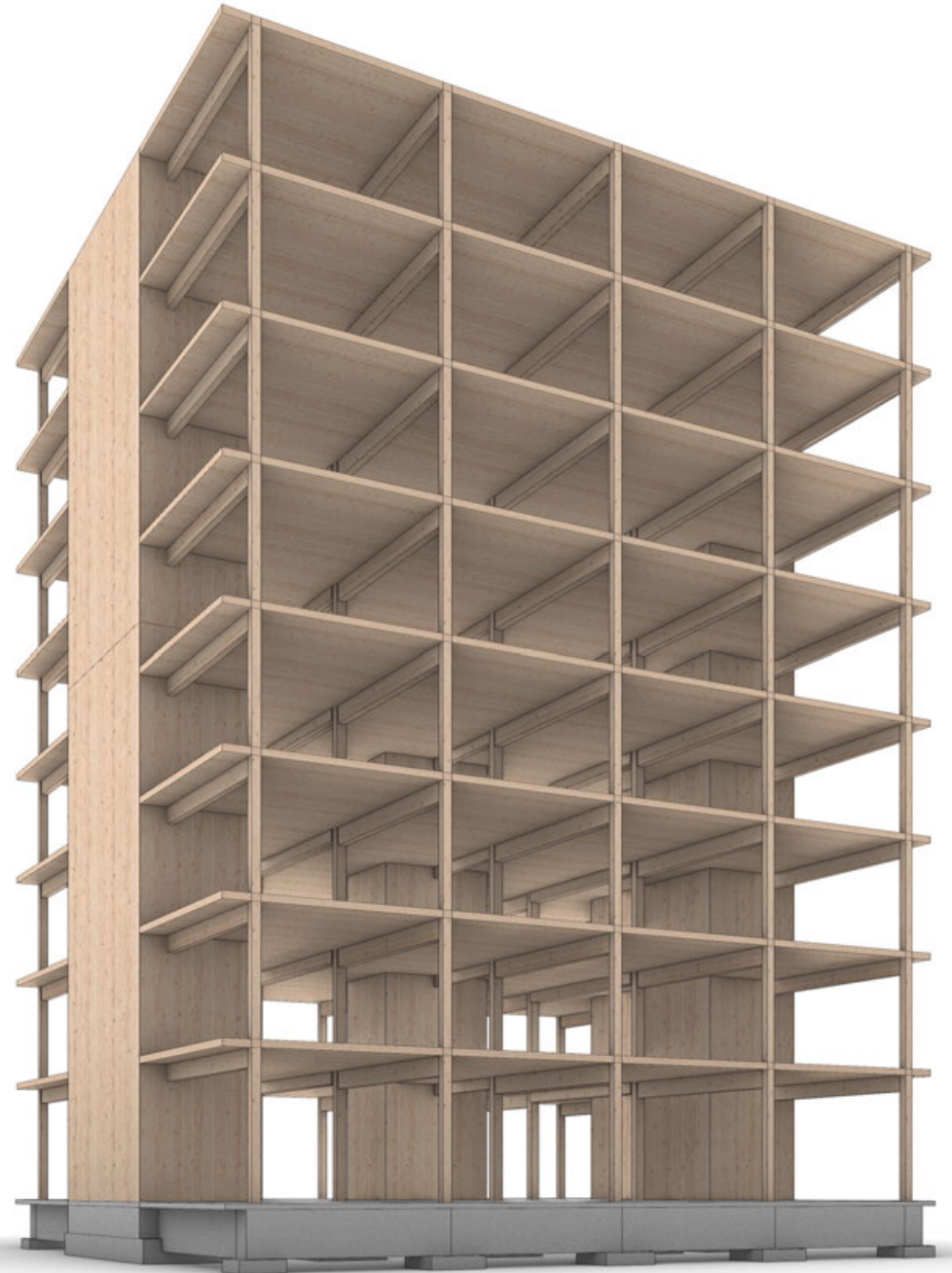


Photo: Marcus Kauffmann, ODF

# Shaft Enclosures in Tall Timber

- » When can shaft enclosures be MT?
- » What FRR requirements exist?
- » If shaft enclosure is MT, is NC required?





# Tall Wood Shaft Enclosures



Exit & Hoistway Enclosures

E&H Enclosures FRR

IV-A

IV-B

IV-C

<p>Up to 12 Stories or 180 ft: MT protected with 2 layers 5/8" type X gyp (if 2 HR req'd) or 3 layers 5/8" type X gyp (if 3 HR req'd) both sides</p> <p>Above 12 Stories or 180 ft: Noncombustible shafts (IBC 2021 602.4)</p>	<p>NC or MT protected with 2 layers 5/8" type X gyp (IBC 2021 602.4.2.6) both sides</p>	<p>NC or MT protected with 1 layer 5/8" type X gyp (IBC 602.4.3.6) both sides</p>
<p>2 HR (not less than FRR of floor assembly penetrated, IBC 713.4)</p>		

# Shaft Enclosure Design in Tall Timber



## 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*.<sup>1</sup> 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.

#### 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 construction can be found in both the shaft enclosures section (713.3) and fire barriers section (707.2) of the code. These sections state that fire barriers can be constructed of any material permitted by the building’s type of construction. One of the baseline requirements for tall wood structures utilizing construction Types IV-A, IV-B, or IV-C is that they be constructed of either mass timber or noncombustible materials (or a combination thereof).



*Generate Architecture and Technologies • MIT – John Klein*

A relatively new category of wood products, mass timber can encompass well known and widely used products such as glued-laminated timber (glulam) and nail-laminated timber (NLT), as well as newer panelized products such as cross-laminated timber (CLT). The definition of mass timber adopted for the 2021 IBC is:

*Structural elements of Type IV construction primarily of solid, built-up, panelized or engineered wood products*



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  - » Acoustical Design

# Connection Fire Protection

In Construction Types IV-A, IV-B & IV-C, building elements are required to be FRR as specified in IBC Tables 601 and 602.

Connections between these building elements must be able to maintain FRR no less than that required of the connected members.

## **16.3 Wood Connections**

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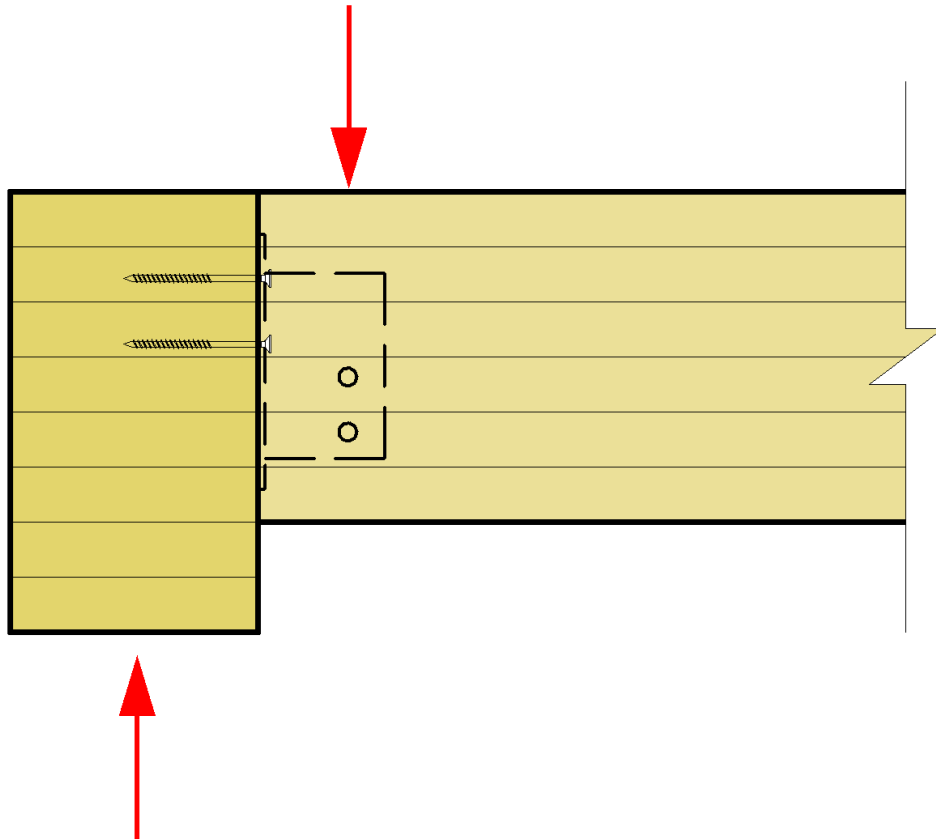
Photo: MyTiCon

Wood connections, including connectors, fasteners, and portions of wood members included in the connection design, shall be protected from fire exposure for the required fire resistance time. Protection shall be provided by wood, fire-rated gypsum board, other approved materials, or a combination thereof.



# Connection Fire Protection

Steel hangers/hardware fully concealed within a timber-to-timber connection is a common method of fire protection



# Connection Fire Protection

Many ways to demonstrate connection fire protection:  
calculations, prescriptive NC, test results, others as approved by AHJ



Photo: John Stamets



Photo: Josh Partee



Photo: Christian Columbres

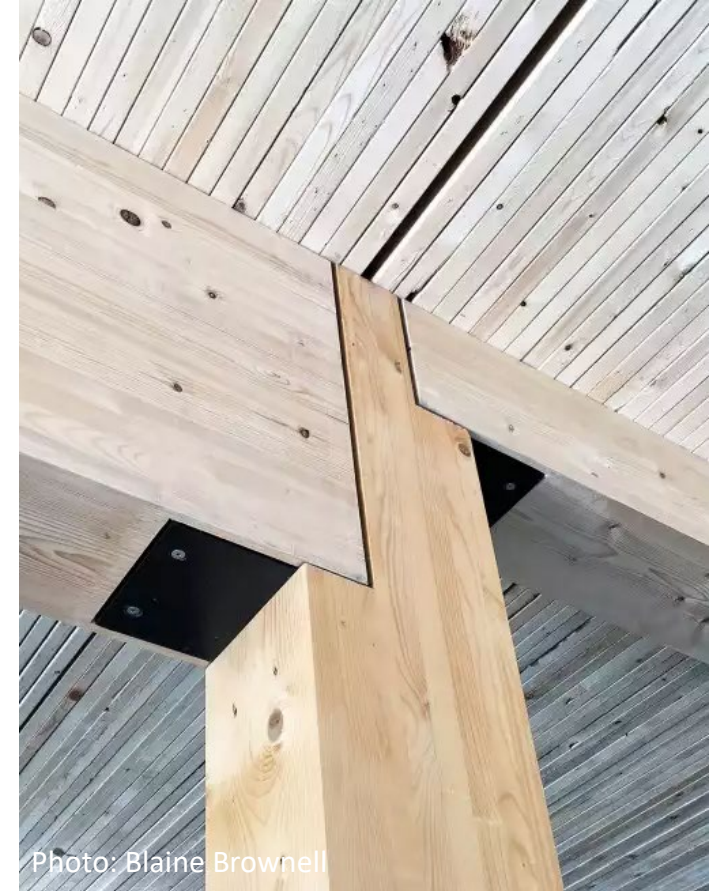


Photo: Blaine Brownell



# Connection Fire Protection

2017 Glulam Beam to Column Connection Fire Tests under standard ASTM E119 time-temperature exposure



Photo: ARUP/SLB



# Mass Timber Connections Index

A library of commonly used mass timber connections with designer notes and information on fire resistance, relative cost and load-carrying capacity.

