



APRIL 11, 2024

Ascent Tower: New Building \$80-\$200 Million

- 4th Annual SEE Award Series: Day 1

Jordan Komp
Associate Principal
and MKE Office Director

Thornton Tomasetti



1500

ENGINEERS,
ARCHITECTS,
SCIENTISTS AND
OTHER
PROFESSIONALS

PROJECTS IN

50 COUNTRIES

50+

OFFICES

5

CONTINENTS



COURSE DESCRIPTION

Mass timber is a relatively new technology in the United States, with unique characteristics and design methods. However, the market is showing a significant demand for projects featuring this material. This presentation will cover the design and construction of Ascent Tower, currently the tallest mass timber building in the world. Ascent has broken the world record for mass timber construction (height), nearly doubling the next tallest timber building in the United States (...for now).

AGENDA

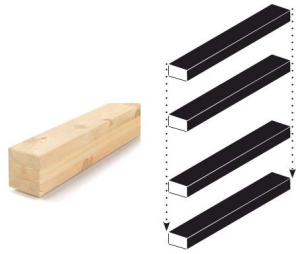
1. Introduction to Mass Timber
2. Introduction to Ascent
3. Mass Timber Design Considerations
4. Ascent Permitting Process
5. Ascent Construction
6. The Future of Mass Timber?



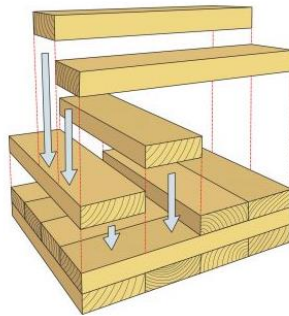
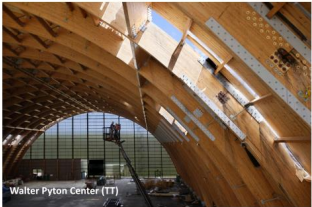
AGENDA

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WHAT IS MASS TIMBER?



GLUED-LAMINATED TIMBER
(GLULAM)



Structuremag



“Mass timber is a category of framing styles typically characterized by the use of large solid wood panels for wall, floor, and roof construction.”

American Wood Council (AWC)



MASS TIMBER SLABS

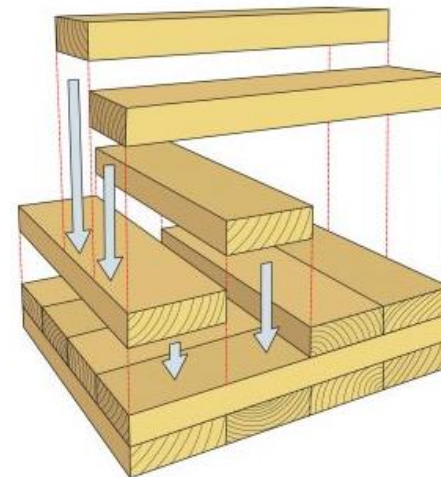
CLT (Cross Laminated Timber)

Pros:

- Timber Aesthetic
- Code Approved
- Two-Way System
- “Layup” Flexibility
- Multiple Manufacturers

Cons:

- Limited Manufacturers in N.A. (currently)
- Cost Driven by Market Availability
- Reliance on Glue



Structuremag



MASS TIMBER SLABS

CLT Alternate #1 (NLT)

Pros:

- Efficient Use of Material
- Timber Aesthetic
- Comparatively Cheap
- Any Carpenter Can Construct

Cons:

- On-Site Quality Control is Difficult
- Labor Intensive, Time Consuming
- Difficult to Mass Produce
- Panel Size Controlled by Lumber Length



MASS TIMBER SLABS

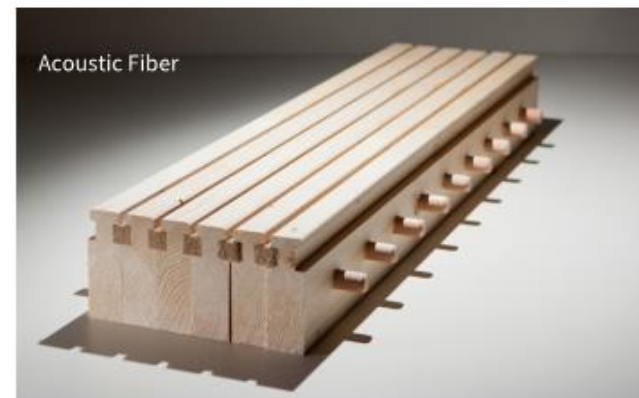
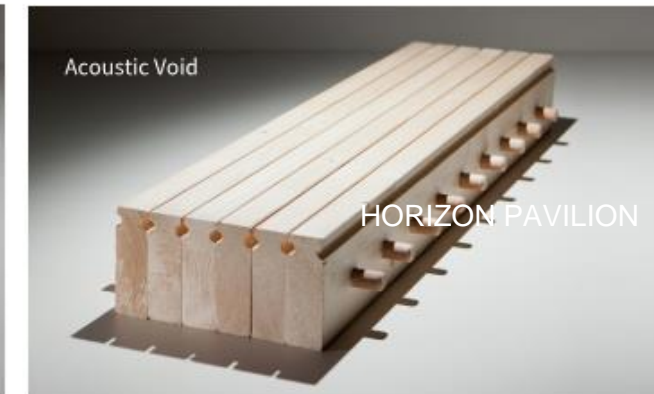
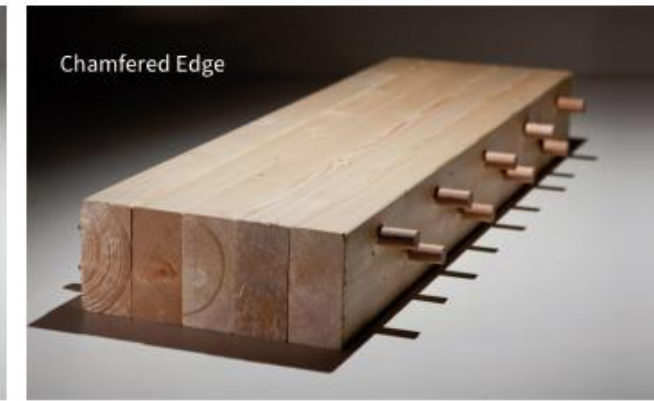
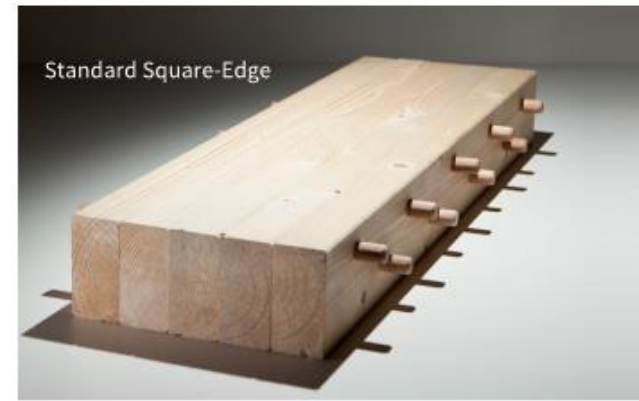
CLT Alternate #2 (DLT)

Pros:

- Efficient Use of Material
- Timber Aesthetic
- “100% Wood”
- High Quality Control
- Potential Additional Acoustical Benefits

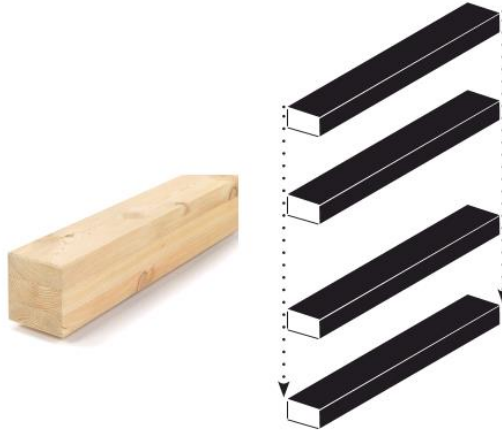
Cons:

- Cost Driven by Market Availability
 - Single Manufacturer (Structurcraft)
- Panel Size Controlled by Lumber Length

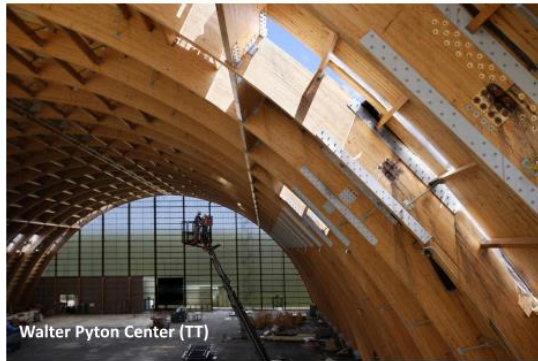


MASS TIMBER BEAMS AND COLUMNS

Beams and Columns

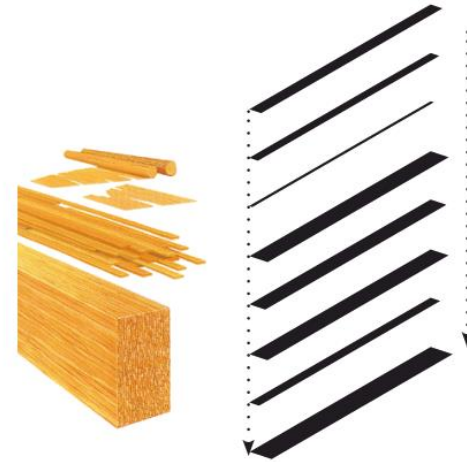


GLUED-LAMINATED TIMBER
[GLULAM]



Walter Pyton Center (TT)

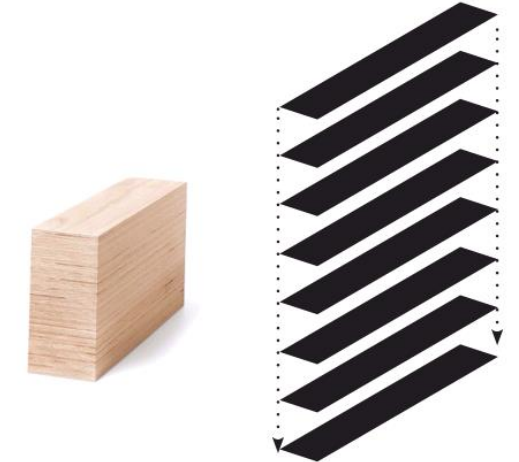
Glued-Laminated Timber
(Glulam)



PARALLEL STRAND LUMBER
[PSL]



Parallel Strand Lumber
(PSL)



LAMINATED VENEER TIMBER
[LVL]



Metropol Parasol
Seville, Spain

Laminated Veneer Lumber
(LVL)

WHY MASS TIMBER?