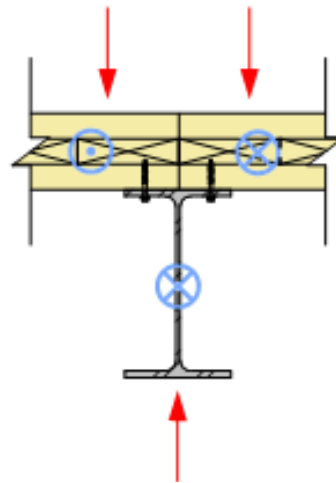
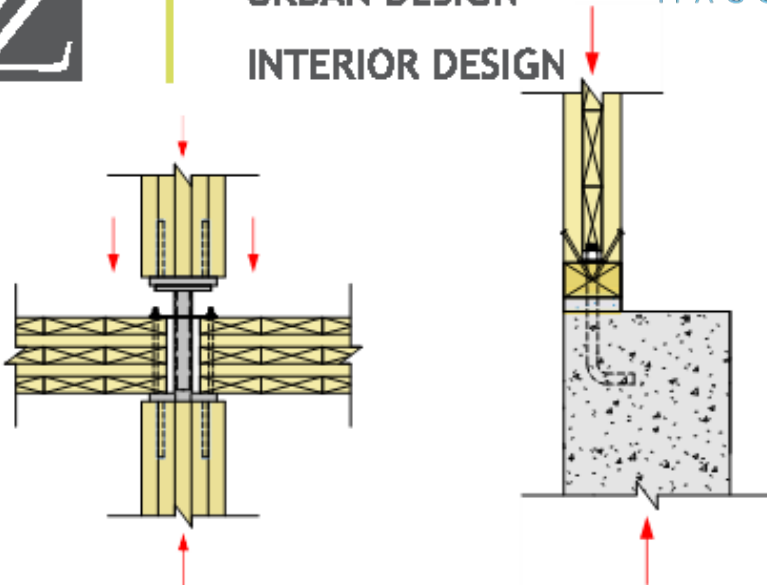


**KL&A**  
Engineers & Builders



ARCHITECTURE  
URBAN DESIGN  
INTERIOR DESIGN

**SWINERTON**  
MASS TIMBER



WoodWorks Index of  
Mass Timber Connections





# Connections

Other connection design considerations:

- » Structural capacity
- » Shrinkage
- » Constructability
- » Aesthetics
- » Cost

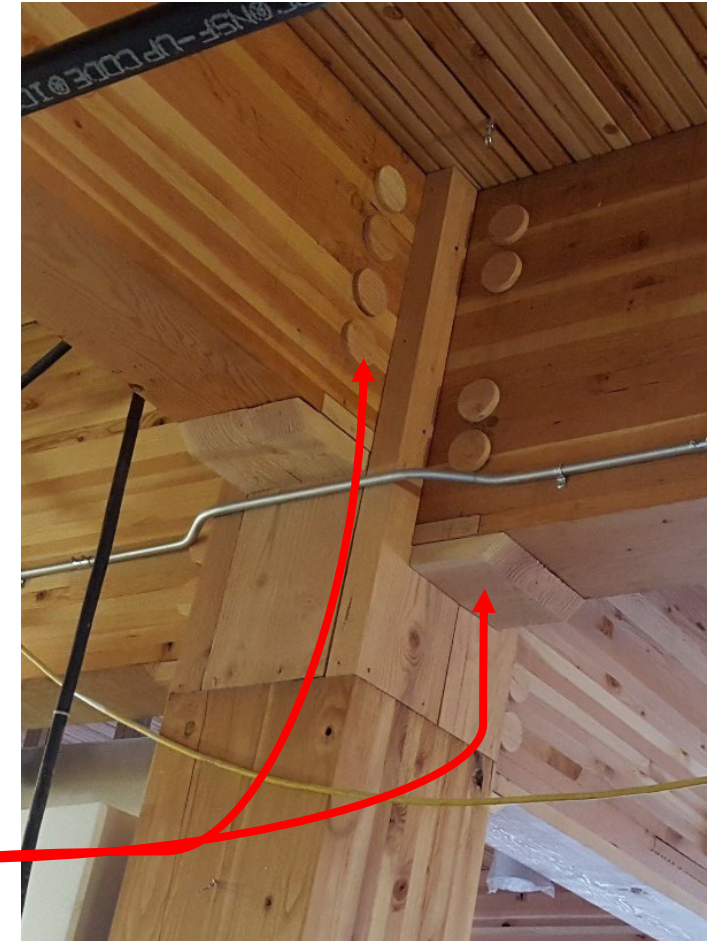


# Tall Mass Timber Inspections

Wood Connection Coverings for Fire-Resistance

**110.3.5 Type IV-A, IV-B, and IV-C connection protection inspection.** In buildings of Type IV-A, IV-B, and IV-C Construction, where connection fire resistance ratings are provided by wood cover calculated to meet the requirements of Section 2304.10.1, inspection of the wood cover shall be made after the cover is installed, but before any other coverings or finishes are installed.

Inspection of Wood Coverings





# Tall Mass Timber Special Inspections

Table is only required for Type IV-A, IV-B, and IV-C

**TABLE 1705.5.3**  
**REQUIRED SPECIAL INSPECTIONS OF MASS TIMBER CONSTRUCTION**

<b><u>Type</u></b>	<b><u>Continuous Special Inspection</u></b>	<b><u>Periodic Special Inspection</u></b>
<u>1. Inspection of anchorage and connections of mass timber construction to timber deep foundation systems.</u>		X
<u>2. Inspect erection of mass timber construction</u>		X
<u>3. Inspection of connections where installation methods are required to meet design loads</u>		
<u>  3.1. Threaded fasteners</u>		
<u>    3.1.1. Verify use of proper installation equipment.</u>		X
<u>    3.1.2. Verify use of pre-drilled holes where required.</u>		X
<u>    3.1.3. Inspect screws, including diameter, length, head type, spacing, installation angle, and depth.</u>		X
<u>  3.2. Adhesive anchors installed in horizontal or upwardly inclined orientation to resist sustained tension loads</u>	X	
<u>  3.3. Adhesive anchors not defined in 3.2.</u>		X
<u>  3.4. Bolted connections</u>		X
<u>  3.5. Concealed connections</u>		X

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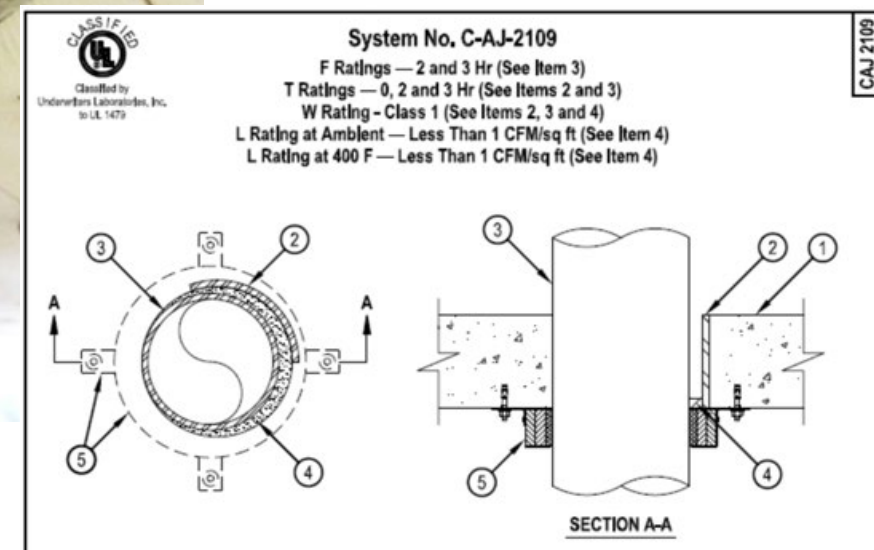
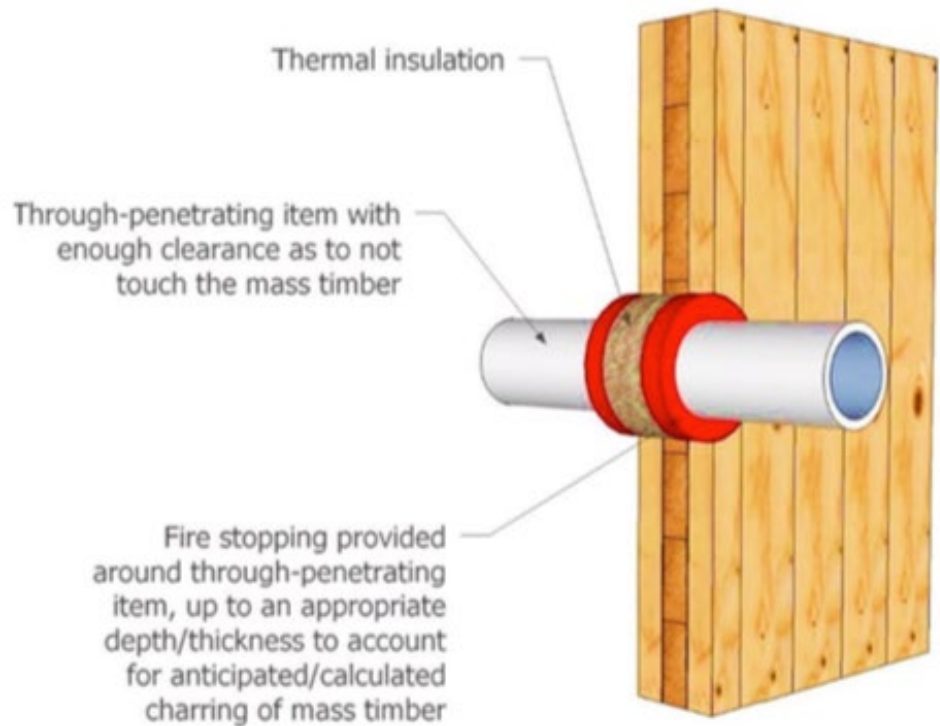
# Penetration Fire Protection

Although not a new code requirement or specific to tall wood, more testing & information is becoming available on firestopping of penetrations through MT assemblies



# Penetration Fire Protection

Most firestopping systems include combination of fire safing (eg. noncombustible materials such as mineral wool insulation) plus fire caulk