Sustainability

- Renewable resource
- Low Fabrication Emissions

Aesthetics

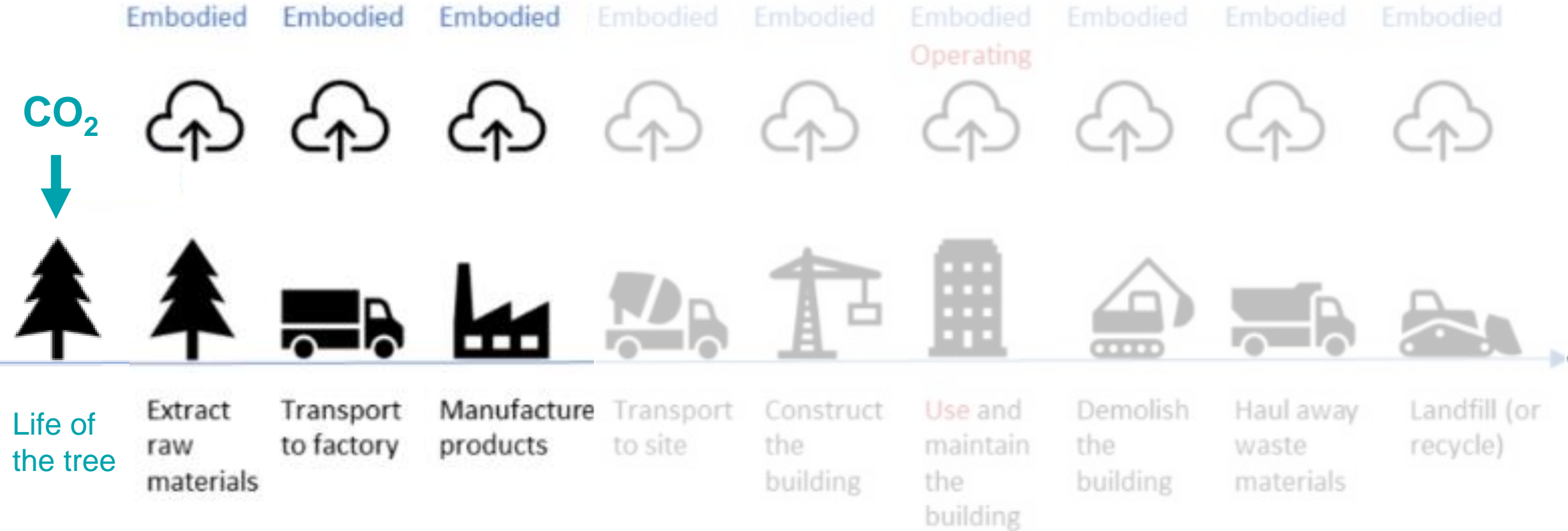
- Connection to nature / biophilia
- Intrinsic Beauty and Appeal

Construction

- Increased Speed of Construction
 - Prefabrication
 - Fit-Out
- Reduced Weight
 - Lighter Foundations



Embodied Carbon: Trees Absorption of CO2

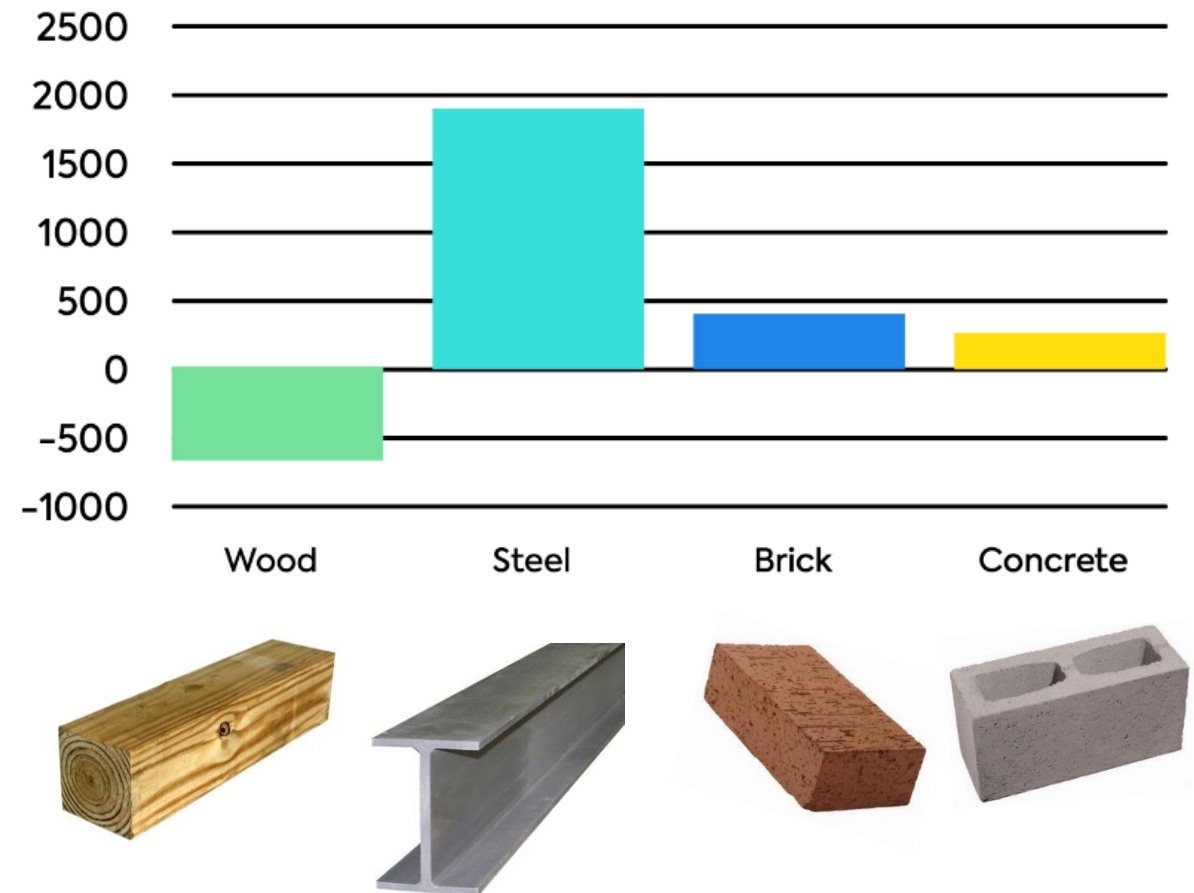


EMBODIED CARBON

Life Cycle



Kg of CO₂ created (or stored) to create each tonne of building materials

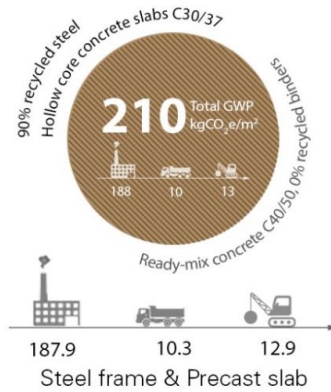


EMBODIED CARBON

GWP

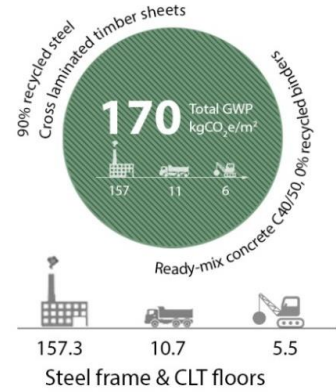
Steel & Concrete

Total GWP (kg CO₂e/m²)



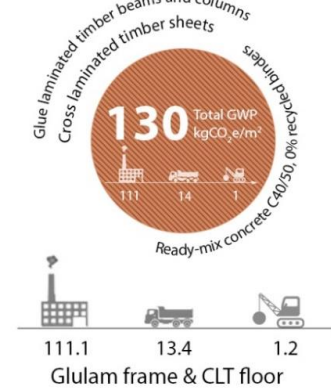
Hybrid (Steel + Timber)

Total GWP (kg CO₂e/m²)



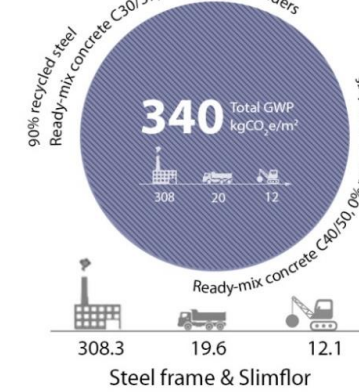
Timber

Total GWP (kg CO₂e/m²)



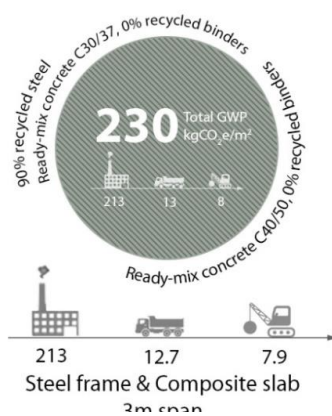
Steel

Total GWP (kg CO₂e/m²)



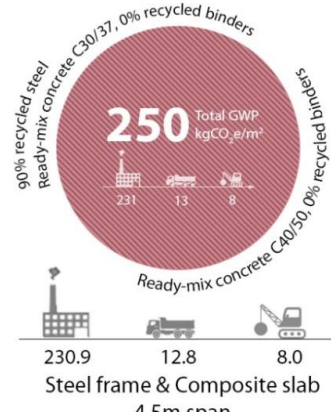
Steel & Composite

Total GWP (kg CO₂e/m²)



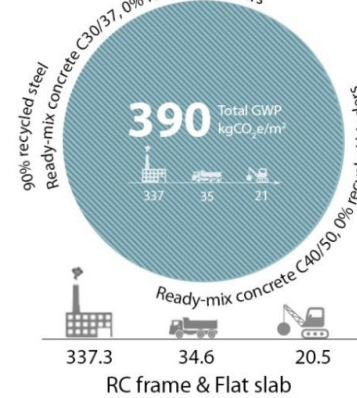
Steel & Composite

Total GWP (kg CO₂e/m²)



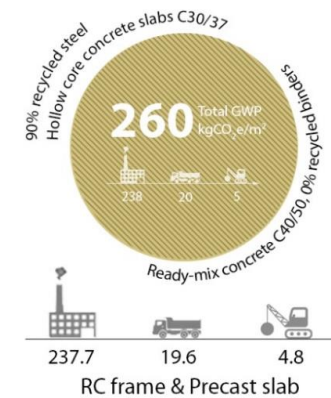
Concrete

Total GWP (kg CO₂e/m²)



Concrete

Total GWP (kg CO₂e/m²)



A photograph of a forest path. Sunlight filters through the tall, thin trees, creating a bright, hazy atmosphere. The path is covered in green ferns and other forest floor vegetation. The overall scene is peaceful and natural.