# Penetration Fire Protection

## Inventory of Fire Tested Penetrations in MT Assemblies



**Table 3: North American Fire Tests of Penetrations and Fire Stops in CLT Assemblies**

CLT Panel	Exposed Side Protection	Penetrating Item	Penetrant Centered or Offset in Hole	Firestopping System Description	F Rating	T Rating	Stated Test Protocol	Source	Testing Lab
3-ply (78mm 3.07")	None	1.5" diameter data cable bunch	Centered	3.5 in diameter hole. Mineral wool was installed in the 1 in. annular space around the data cables to a total depth of approximately 2 – 5/64 in. The remaining 1 in. annular space from the top of the mineral wool to the top of the floor assembly was filled with Hilti FS-One Max caulking.	1 hour	0.5 hour	CANULC S115	26	Intertek March 30, 2016
3-ply (78mm 3.07")	None	2" copper pipe	Centered	4.375 in diameter hole. Pipe wrap was installed around the copper pipe to a total depth of approximately 2 – 5/64 in. The remaining 1 in. annular space starting at the top of the mineral wool to the top of the floor assembly was filled with Hilti FS-One Max caulking.	1 hour	NA.	CANULC S115	26	Intertek March 30, 2016
3-ply (78mm 3.07")	None	2.5" sched. 40 pipe	Centered	4.92 in diameter hole. Pipe wrap was installed around the schedule 40 pipe to a total depth of approximately 2 – 5/64 in. The remaining 1 in. annular space starting at the top of the pipe wrap to the top of the floor assembly was filled with Hilti FS-One Max caulking.	1 hour	NA.	CANULC S115	26	Intertek March 30, 2016
3-ply (78mm 3.07")	None	6" cast iron pipe	Centered	8.35 in diameter hole. Mineral wool was installed in the 1 in. annular space around the cast iron pipe to a total depth of approximately 2 – 5/64 in. The remaining 1 in. annular space starting at the top of the pipe wrap to the top of the floor assembly was filled with Hilti FS-One Max caulking.	1 hour	NA.	CANULC S115	26	Intertek March 30, 2016
3-ply (78mm 3.07")	None	Hilti 6 in drop in device. System No.: F-B-2049	Centered	9.01" diameter hole. Mineral wool was installed in the 1 – 1/4 in. annular space around the drop-in device to a total depth of approximately 1 – 7/64 in and the remaining 1 in. annular space from the top of the mineral wool to the top edge of the 9 – 1/64 in. hole in the CLT was filled with Hilti FS-One Max caulking.	1 hour	0.75 hour	CANULC S115	26	Intertek March 30, 2016
5-ply CLT (131 mm 5.16")	None	1.5" diameter data cable bunch	Centered	3.5" diameter hole. Mineral wool was installed in the 1 in. annular space around the data cables to a total depth of approximately 4 – 5/32 in. The remaining 1 in. annular space from the top of the mineral wool to the top of the floor assembly was filled with Hilti FS-One Max caulking.	2 hours	1.5 hours	CANULC S115	26	Intertek March 30, 2016
5-ply CLT (131 mm 5.16")	None	2" copper pipe	Centered	4.375 in diameter hole. Pipe wrap was installed around the copper pipe to a total depth of approximately 4 – 5/32 in. The remaining 1 in. annular space starting at the top of the mineral wool to the top of the floor assembly was filled with Hilti FS-One Max caulking.	2 hours	NA.	CANULC S115	26	Intertek March 30, 2016
5-ply CLT (131 mm 5.16")	None	2.5" sched. 40 pipe	Centered	4.92 in diameter hole. Pipe wrap was installed around the schedule 40 pipe to a total depth of approximately 4 – 5/32 in. The remaining 1 in. annular space starting at the top of the pipe wrap to the top of the floor assembly was filled with Hilti FS-One Max caulking.	2 hours	0.5 hour	CANULC S115	26	Intertek March 30, 2016
5-ply CLT (131 mm 5.16")	None	6" cast iron pipe	Centered	8.35 in diameter hole. Mineral wool was installed in the 1 in. annular space around the cast iron pipe to a total depth of approximately 4 – 5/32 in. The remaining 1 in. annular space starting at the top of the pipe wrap to the top of the floor assembly was filled with Hilti FS-One Max caulking.	2 hours	NA.	CANULC S115	26	Intertek March 30, 2016
5-ply CLT (131 mm 5.16")	None	Hilti 6 in drop in device. System No.: F-B-2049	Centered	9.01" diameter hole. Mineral wool was installed in the 1 – 1/4 in. annular space around the drop-in device to a total depth of approximately 1 – 7/64 in and the remaining 1 in. annular space from the top of the mineral wool to the top edge of the 9 – 1/64 in. hole in the CLT was filled with Hilti FS-One Max caulking.	2 hours	1.5 hours	CANULC S115	26	Intertek March 30, 2016
5-ply (175mm 6.875")	None	1" nominal PVC pipe	Centered	4.21 in diameter with a 3/4 in plywood reducer flush with the top of the slab reducing the opening to 2.28 in. Two wraps of Hilti CP 648-E W4 5/1-3/4" Firestop wrap strip at two locations with a 30 gauge steel sleeve which extended from the top of the slab to 1 in below the slab. The first location was with the bottom of the wrap strip flush with the bottom of the steel sleeve and the second was with the bottom of the wrap strip 3 in. from the bottom of the slab. The void between the steel sleeve and the CLT and between the steel sleeve and pipe at the top was filled with Roxul Safe mineral wool leaving a 3/4 in deep void at the top of the assembly. Hilti FS-One Max Intumescent Firestop Sealant was applied to a depth of 3/4 in on the top of the assembly between the plywood and steel sleeve as well as the steel sleeve and pipe.	2 hours	2 hours	ASTM E814	24	QAI Laboratories March 3, 2017

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# Sealants at MT Panel Edges

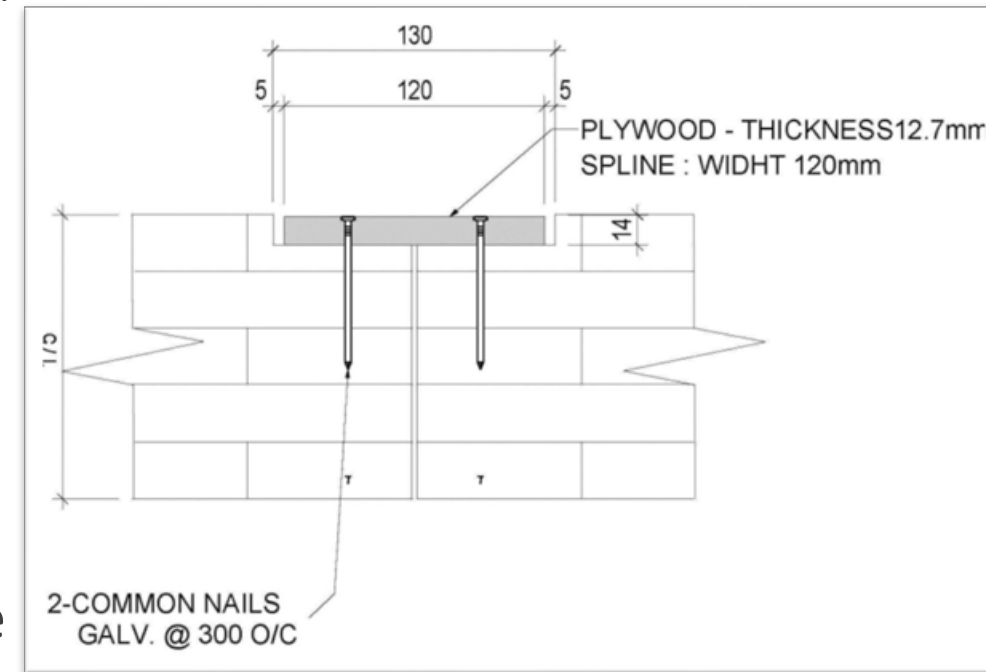


# Sealants at MT Panel Edges

## 703.9 Sealing of adjacent mass timber elements.

In buildings of Type IVA, IVB, and IVC construction, sealant or adhesive shall be provided to resist the passage of air in the following locations:

1. At abutting edges and intersections of mass timber building elements required to be fire resistance-rated
2. At abutting intersections of mass timber building elements and building elements of other materials where both are required to be fire resistance-rated.





# Sealants at MT Panel Edges

Sealants shall meet the requirements of ASTM C920 (elastomeric joint sealants). Adhesives shall meet the requirements of ASTM D3498 (gap filling construction adhesives, i.e. not fire caulk).

Exception: Sealants or adhesives need not be provided where they are not a required component of a fire resistance- rated assembly.



# Sealants at MT Panel Edges

Several MT fire tested assemblies have successfully been completed w/o adhesives/sealants at abutting panel edges

2021 IBC will require periodic special inspections of adhesive/sealant installation (when required to be installed)





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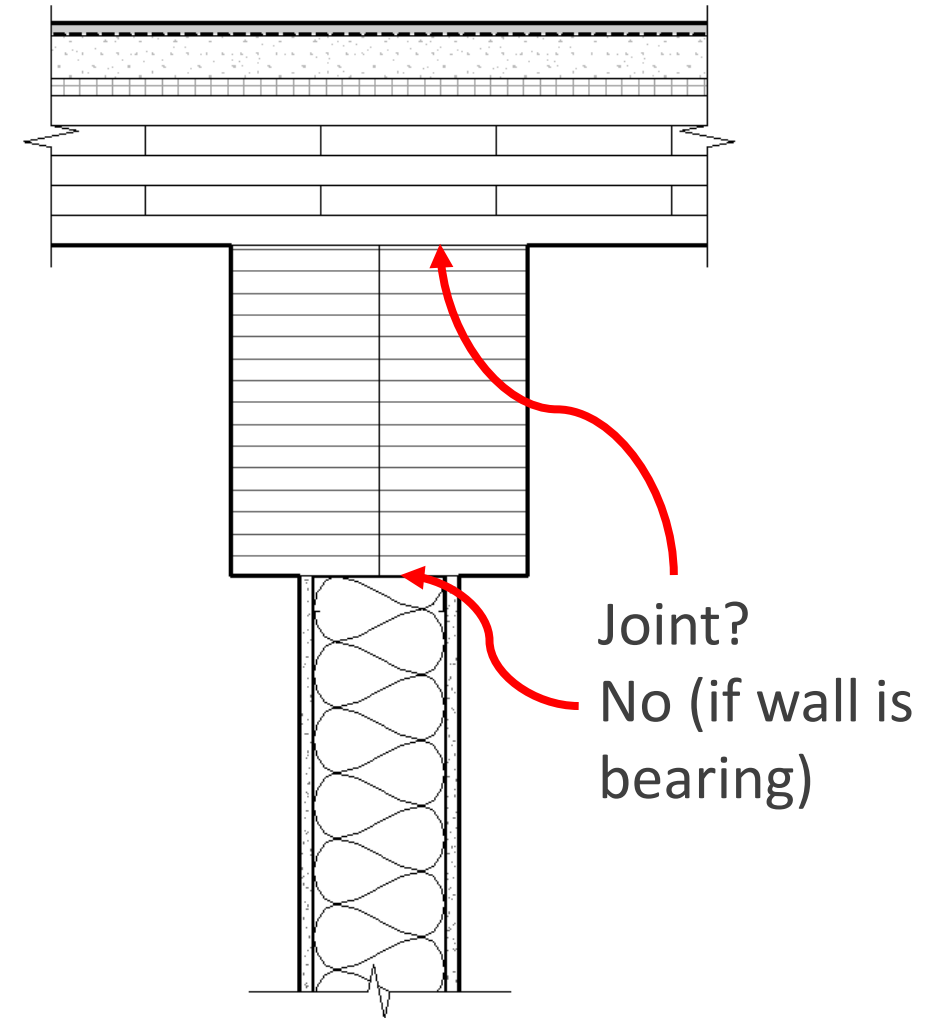
# Joints & Intersecting Elements

## Section 202 Definitions

Joint. The opening in or between adjacent assemblies that is created due to building tolerances, or is designed to allow independent movement of the building in any plane caused by thermal, seismic, wind or any other loading.

Considerations:

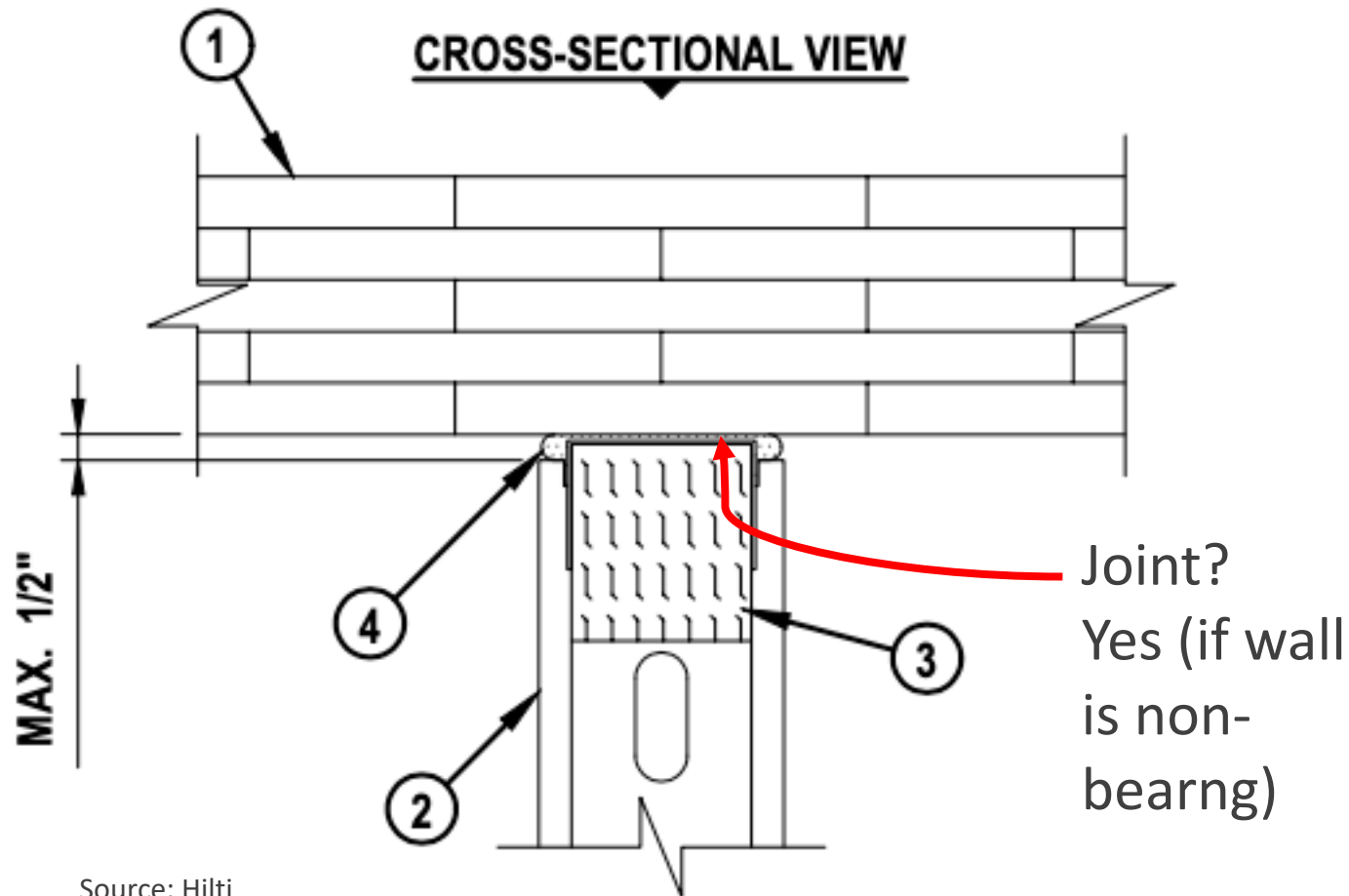
- » Is wall, beam and slab rated?
- » Required to prevent smoke passage?
- » Not a tall timber specific item, applicable to all mass timber construction



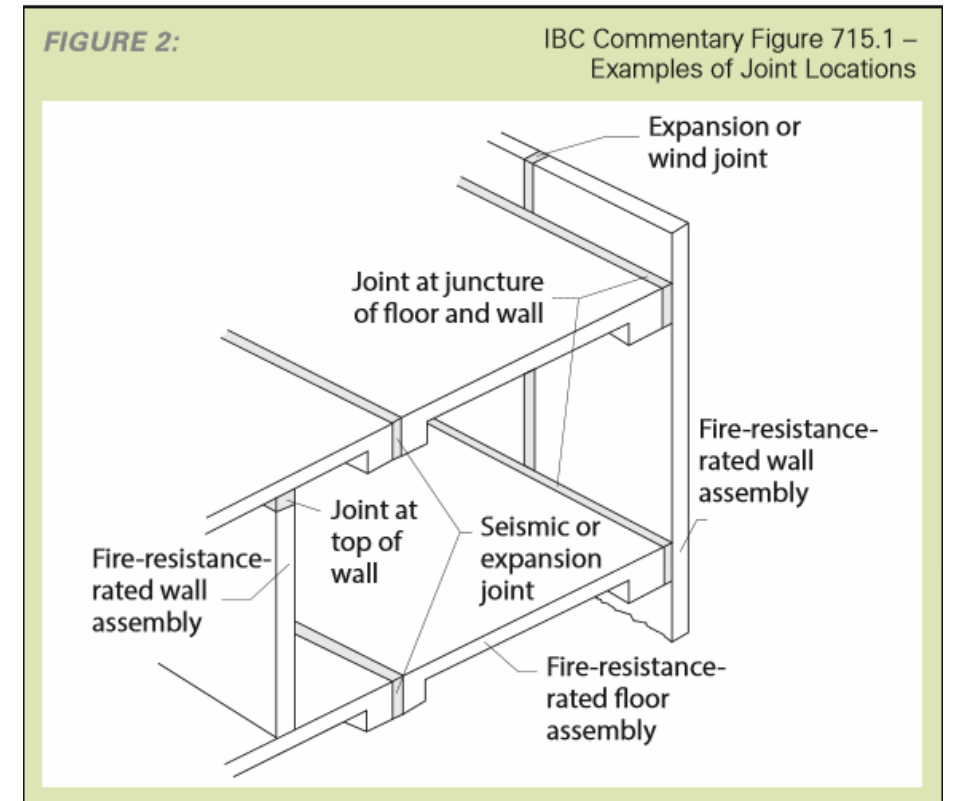


# Joints & Intersecting Elements

Not a tall timber specific item, applicable to all mass timber construction



Source: Hilti



Source: International Building Code

# Joints & Intersecting Elements

## Section 715 Joints and Voids

### **715.3 Fire-resistance-rated assembly intersections.**

Joints installed in or between fire-resistance-rated walls, floors or floor/ceiling assemblies and roofs or roof/ceiling assemblies shall be protected by an approved fire-resistant joint system designed to resist the passage of fire for a time period not less than the required fire-resistance rating of the wall, floor or roof in or between which the system is installed.

#### **715.3.1 Fire test criteria.**

Fire-resistant joint systems shall be tested in accordance with the requirements of either ASTM E1966 or UL 2079.

Not a tall timber specific item, applicable to all mass timber construction.  
Firestop manufacturers should be consulted for specific solutions.



# Occupancy Separation

Protection of MT used for occupancy separation

## **Addition to IBC 508.4.4.1 requires:**

Mass timber elements serving as fire barriers or horizontal assemblies to separate occupancies in Type IV-B or IV-C construction shall be separated from the interior of the building with a minimum of ½" gypsum board or a noncombustible equivalent.



# Incidental Use Separation

Protection of MT used for incidental use separation

## **New section 509.4.1.1 requires:**

Where Table 509 specifies a fire- resistance-rated separation, mass timber elements serving as fire barriers or a horizontal assembly in Type IV-B or IV-C construction shall be separated from the interior of the incidental use with a minimum of ½” gypsum board or a noncombustible equivalent.





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# Fire Safety During Construction

New code provisions in International Fire Code (IFC) address construction fire safety of tall wood buildings

**3308.4 Fire safety requirements for buildings of Types IV-A, IV-B, and IV-C construction.** Buildings of Types IV-A, IV-B, and IV-C construction designed to be greater than six stories above grade plane shall meet the following requirements during construction unless otherwise approved by the fire code official.

1. Standpipes shall be provided in accordance with Section 3313.
2. A water supply for fire department operations, as approved by the fire chief.



Photo: Structurlam



# Fire Safety During Construction

## IFC 3313 Standpipe Requirements

### SECTION 3313 STANDPIPES

#### **3313.1 Where required.**

In buildings required to have standpipes by Section 905.3.1, not less than one standpipe shall be provided for use during construction. Such standpipes shall be installed prior to construction exceeding 40 feet (12 192 mm) in height above the lowest level of fire department vehicle access. Such standpipe shall be provided with fire department hose connections at accessible locations adjacent to usable stairways. Such standpipes shall be extended as construction progresses to within one floor of the highest point of construction having secured decking or flooring.

#### **3313.2 Buildings being demolished.**

Where a building is being demolished and a standpipe is existing within such a building, such standpipe shall be maintained in an operable condition so as to be available for use by the fire department. Such standpipe shall be demolished with the building but shall not be demolished more than one floor below the floor being demolished.

#### **3313.3 Detailed requirements.**

Standpipes shall be installed in accordance with the provisions of Section 905.

**Exception:** Standpipes shall be either temporary or permanent in nature, and with or without a water supply, provided that such standpipes comply with the requirements of Section 905 as to capacity, outlets and materials.

# Fire Safety During Construction

## IFC 3308.4 Cont'd

3. Where building construction exceeds six stories above grade plane, at least one layer of noncombustible protection where required by Section 602.4 of the International Building Code shall be installed on all building elements more than 4 floor levels, including mezzanines, below active mass timber construction before erecting additional floor levels.
4. Where building construction exceeds six stories above grade plane required exterior wall coverings shall be installed on all floor levels more than 4 floor levels, including mezzanines, below active mass timber construction before erecting additional floor level.

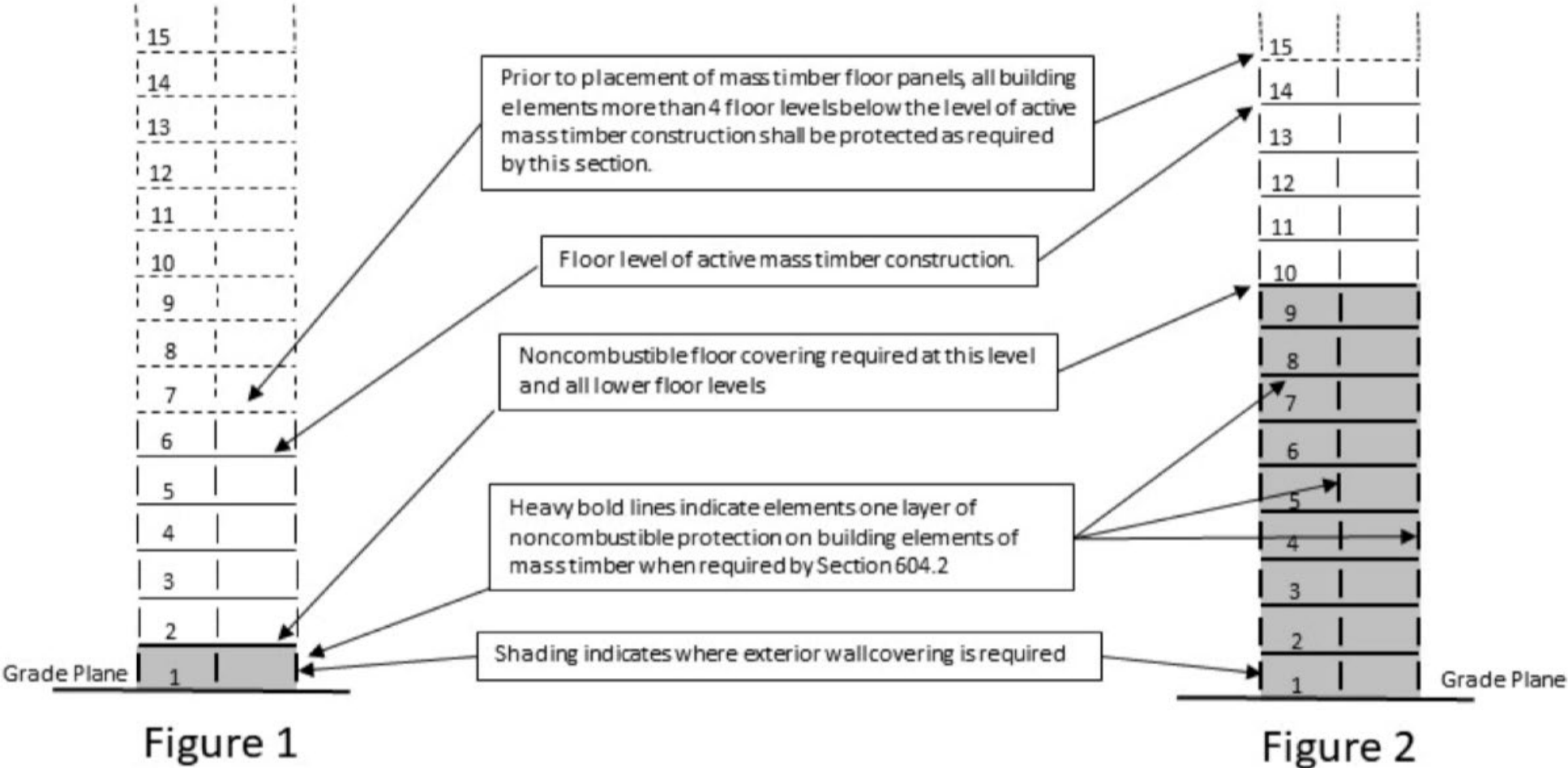
Exception: Shafts and vertical exit enclosures