ASCENT:

The building will sequester approximately 7,200 metric tons of CO₂.

It will take approximately 25 minutes to grow this volume of wood in North American forests.

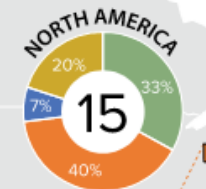
This CO₂ benefit is also equivalent to taking approximately 2400 cars off the road for a year or the energy to operate over 1100 homes for a year.

Tall Timber: A Global Audit

This data study comprises the 84 mass timber buildings eight stories and taller, built or under construction, organized by structural type and by region, globally. Key projects of each type are highlighted, and the proportion of each structural type within each region is shown in the ring diagrams. The three tallest buildings of each structural type are shown as elevations with project data. The data in this study are accompanied by a research paper on pages 22–29, which provides the context and additional information on the current state of tall timber buildings as of February 2022.

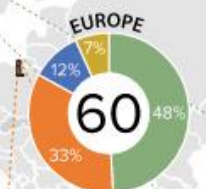


12 FLOORS
Tallwood 1 at District 56
Status: Under construction (2022)
Location: Langford, Canada
Height: 41.6 m



22 FLOORS
De Karel Doorman
Status: Completed (2012)
Location: Rotterdam, The Netherlands
Height: 70.5 m

14 FLOORS
Treet
Status: Complete (2015)
Location: Bergen, Norway
Height: 49.0 m



19 FLOORS
Sara Kulturhus
Status: Completed (2021)
Location: Skellefteå, Sweden
Height: 72.8 m

14 FLOORS
Lighthouse Joensuu
Status: Completed (2019)
Location: Joensuu, Finland
Height: 48.0 m

Structural Types

- All-Timber
- Concrete-Timber Hybrid
- Steel-Timber Hybrid
- Concrete-Steel-Timber Hybrid

X
Total Number of Buildings in Region

XX
Elevation drawings of three tallest buildings of each structural type.

Project Name
Status: Construction/Status (Year)
Location: City, Country
Height: X m

25 FLOORS
Ascent
Status: Under construction (2022)
Location: Milwaukee, USA
Height: 86.6 m

16 FLOORS
Hyperion
Status: Completed (2021)
Location: Bordeaux, France
Height: 55.0 m

24 FLOORS
HoHo
Status: Completed (2020)
Location: Vienna, Austria
Height: 84.0 m

22 FLOORS
HAUT
Status: Under construction (2022)
Location: Amsterdam, The Netherlands
Height: 73.0 m

18 FLOORS
Mjøstårnet
Status: Completed (2019)
Location: Brumunddal, Norway
Height: 85.4 m



11 FLOORS
25 King
Status: Completed (2018)
Location: Brisbane, Australia
Height: 46.8 m

19 FLOORS
55 Southbank
Status: Completed (2020)
Location: Melbourne, Australia
Height: 69.7 m



49 weeks
Stadthaus, London, was built in 49 weeks, compared to a 72-week construction time of a concrete-framed building of this size.

900,000 kilograms
Origine, Québec City, is estimated to have released 900,000 fewer kilograms of CO₂ equivalent than a conventional concrete and steel building.

17 minutes
It took just 17 minutes for Austrian forests to grow the volume of timber needed for HoHo, Vienna's structural timber.

+16
De Karel Doorman, Rotterdam, added 16 stories of concrete-steel-timber hybrid construction on top of the original 1951 Ter Meulen building.

x 13,500
The amount of carbon dioxide trapped in the timber used at Sara Kulturhus, Skellefteå, is equivalent to about 13,500 flights from Stockholm to New York.

AGENDA

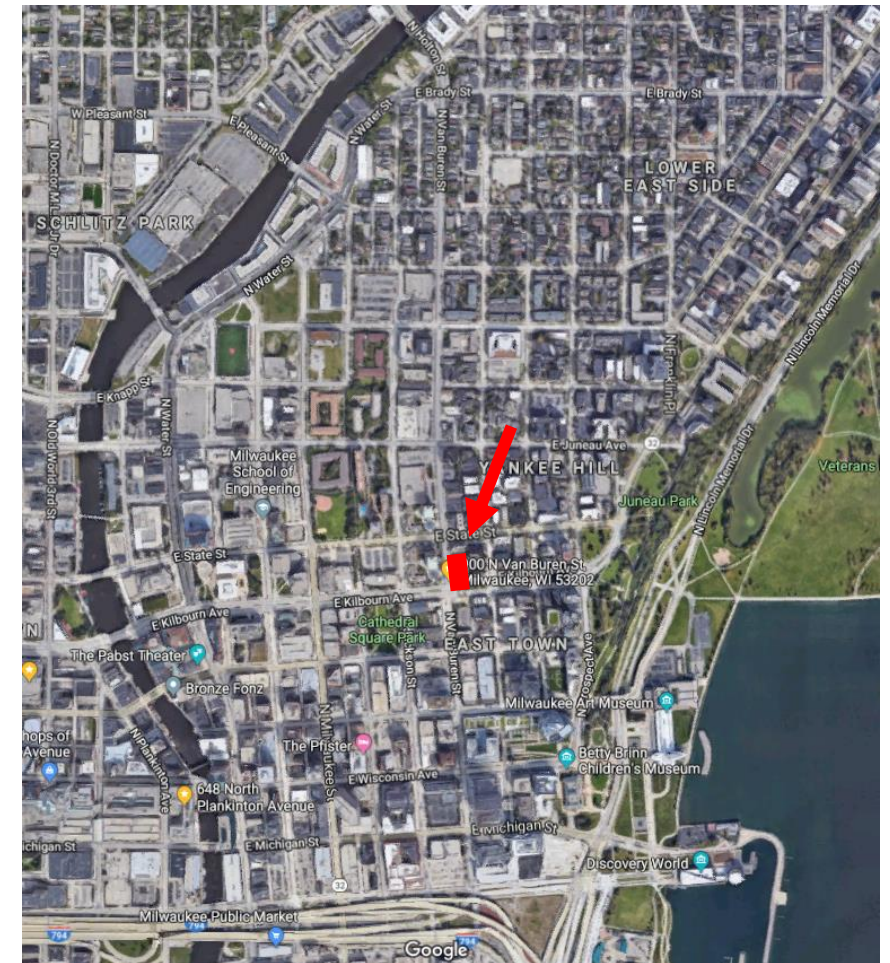
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ASCENT:

Milwaukee, WI



Korb + Associates



ASCENT:

TEAM:



NEW LAND

ENTERPRISES
DEVELOPER



ARCHITECT

Thornton Tomasetti

S.E.R.