Photo: Urban One



# Fire Safety During Construction



**Examples of Protection During Construction  
For Mass Timber Buildings Greater Than  
6 Stories Above Grade Plane**

# Outline

- » Tall Wood Introduction
- » Lateral Systems in Tall Wood
- » Connections in Tall Wood
- » Penetrations in Tall Wood
- » Sealants at Mass Timber Panel Edges
- » Joints and Intersecting Elements
- » Fire Safety During Construction
- Acoustical Design

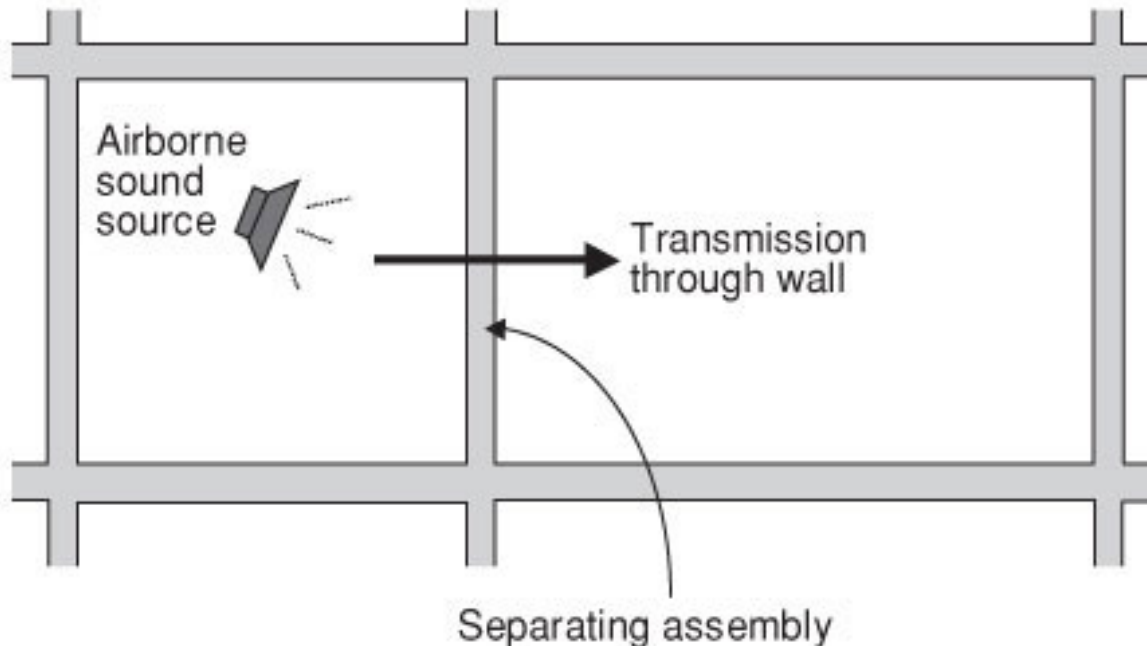


# Acoustical Design

## Air-Borne Sound:

### Sound Transmission Class (STC)

- » Measures how effectively an assembly isolates air-borne sound and reduces the level that passes from one side to the other
- » Applies to walls and floor/ceiling assemblies

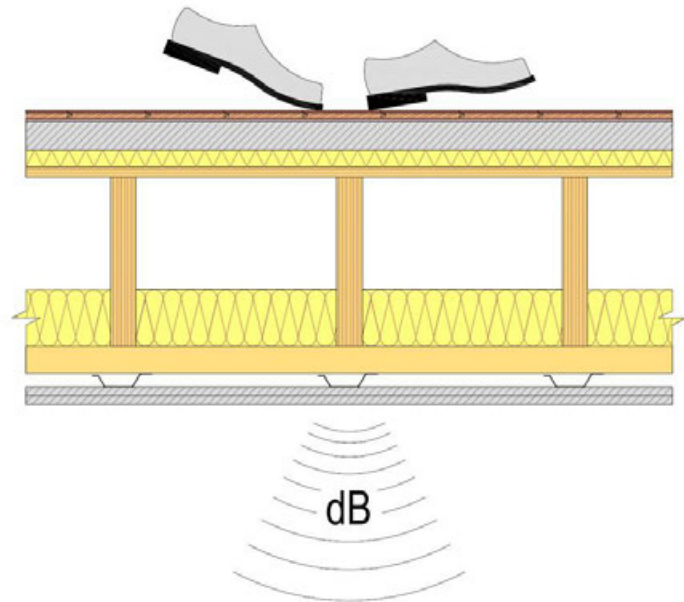


# Acoustical Design

## Structure-Borne Sound:

### Impact Insulation Class (IIC)

- » Evaluates how effectively an assembly blocks impact sound from passing through it
- » Only applies to floor/ceiling assemblies





# Acoustical Design

Code requirements only address residential occupancies:

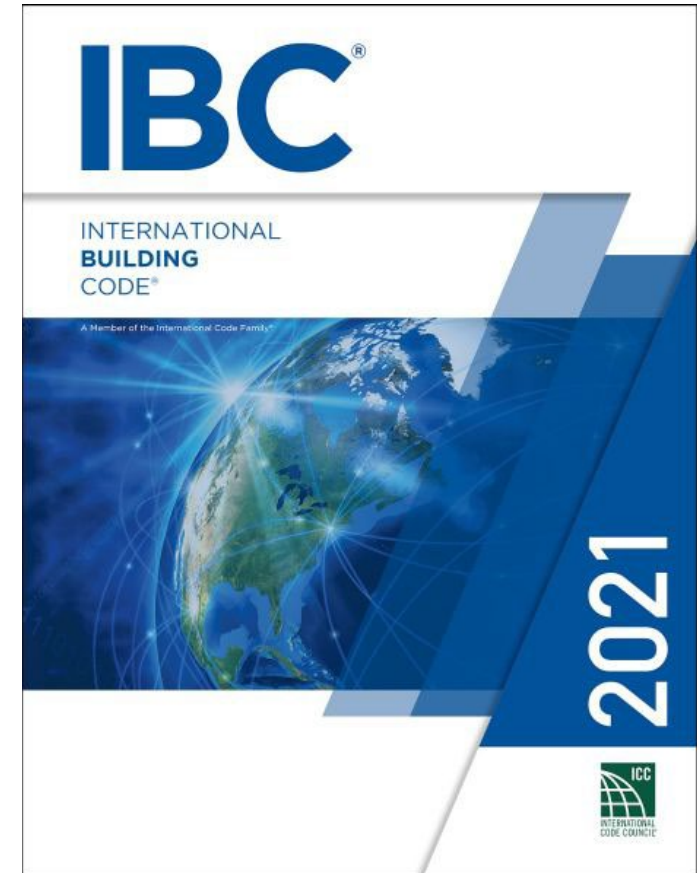
For unit to unit or unit to public or service areas:

Min. STC of 50 (45 if field tested):

» Walls, Partitions, and Floor/Ceiling Assemblies

Min. IIC of 50 (45 if field tested) for:

» Floor/Ceiling Assemblies



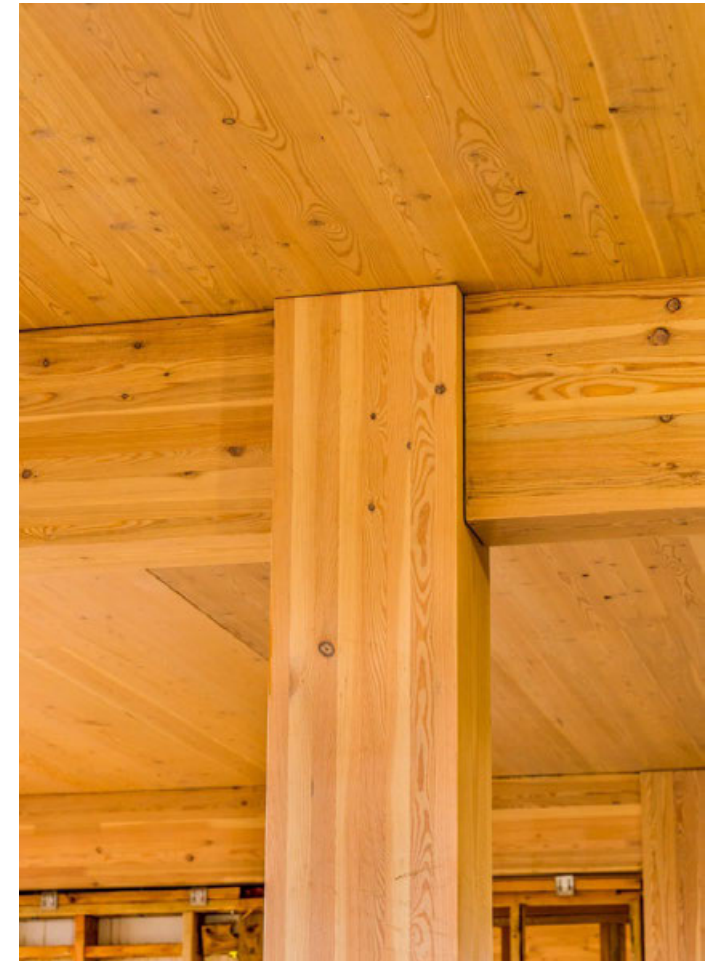
# Acoustical Design

STC	What can be heard
25	Normal speech can be understood quite easily and distinctly through wall
30	Loud speech can be understood fairly well, normal speech heard but not understood
35	Loud speech audible but not intelligible
40	Onset of "privacy"
42	Loud speech audible as a murmur
45	Loud speech not audible; 90% of statistical population not annoyed
50	Very loud sounds such as musical instruments or a stereo can be faintly heard; 99% of population not annoyed.
60+	Superior soundproofing; most sounds inaudible



# Mass Timber Acoustical Design

Mass Timber: Structure Often is Finish



# Mass Timber Acoustical Design

But by Itself, Not Adequate for Acoustics



T3 Minneapolis  
Architect: MGA | Michael Green Architecture, DLR Group  
Structural Engineer: Magnusson Klemencic Associates  
Design Assist + Build: StructureCraft



# Mass Timber Acoustics

**TABLE 1:**  
**Examples of Acoustically-Tested Mass Timber Panels**

Mass Timber Panel	Thickness	STC Rating	IIC Rating
3-ply CLT wall <sup>4</sup>	3.07"	33	N/A
5-ply CLT wall <sup>4</sup>	6.875"	38	N/A
5-ply CLT floor <sup>5</sup>	5.1875"	39	22
5-ply CLT floor <sup>4</sup>	6.875"	41	25
7-ply CLT floor <sup>4</sup>	9.65"	44	30
2x4 NLT wall <sup>6</sup>	3-1/2" bare NLT 4-1/4" with 3/4" plywood	24 bare NLT 29 with 3/4" plywood	N/A
2x6 NLT wall <sup>6</sup>	5-1/2" bare NLT 6-1/4" with 3/4" plywood	22 bare NLT 31 with 3/4" plywood	N/A
2x6 NLT floor + 1/2" plywood <sup>2</sup>	6" with 1/2" plywood	34	33

# Acoustical Detailing

Regardless of the structural materials used in a wall or floor ceiling assembly, there are 3 effective methods of improving acoustical performance:

1. Add mass
2. Add noise barriers
3. Add decouplers



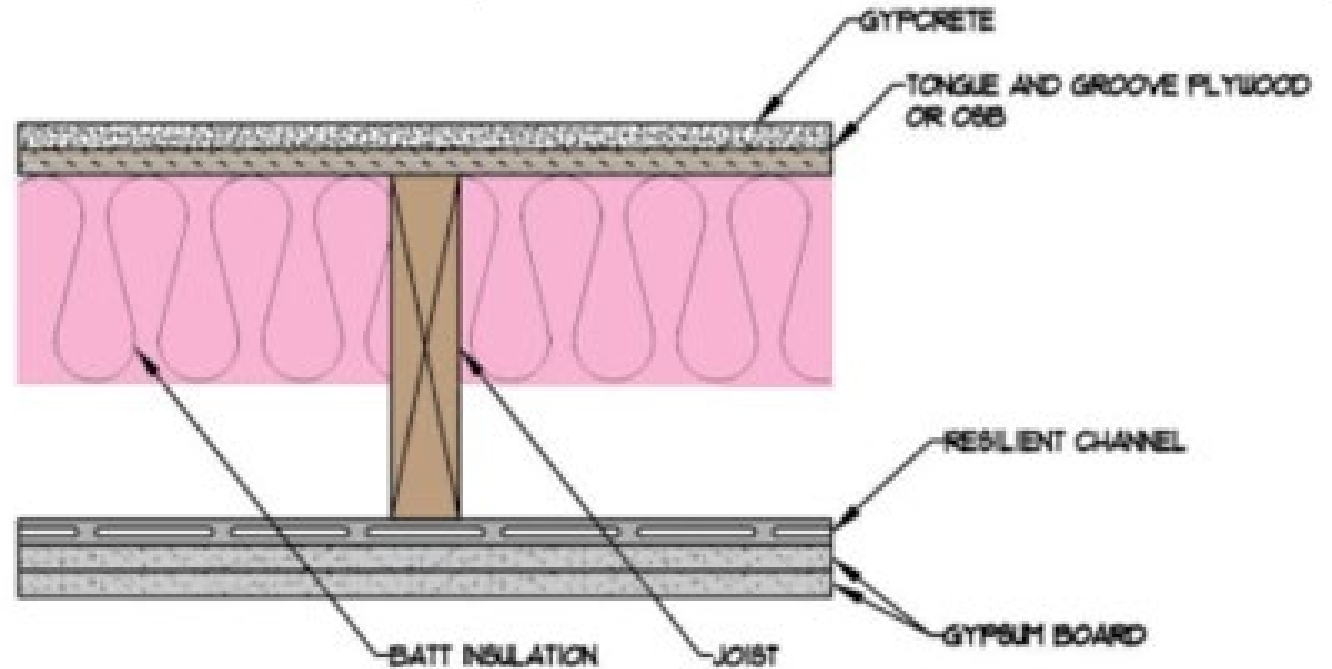
Image credit: Christian Columbres



# Acoustical Detailing

What does this look like in typical wood-frame construction:

1. Add mass
2. Add noise barriers
3. Add decouplers



---

STC 62

---

# Mass Timber Acoustics



Concrete Slab:

6" Thick

80 PSF

STC 53



CLT Slab:

6-7/8" Thick

18 PSF

STC 41

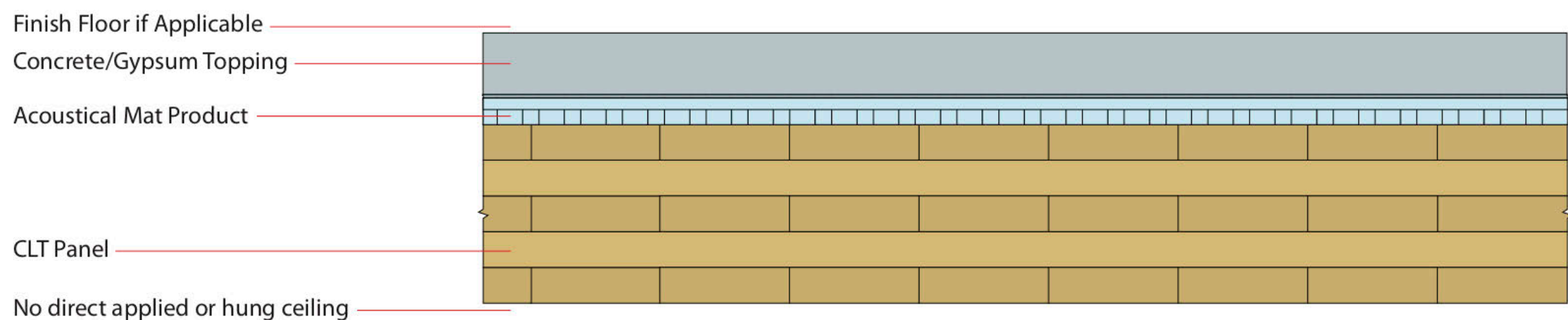




# Mass Timber Acoustics

There are three main ways to improve an assembly's acoustical performance:

1. Add mass
2. Add noise barriers
3. Add decouplers



# Mass Timber Acoustics

There are three main ways to improve an assembly's acoustical performance:

1. Add mass
2. Add noise barriers
- 3. Add decouplers

Acoustical Mat:

- » Typically roll out or board products
- » Thicknesses vary: Usually  $\frac{1}{4}$ " to 1"+



Credit: Maxxon



# Mass Timber Acoustics

Acoustical floor underlayments



Photo: AcoustiTECH<sup>10</sup>

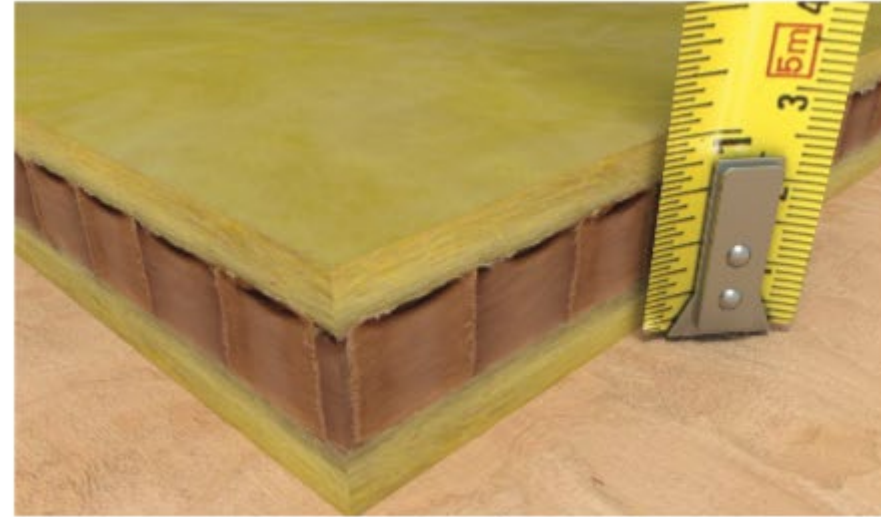


Photo: Kinetics Noise Control, Inc.,<sup>11</sup>



Photo: Maxxon Corporation

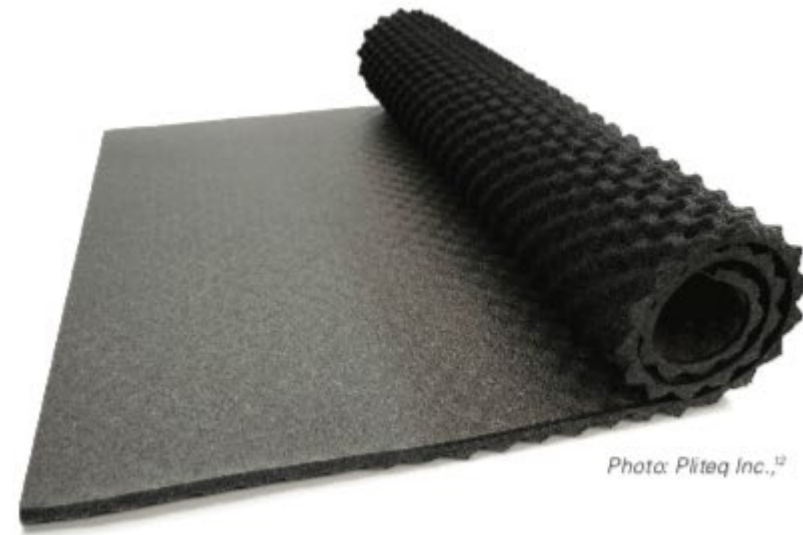


Photo: Pliteq Inc.,<sup>12</sup>

# Mass Timber Acoustics

Common mass timber floor assembly:

- » Finish floor (if applicable)
- » Underlayment (if finish floor)
- » 1.5" to 4" thick concrete/gypcrete topping
- » Acoustical mat
- » WSP (if applicable)
- » Mass timber floor panels





# Mass Timber Acoustics

## Solutions Paper



### Acoustics and Mass Timber: Room-to-Room Noise Control

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



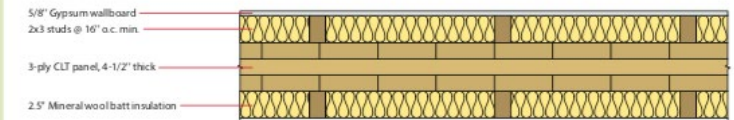
T3 Minneapolis  
Architect: MGA | Michael Green Architecture, DLR Group  
Structural Engineer: Magnusson Klemencic Associates  
Design Assist • Build: StructureCraft

The growing availability and code acceptance 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 has given designers a low-carbon alternative to steel, concrete, and masonry for many applications. However, the use of mass timber in multi-family and commercial buildings presents unique acoustic challenges.

While laboratory measurements of the impact and airborne sound isolation of traditional building assemblies such as light wood-frame, steel and concrete are widely available, fewer resources exist that quantify the acoustic performance of mass timber assemblies. Additionally, one of the most desired aspects of mass timber construction is the ability to leave a building's structure exposed as finish, which creates the need for asymmetric assemblies. With careful design and detailing, mass timber buildings can meet the acoustic performance expectations of most building types.