GENERAL CONTRACTOR



TIMBER CONTRACTOR



CadMakers

DETAILER



KLH®

CLT



WIEHAG

TIMBER CONSTRUCTION

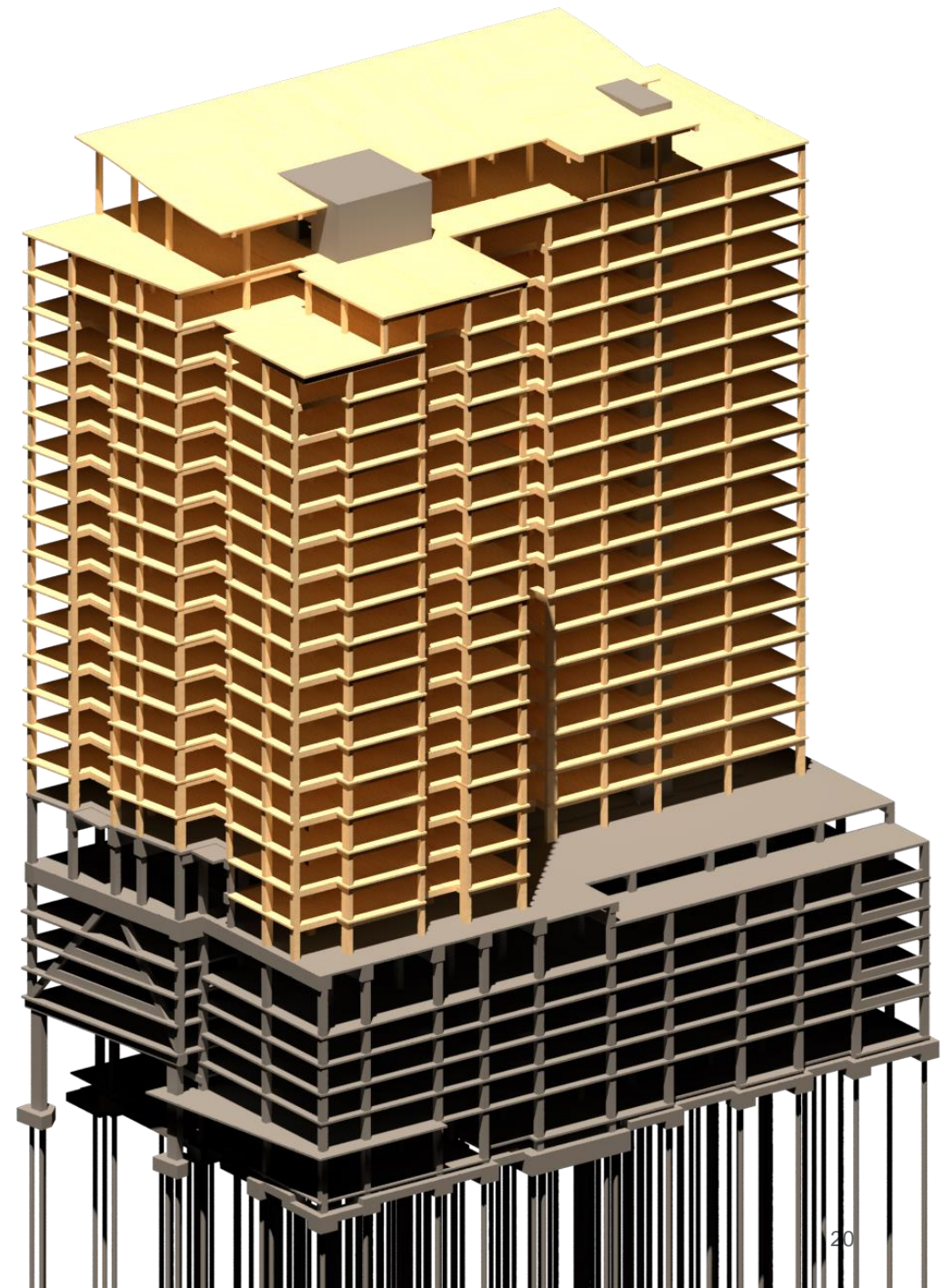
GLULAM

CONCRETE + STEEL +
MASS TIMBER ERECTION

MASS TIMBER PROCUREMENT

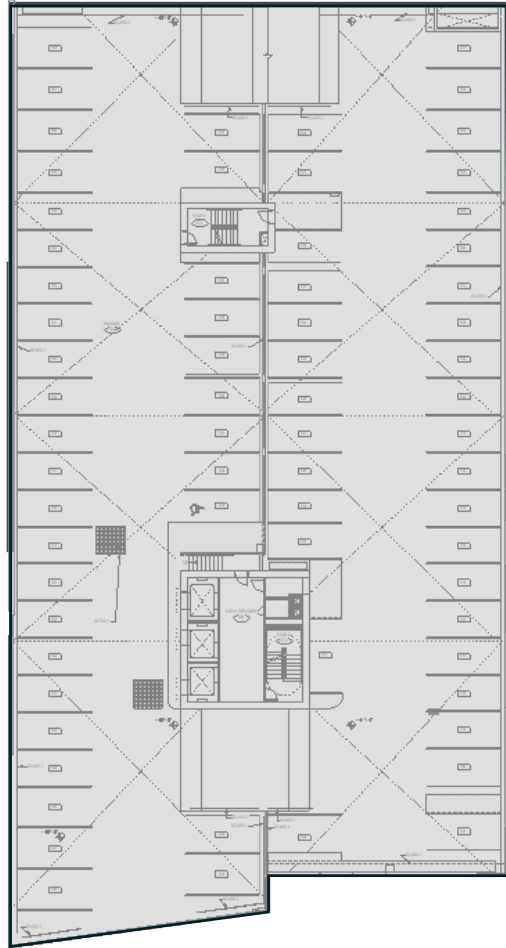
ASCENT FACTS:

- 19 STORIES OF TIMBER OVER A 6 STORY CONCRETE PODIUM
- HEIGHT: 284 FT
- FLOOR AREA OF TIMBER: ~324,400 SF (259 UNITS)
- GROSS AREA: ~456,000 SF
- APPROVALS PURSUED UNDER WCBC SECTION 361, SIMILAR TO 2015 IBC'S "ALTERNATE MATERIALS, DESIGN AND METHODS" SECTION
- ACHIEVES CLASS FIRE RESISTANCE THROUGH BOTH ENCAPSULATION AND SACRIFICIAL/ CHAR METHOD – (50% OF MASS TIMBER EXPOSED)



ASCENT:

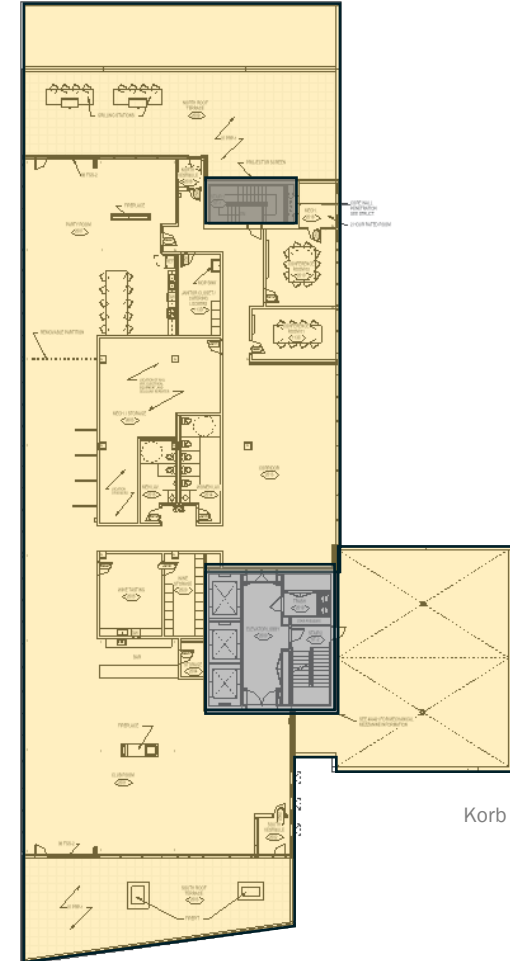
Typical Floor Plans:



TYPICAL PARKING
LEVEL



TYPICAL RESIDENTIAL
LEVEL

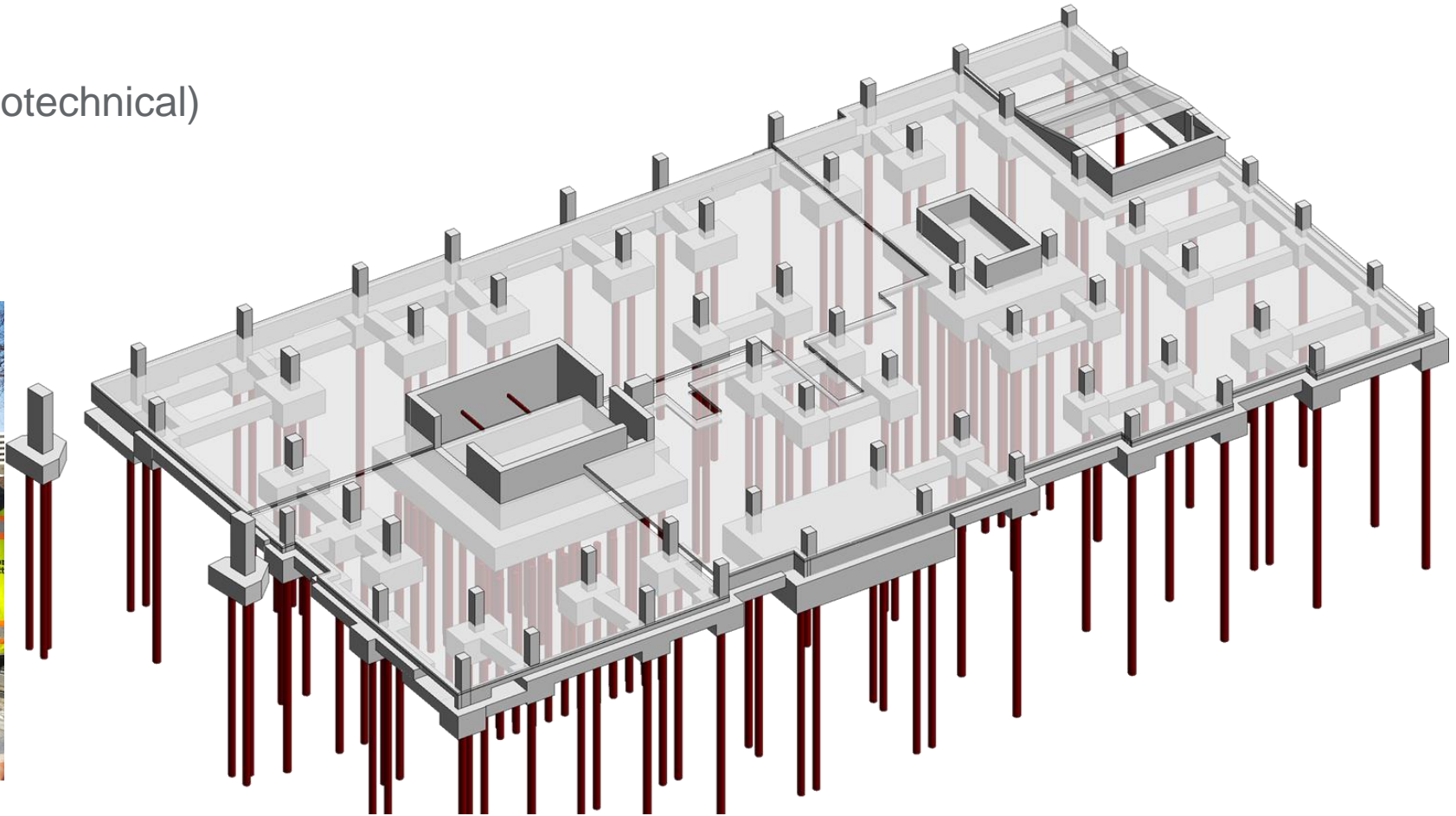


AMENITIES LEVEL
(L25)