FIGURE 3:  
Interior CLT partition wall with chase walls on both sides

#### Example Mass Timber Wall Assembly, STC 58 Plan View



Source: US CLT Handbook

#### Mass Timber Assembly Options: Walls

Mass timber panels can also be used for interior and exterior walls—both bearing and non-bearing. For interior walls, the need to conceal services such as electrical and plumbing is an added consideration. Common approaches include building a chase wall in front of the mass timber wall or installing gypsum wallboard on resilient channels that are attached to the mass timber wall. As with bare mass timber floor panels, bare mass timber walls don't typically provide adequate noise control, and chase walls also function as acoustical improvements. For example, a 3-ply CLT wall panel with a thickness of 3.07" has an STC rating of 33.<sup>4</sup> In contrast, Figure 3 shows an interior CLT partition wall with chase walls on both sides. This assembly achieves an STC rating of 58, exceeding the IBC's acoustical requirements for multi-family construction. Other examples are included in the inventory of tested assemblies noted above.

#### Acoustical Differences between Mass Timber Panel Options

The majority of acoustically-tested mass timber assemblies include CLT. However, tests have also been done on other mass timber panel options such as NLT and dowel-laminated timber (DLT), as well as traditional heavy timber options such as tongue and groove decking. Most tests have concluded that CLT acoustical performance is slightly better than that of other mass timber options, largely because the cross-orientation of laminations in a CLT panel limits sound flanking.

For those interested in comparing similar assemblies and mass timber panel types and thicknesses, the inventory noted above contains tested assemblies using CLT, NLT, glued-laminated timber panels (GLT), and tongue and groove decking.

#### Improving Performance by Minimizing Flanking

Even when the assemblies in a building are carefully designed and installed for high acoustical performance, consideration of flanking paths—in areas such as assembly intersections, beam-to-column/wall connections, and MEP penetrations—is necessary for a building to meet overall acoustical performance objectives.

One way to minimize flanking paths at these connections and interfaces is to use resilient connection isolation and sealant strips. These products are capable of resisting structural loads in compression between structural members and connections while providing isolation and breaking hard, direct connections between members. In the context of the three methods for improving acoustical performance noted above, these strips act as decouplers. With airtight connections, interfaces and penetrations, there is a much greater chance that the acoustic performance of a mass timber building will meet expectations.

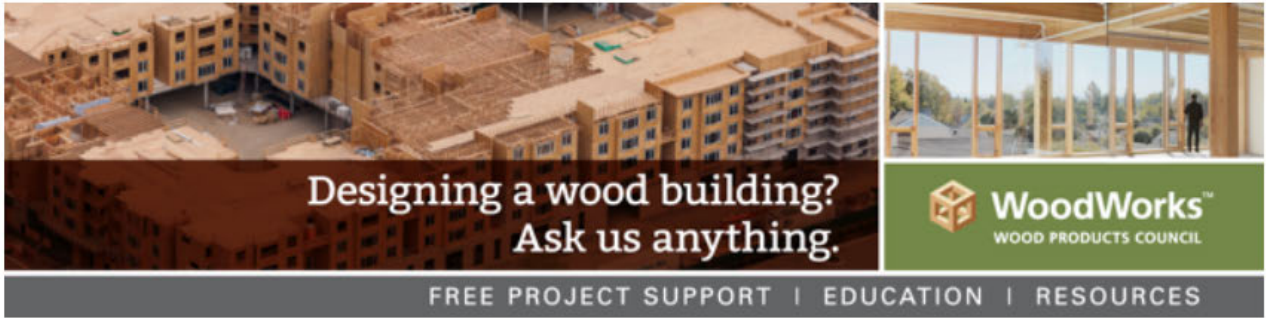


Acoustical isolation strips

Photos: Rothoblaas

# Mass Timber Acoustics

## Inventory of Tested Assemblies



### Acoustically-Tested Mass Timber Assemblies

Following is a list of mass timber assemblies that have been acoustically tested as of January 23, 2019. Sources are noted at the end of this document. For free technical assistance on any questions related to the acoustical design of mass timber assemblies, or free technical assistance related to any aspect of the design, engineering or construction of a commercial or multi-family wood building in the U.S., email [help@woodworks.org](mailto:help@woodworks.org) or contact the [WoodWorks](#) Regional Director nearest you: <http://www.woodworks.org/project-assistance>

#### Contents:

Table 1: CLT Floor Assemblies with Concrete/Gypsum Topping, Ceiling Side Exposed .....	2
Table 2: CLT Floor Assemblies without Concrete/Gypsum Topping, Ceiling Side Exposed.....	7
Table 3: CLT Floor Assemblies without Concrete/Gypsum Topping, with Wood Sleepers, Ceiling Side Exposed .....	9
Table 4: NLT, GLT & T&G Decking Floor Assemblies, Ceiling Side Exposed.....	11
Table 5: Mass Timber Floor Assemblies with Ceiling Side Concealed .....	14
Table 6: Single CLT Wall .....	21
Table 7: Single NLT Wall .....	26
Table 8: Double CLT Wall .....	29
Sources.....	32
Disclaimer .....	34



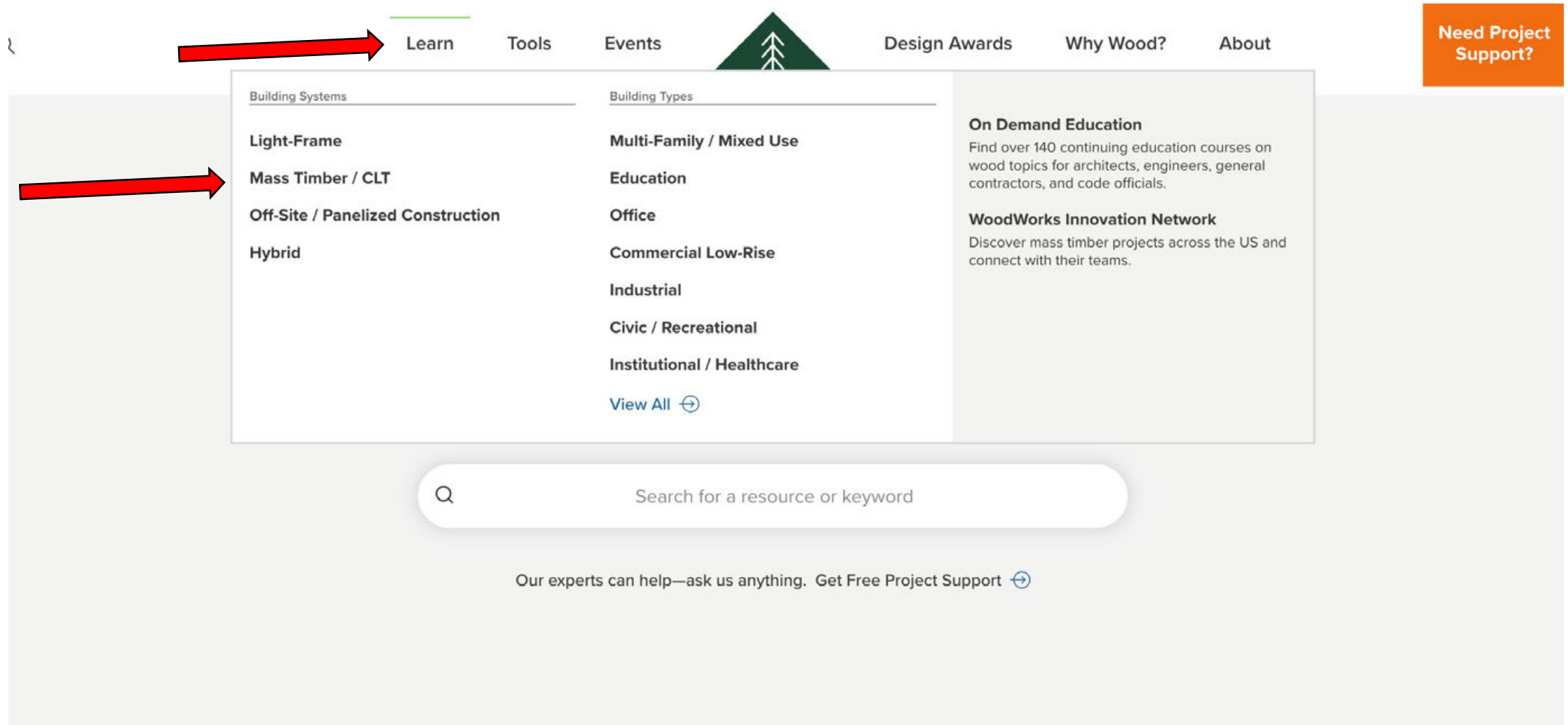
# Mass Timber Acoustics

Table 1: CLT Floor Assemblies with Concrete/Gypsum Topping, Ceiling Side Exposed



CLT Panel	Concrete/Gypsum Topping	Acoustical Mat Product Between CLT and Topping	Finish Floor	STC <sup>1</sup>	IIC <sup>1</sup>	Source
CLT 5-ply (6.875")	1-1/2" Gyp-Crete®	Maxxon Acousti-Mat® 3/4	None	47 <sup>2</sup> ASTC	47 <sup>2</sup> AIIC	1
			LVT	-	49 <sup>2</sup> AIIC	
			Carpet + Pad	-	75 <sup>2</sup> AIIC	
			LVT on Acousti-Top®	-	52 <sup>2</sup> AIIC	
			Eng Wood on Acousti-Top®	-	51 <sup>2</sup> AIIC	
			None	49 <sup>2</sup> ASTC	45 <sup>2</sup> AIIC	
		Maxxon Acousti-Mat® ¾ Premium	LVT	-	47 <sup>2</sup> AIIC	
			LVT on Acousti-Top®	-	49 <sup>2</sup> AIIC	
	1-1/2" Levelrock® Brand 2500	USG SAM N25 Ultra	None	45 <sup>6</sup>	39 <sup>6</sup>	15
			LVT	48 <sup>6</sup>	47 <sup>6</sup>	16
			LVT Plus	48 <sup>6</sup>	49 <sup>6</sup>	58
			Eng Wood	47 <sup>6</sup>	47 <sup>6</sup>	59
			Carpet + Pad	45 <sup>6</sup>	67 <sup>6</sup>	60
			Ceramic Tile	50 <sup>6</sup>	46 <sup>6</sup>	61
		Soprema® Insonomat	None	45 <sup>6</sup>	42 <sup>6</sup>	15
			LVT	48 <sup>6</sup>	44 <sup>6</sup>	16
			LVT Plus	48 <sup>6</sup>	47 <sup>6</sup>	58
			Eng Wood	47 <sup>6</sup>	45 <sup>6</sup>	59
			Carpet + Pad	45 <sup>6</sup>	71 <sup>6</sup>	60
			Ceramic Tile	50 <sup>6</sup>	46 <sup>6</sup>	61
		USG SAM N75 Ultra	None	45 <sup>6</sup>	38 <sup>6</sup>	15
			LVT	48 <sup>6</sup>	47 <sup>6</sup>	16
			LVT Plus	48 <sup>6</sup>	49 <sup>6</sup>	58
			Eng Wood	47 <sup>6</sup>	49 <sup>6</sup>	59

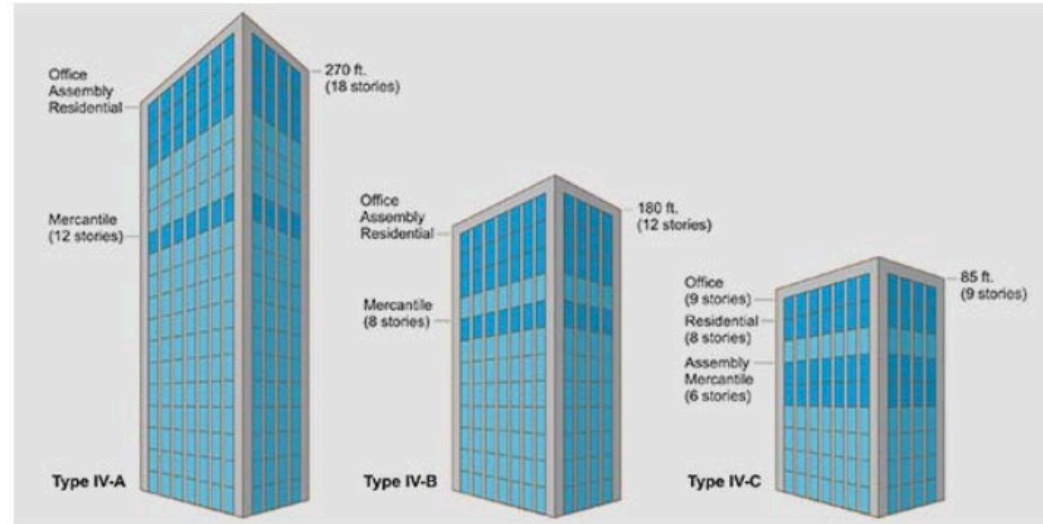
# TALL MASS TIMBER RESOURCES



**Woodworks.org > Learn > Mass Timber / CLT > Tall Mass Timber**



# TALL MASS TIMBER RESOURCES



## Tall Mass Timber

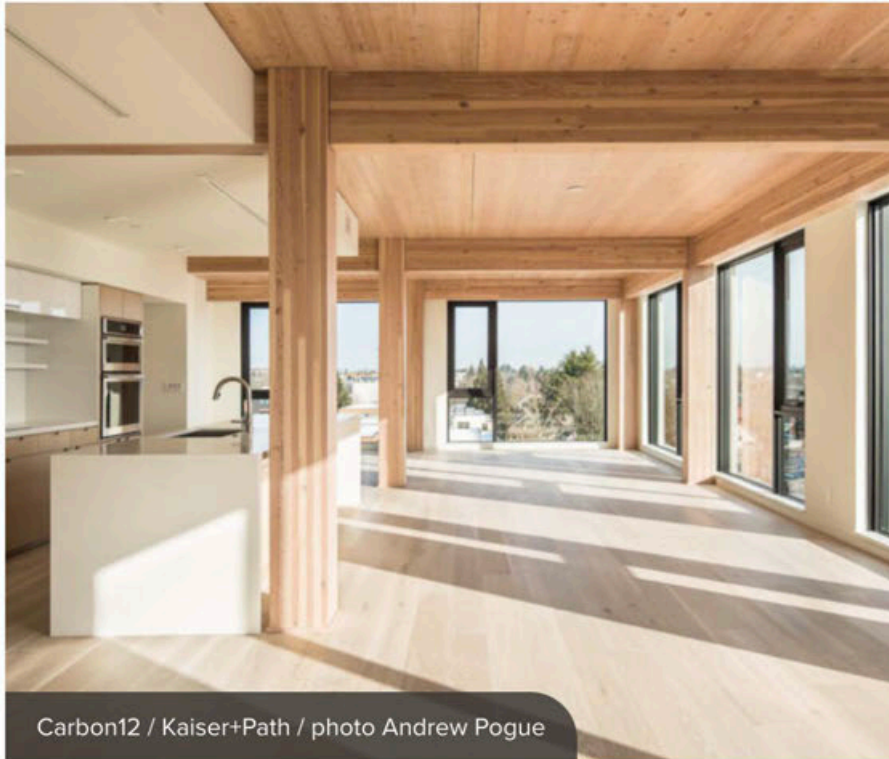
Code opportunities and requirements, FAQs, project examples and resources for teams interested in tall timber projects.

[Learn More](#) ➞

[www.woodworks.org/learn/mass-timber-clt/tall-mass-timber/](http://www.woodworks.org/learn/mass-timber-clt/tall-mass-timber/)

# TALL MASS TIMBER RESOURCES

## Technical Design Guidance from WoodWorks



Carbon12 / Kaiser+Path / photo Andrew Pogue

Solution Papers

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

Looking for information on the tall wood provisions in the 2021 International Building Code? This paper summarizes the provisions as well as the background and research that supported their adoption.



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

Solution Papers



### Shaft Wall Requirements in Tall Mass Timber Buildings

Solution Papers



### Concealed Spaces in Mass Timber and Heavy Timber Structures

Solution Papers



### Acoustics and Mass Timber: Room-to-Room Noise Control

Solution Papers



### Fire Design of Mass Timber Members: Code Applications, Construction Types and Fire Ratings

Solution Papers



# TALL MASS TIMBER RESOURCES

## Answers to Tall Mass Timber FAQs

### 5. How are design teams leveraging tall mass timber code provisions to maximize the amount of timber exposure?

[Follow this link](#) for an article that discusses how teams are utilizing the new code provisions to enhance the appearance of their tall mass timber structures with exposed timber framing.

### 6. I've heard that the 2024 IBC will allow 100% timber ceiling exposure in type IV-B, up to 12 stories tall. Is that code language finalized?

Yes, the 2024 IBC will include new code changes, which have been approved and will be incorporated, which allow timber ceiling exposure in Type IV-B construction up to 100%. The new code language as it will read in the 2024 IBC is available [here](#). Several jurisdictions such as the City of Denver, City of Dallas, State of Oregon and State of Washington are already in the process of incorporating these new timber exposure limits in their building codes, and several design teams are looking to utilize the new limits in project-specific discussions with their local building officials. Reach out to your local WoodWorks [Regional Director](#) to see how projects in your area can approach these design topics.

# TALL MASS TIMBER RESOURCES


## Articles and Expert Tips

[Learn](#)[Tools](#)[Events](#)[Award Gallery](#)[Why Wood?](#)[About](#)[Need Project Support?](#)

Expert Tips

### Tall Mass Timber Trends and Exposed Timber Allowances

*Recent code changes and jurisdictional approvals provide for greater areas of exposed mass timber.*

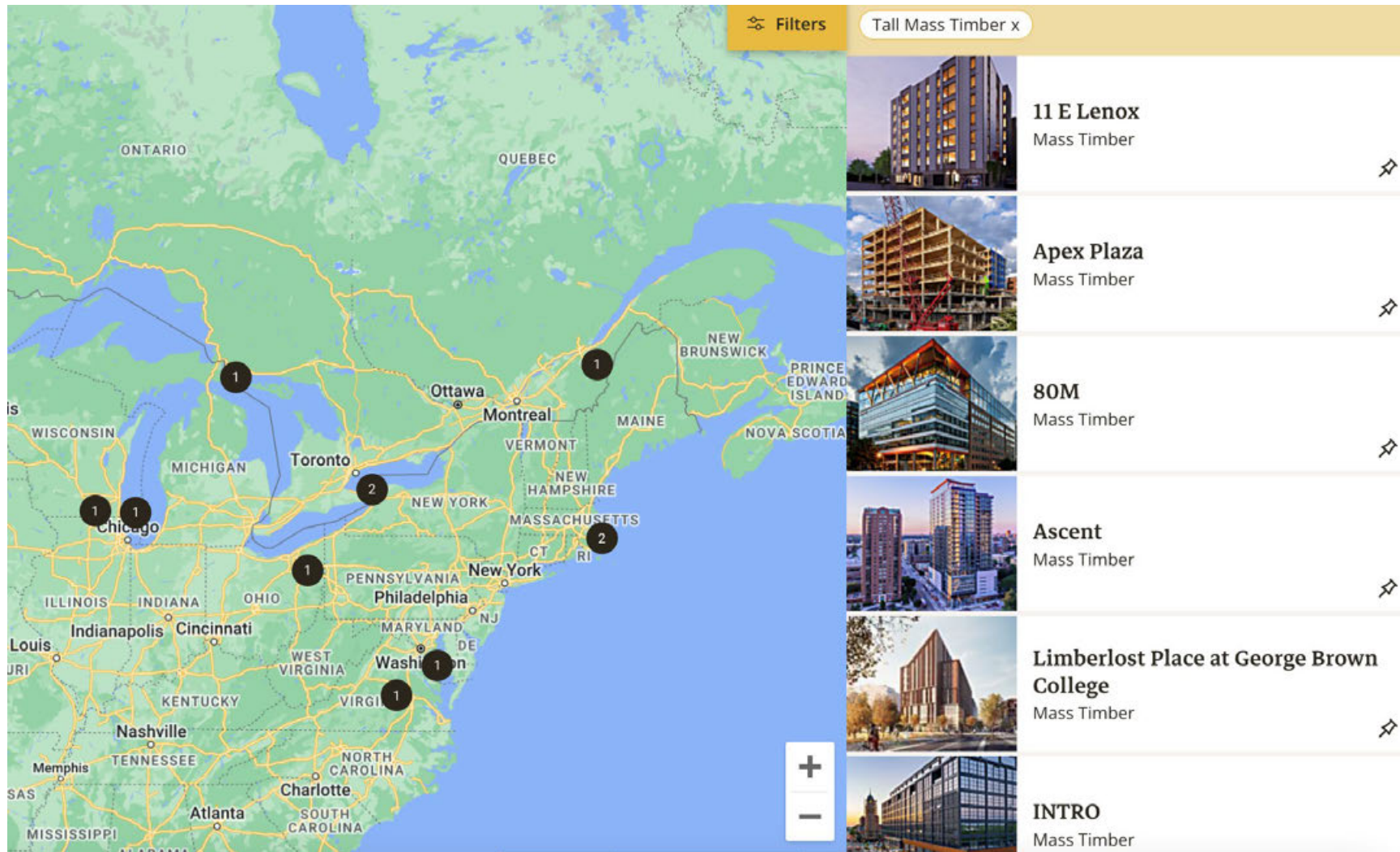
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# TALL MASS TIMBER RESOURCES

# Interactive Tall Mass Timber Project Map



# TALL MASS TIMBER RESOURCES

## Filter by Tall Mass Timber Projects

The screenshot displays the Woodworks Innovation Network website interface. The top navigation bar includes the logo, search icon, and links for Project Map, Manufacturers & Suppliers, and People & Companies. The main content area features a map of North America with project locations marked by black circles and numbers. A red arrow points to the 'Hide Filters' button in the top right corner of the map area. The filter sidebar on the right includes sections for Filter By, Building Systems, Secondary Systems, and Building Type. A red arrow points to the 'Tall Mass Timber' filter option in the Secondary Systems section.

**WOODWORKS INNOVATION NETWORK**

Project Map Manufacturers & Suppliers People & Companies

EN Sign in Join now

Hide Filters

Search By City

**Building Systems**

Mass Timber 20 Innovative Light-Frame 0

☒ Include Unclaimed Projects 0

**Secondary Systems**

☐ Hybrid Non-wood 98

☐ Hybrid Wood 83

☐ Prefab/Offsite 15

☒ Tall Mass Timber 20

☐ Vertical Additions 6

☐ Volumetric Modular 3

**Building Type**

☐ Assembly (Worship, Restaurant, Theater) 0

☐ Business (Office) 5

☐ Civic (Recreational) 0

☐ Custom Innovative Residential 0

☐ Educational 2

☐ Factory/Industrial (warehouse, storage, parking, etc.) 0

Get free project help

<https://www.woodworksinnovationnetwork.org>



# Questions? Ask us anything.



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