ASCENT STRUCTURE

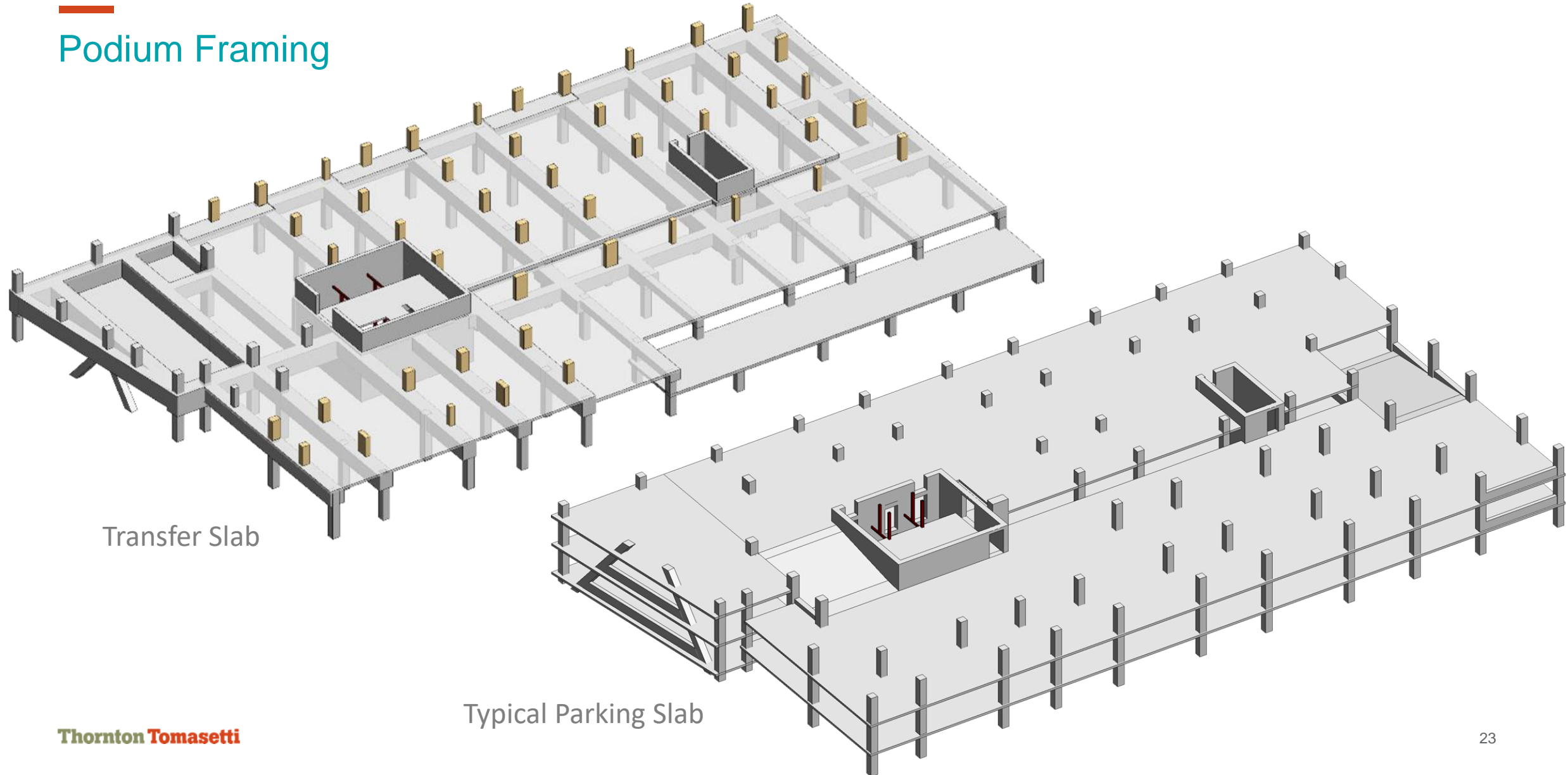
Foundation

- Light weight superstructure
- Static Load Test: 450 Tons (Geotechnical)
 - Limited by reaction frame!



ASCENT STRUCTURE

Podium Framing

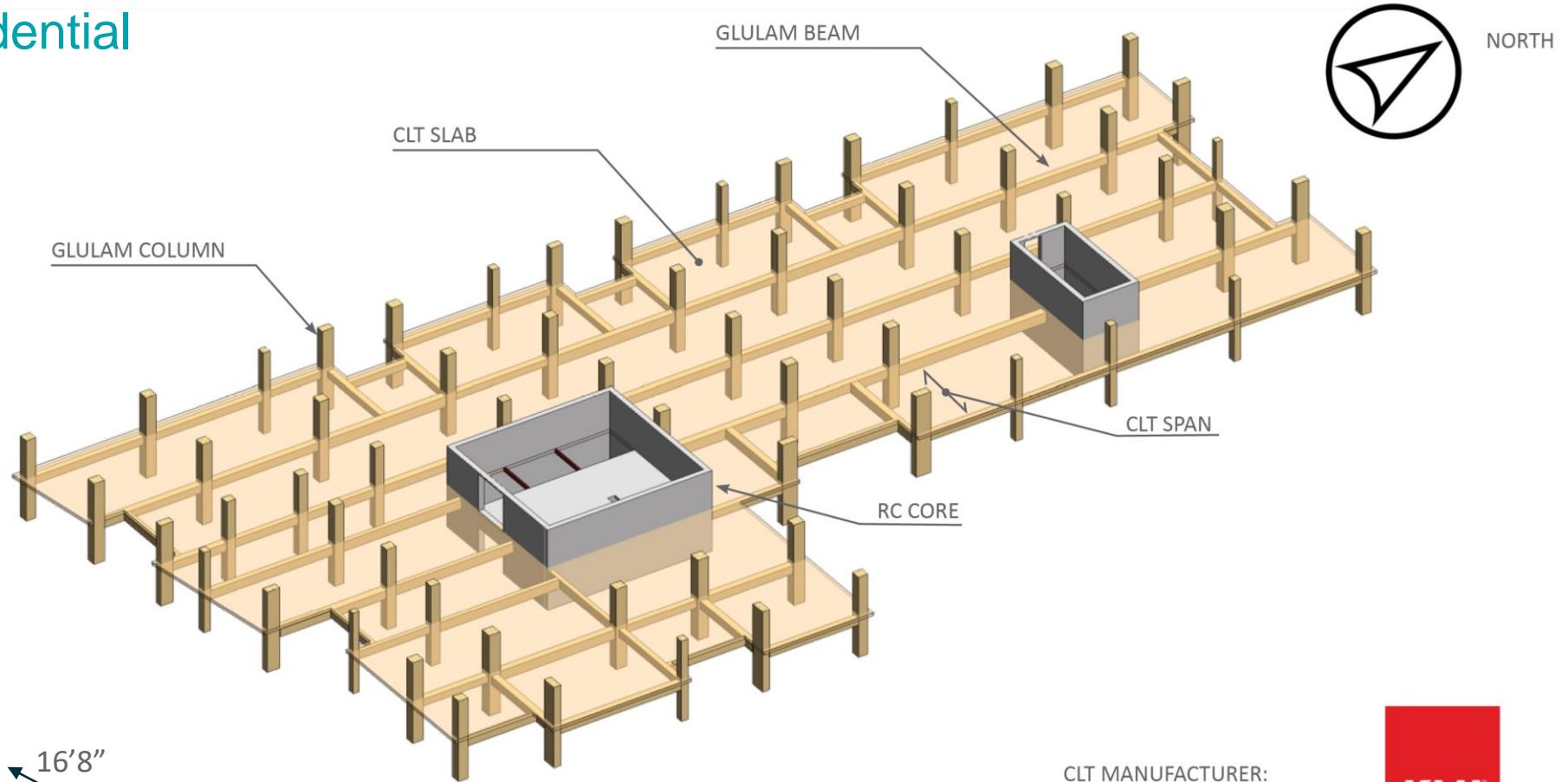


Transfer Slab

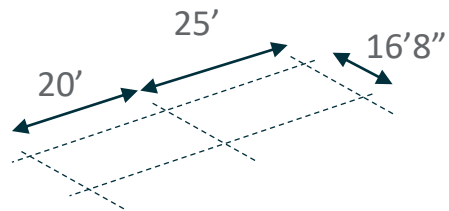
Typical Parking Slab

ASCENT STRUCTURE

Typical Residential



TYPICAL GRID



CLT MANUFACTURER:

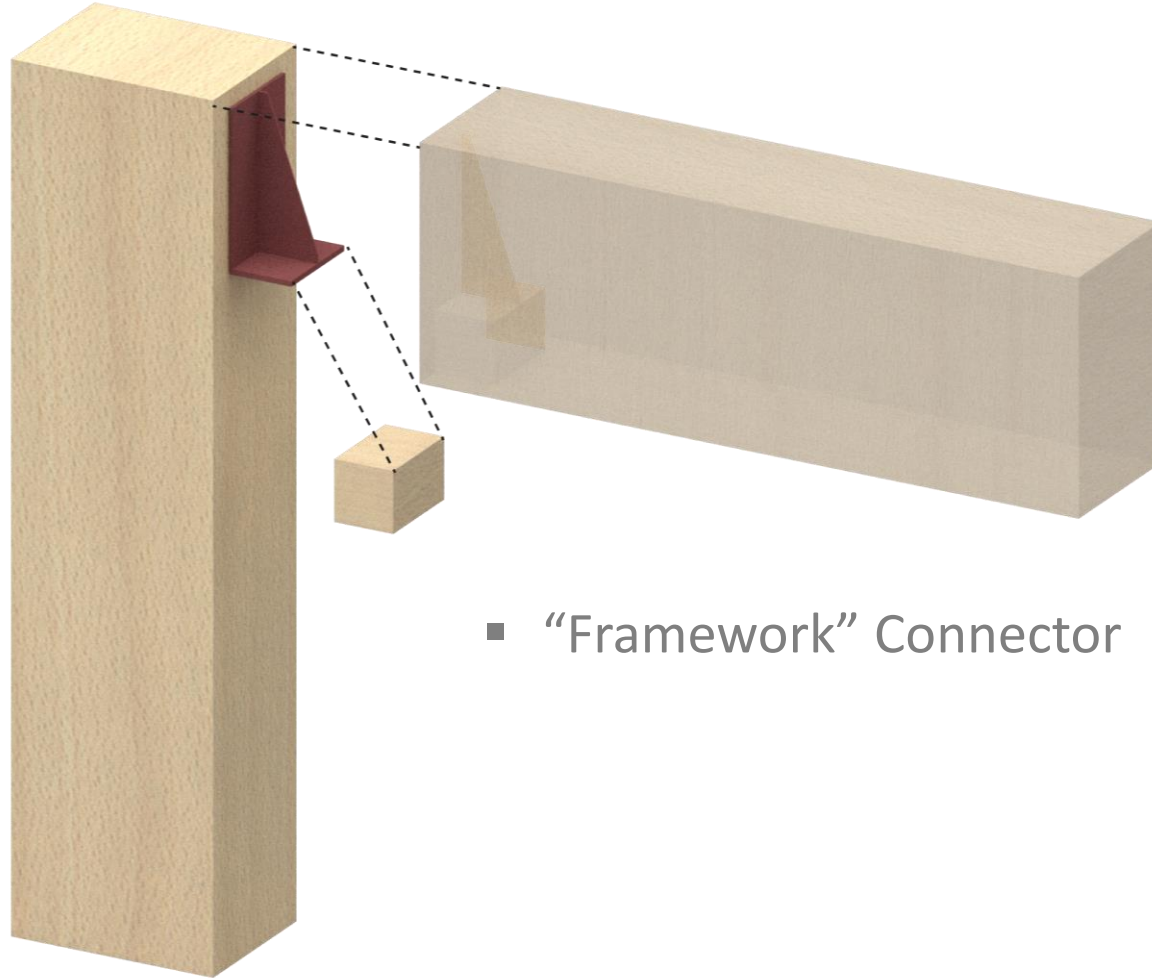


GLULAM MANUFACTURER:



ASCENT CONNECTIONS

Exposed

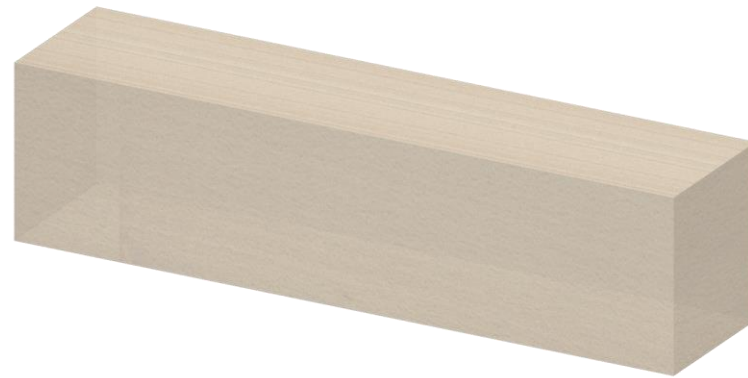
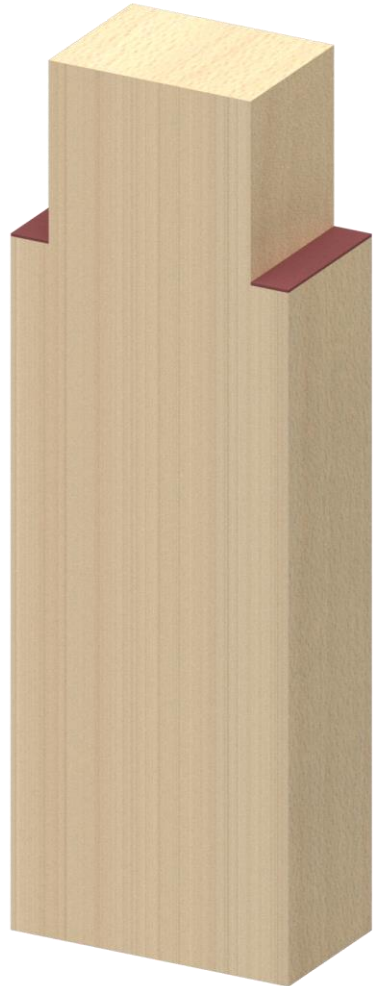


- “Framework” Connector



ASCENT CONNECTIONS

Concealed

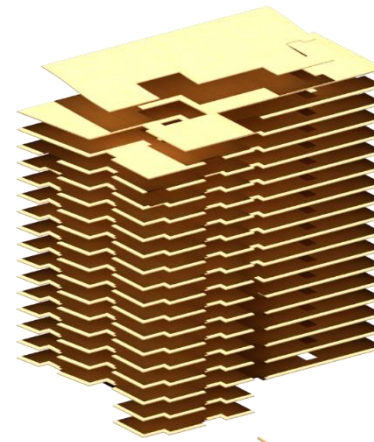
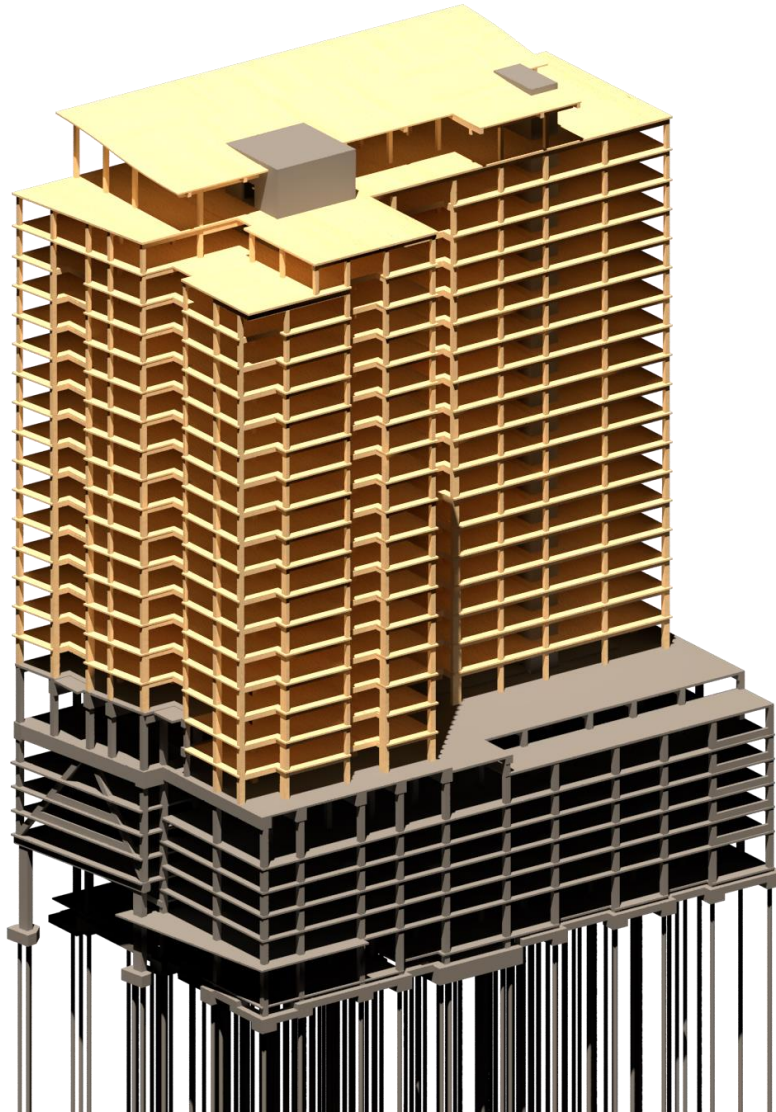


- Wood-Wood Bearing

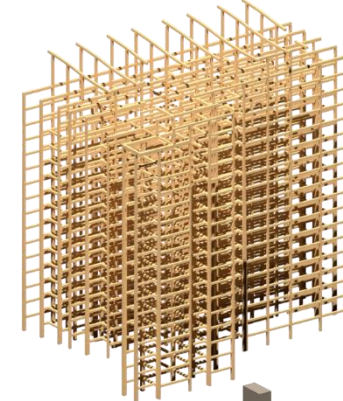


ASCENT STRUCTURE

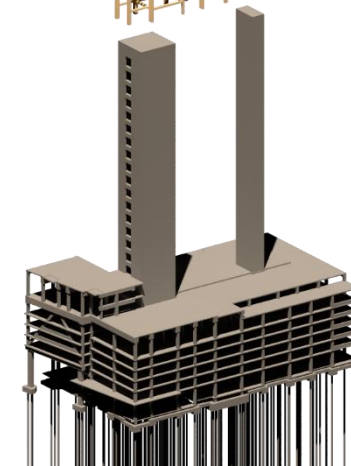
Systems



SLABS (CLT)



BEAMS + COLUMNS
(GLULAM)



PODIUM AND LATERAL
SYSTEM (CONCRETE)

CONSTRUCTION SEQUENCE

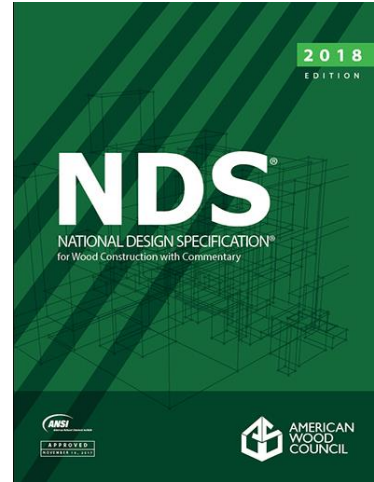
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MASS TIMBER

Material Considerations

- Visual Appearance vs. Material Properties
- Design Methodology
- Code Compliance (NDS vs. Eurocode)



Spruce



Douglas Fir



Yellow Pine



Smartlam

MASS TIMBER

Sound and Vibration Considerations

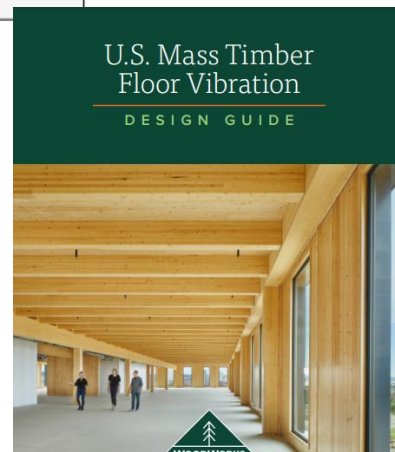
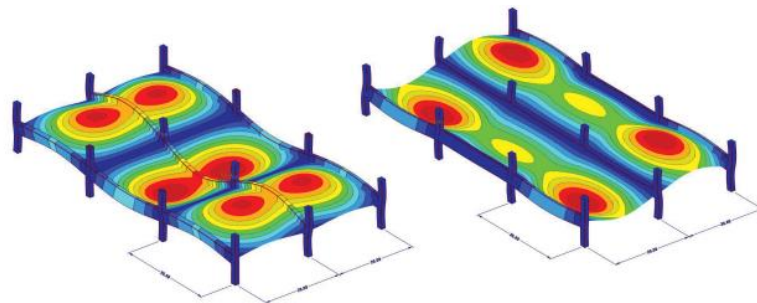
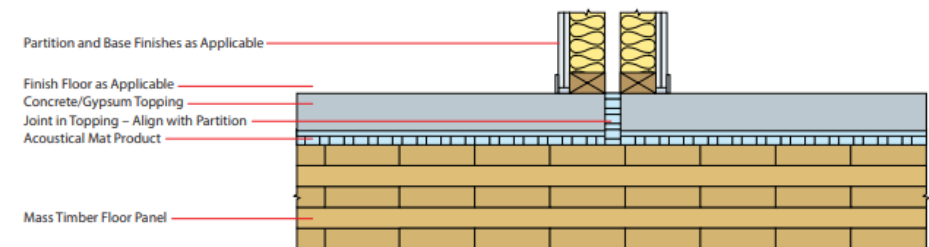
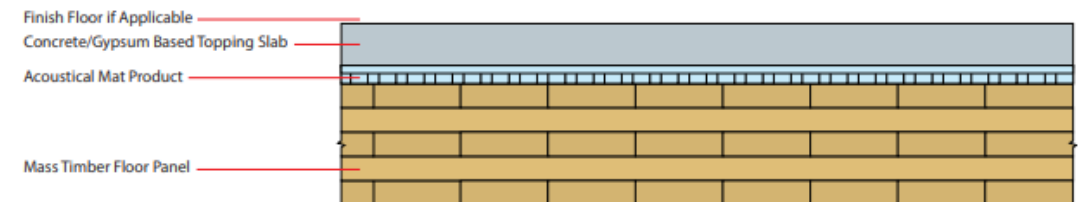
Category	Range of Damping ζ (% critical)	Discussion
Lightly damped	1-2%	The lower end includes bare floors without topping and with minimal furnishing. The higher end includes floors with concrete topping and furnishings.
Moderately damped	2-4%	Lower values include bare timber-concrete composite floors, or timber floors with a floating concrete layer and full furnishings. The higher values include floors with floating floor layers, raised floors, full furnishings and mechanical systems. Floors with both furnishings and permanent partitions, not otherwise accounted for, could also be represented at the higher end of this damping range.
Heavily damped	4-5%	Floors in this range represent the upper limit of inherent damping. These floors likely include floating toppings, raised floors, suspended ceilings, furnishings, fixtures and/or permanent partitions not otherwise taken into account.
Explicit damping control	5%+	Generally, mass timber floors do not have more than 5% damping unless explicit damping control (e.g., a tuned mass damper) is added. These systems are beyond the scope of this guide.

Acoustical floor underlayments



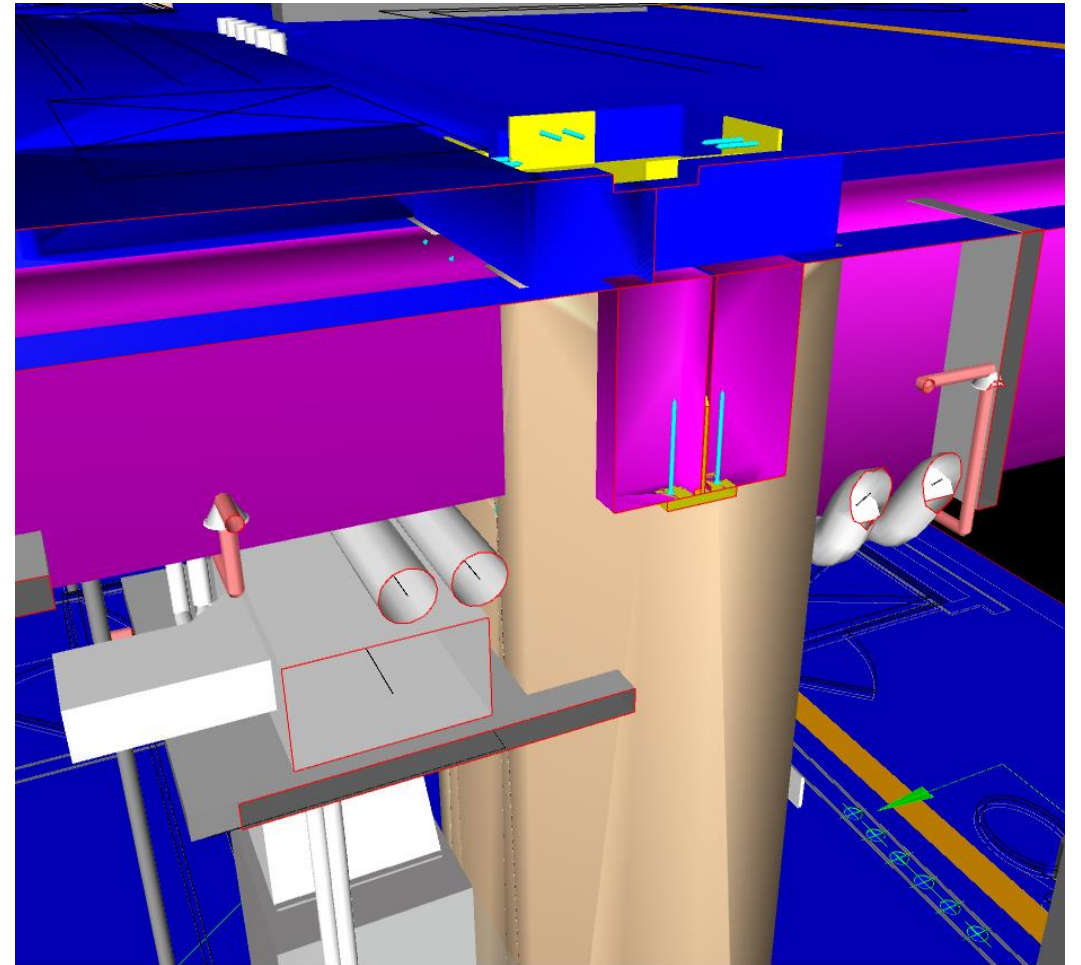
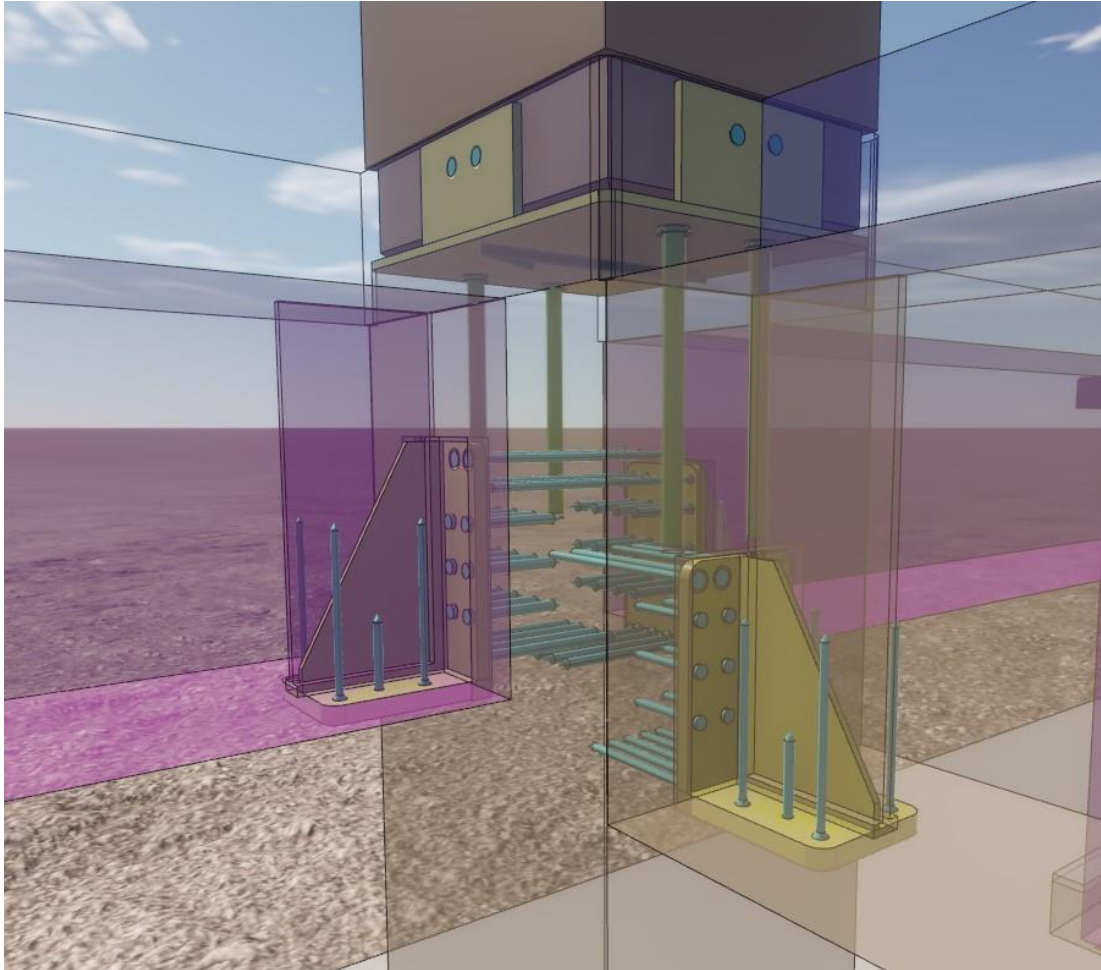
Photo: AcoustiTECHTM

Typical Mass Timber Floor Assembly Section View



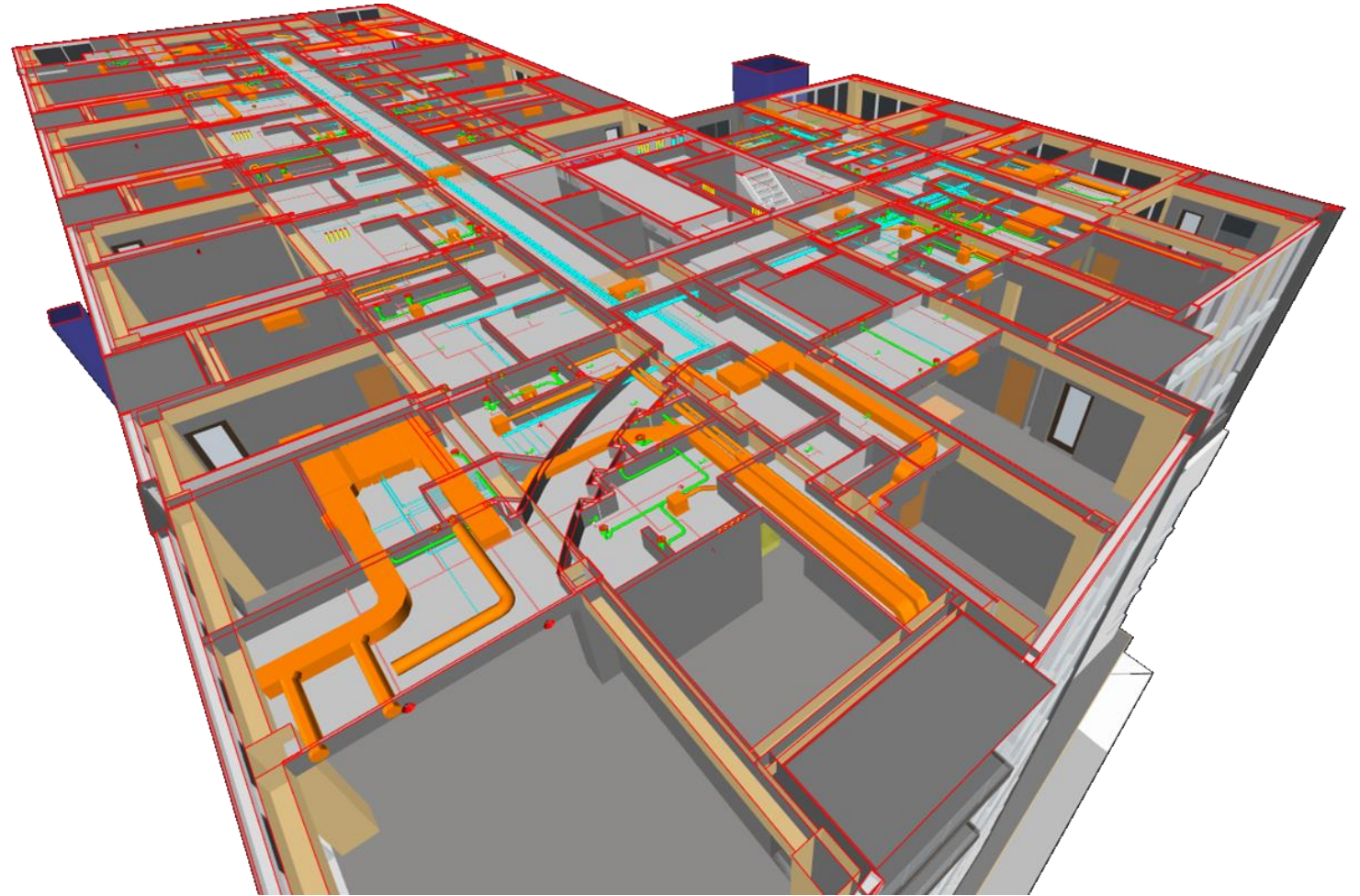
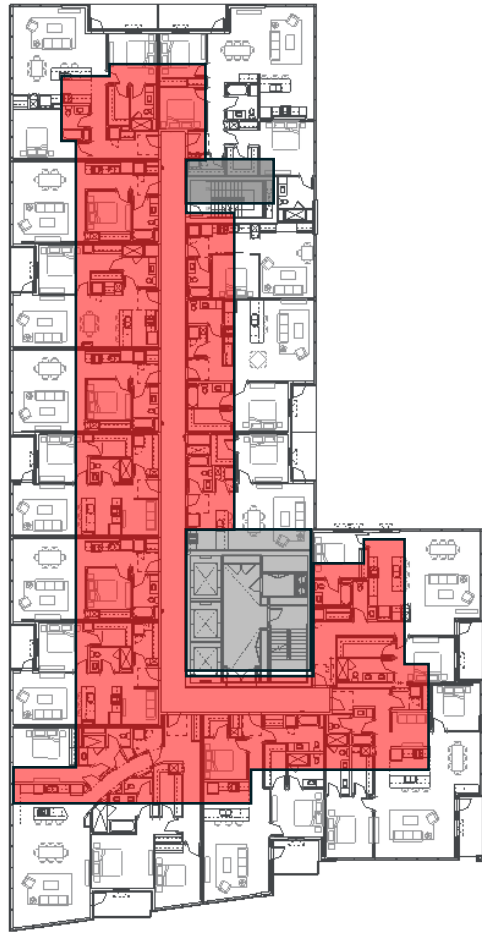
MASS TIMBER

Modeling



MASS TIMBER

Coordination



TYPICAL RESIDENTIAL
LEVEL

MASS TIMBER

Fire Rating

- Char
 - Calculations (Char Method)
 - Full Scale (Global) Testing
 - Element (Member) Testing
 - Connection Testing
- Product Certificates
- Concealment
- Intumescent Paint (connections only)

Table 16.2.1A Effective Char Rates and Char Depths (for $\beta_n = 1.5$ in./hr.)

Required Fire Endurance (hr.)	Effective Char Rate, β_{eff} (in./hr.)	Effective Char Depth, a_{char} (in.)
1-Hour	1.8	1.8
1½-Hour	1.67	2.5
2-Hour	1.58	3.2

Table 16.2.2 Adjustment Factors for Fire Design¹

	ASD							
	Design Stress to Member Strength Factor	Size Factor ²	Volume Factor ²	Flat Use Factor ²	Beam Stability Factor ³	Column Stability Factor ³		
Bending Strength	F_b	x	2.85	C_F	C_V	C_{fu}	C_L	-
Beam Buckling Strength	F_{bE}	x	2.03	-	-	-	-	-
Tensile Strength	F_t	x	2.85	C_F	-	-	-	-
Compressive Strength	F_c	x	2.58	C_F	-	-	-	C_P
Column Buckling Strength	F_{cE}	x	2.03	-	-	-	-	-

1. See 4.3, 5.3, 8.3, and 10.3 for applicability of adjustment factors for specific products.

2. Factor shall be based on initial cross-section dimensions.

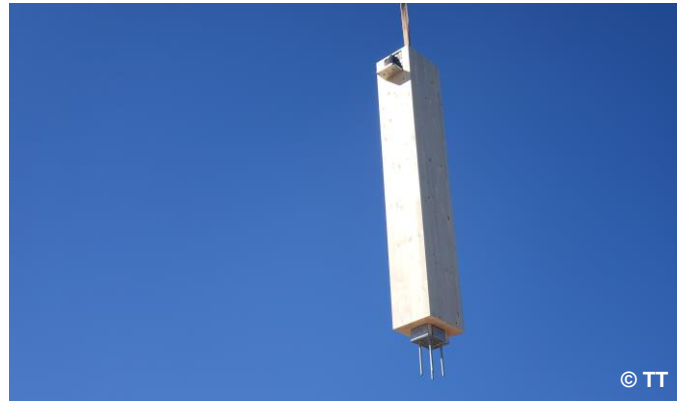
3. Factor shall be based on reduced cross-section dimensions.

MASS TIMBER

Fire Performance



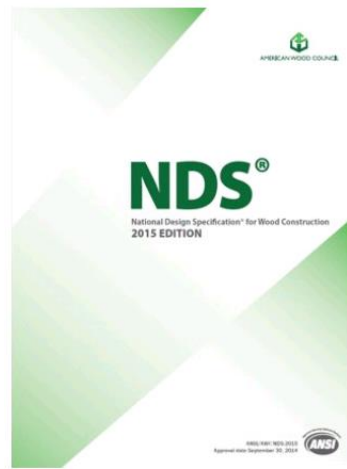
BEAMS



COLUMNS



CLT



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PRECEDENTS



T3, Minneapolis, USA
(7 stories)

Thornton Tomasetti



Brock Commons, Vancouver, Canada
(18 stories)



Mjøstårnet, Brumunddal, Norway
(18 stories)

PERMITTING

IBC 2015-2018

602.2 Types I and II. Types I and II construction are those types of construction in which the building elements listed in Table 601 are of **noncombustible materials** except as permitted in Section 603 and elsewhere in this code.

602.3 Type III. Type III construction is that type of construction in which the exterior walls are of noncombustible materials and the interior building elements are of any material permitted by this code. *Fire-retardant-treated wood* framing complying with Section 2303.2 shall be permitted within *exterior wall* assemblies of a 2-hour rating or less.

602.4 Type IV. Type IV construction (Heavy Timber, HT) is that type of construction in which the exterior walls are of noncombustible materials and the interior building elements are of solid or laminated wood without concealed spaces. The details of Type IV construction shall comply with the provisions of this section and Section 2304.11. Exterior walls complying with Section 602.4.1 or 602.4.2 shall be permitted.

602.5 Type V. Type V construction is that type of construction in which the structural elements, *exterior walls* and interior walls are of any materials permitted by this code.

Type	Interior Material	Exterior Material	Façade exceptions
Types I & II	Non Combustible	Non Combustible	None
Type III	Any	Non Combustible	Fire-retardant-treated wood (FRTW)
Type IV	Solid or laminated wood	Non Combustible	FRTW CLT
Type V	Any	Any	N/A

PERMITTING

IBC 2015-2018

TABLE 504.3^a
ALLOWABLE BUILDING HEIGHT IN FEET ABOVE GRADE PLANE

OCCUPANCY CLASSIFICATION	TYPE OF CONSTRUCTION									
	SEE FOOTNOTES	TYPE I		TYPE II		TYPE III		TYPE IV	TYPE V	
		A	B	A	B	A	B	HT	A	B
A, B, E, F, M, S, U	NS ^b	UL	160	65	55	65	55	65	50	40
	S	UL	180	85	75	85	75	85	70	60
H-1, H-2, H-3, H-5	NS ^{c, d}	UL	160	65	55	65	55	65	50	40
	S									
H-4	NS ^{c, d}	UL	160	65	55	65	55	65	50	40
	S	UL	180	85	75	85	75	85	70	60
I-1 Condition 1, I-3	NS ^{d, e}	UL	160	65	55	65	55	65	50	40
	S	UL	180	85	75	85	75	85	70	60
I-1 Condition 2, I-2	NS ^{d, f, e}	UL	160	65	55	65	55	65	50	40
	S	UL	180	85						
I-4	NS ^{d, g}	UL	160	65	55	65	55	65	50	40
	S	UL	180	85	75	85	75	85	70	60
R	NS ^{d, h}	UL	160	65	55	65	55	65	50	40
	S13R	60	60	60	60	60	60	60	60	60
	S	UL	180	85	75	85	75	85	70	60

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RESIDENTIAL

IBC 2015

PERMITTING

IBC 2015-2018

TABLE 504.4^{a, b}—continued
ALLOWABLE NUMBER OF STORIES ABOVE GRADE PLANE

OCCUPANCY CLASSIFICATION	TYPE OF CONSTRUCTION									
	SEE FOOTNOTES	TYPE I		TYPE II		TYPE III		TYPE IV	TYPE V	
		A	B	A	B	A	B	HT	A	B
B	NS	UL	11	5	3	5	3	5	3	2
	S	UL	12	6	4	6	4	6	4	3
R-1	NS ^{d, h}	UL	11	4	4	4	4	4	3	2
	S13R	4	4						4	3
	S	UL	12	5	5				5	5
R-2	NS ^{d, h}	UL	11	4	4	4	4	4	3	2
	S13R	4	4						4	4
	S	UL	12	5	5				5	5
R-3	NS ^{d, h}	UL	11	4	4	4	4	4	3	3
	S13R	4	4						4	4
	S	UL	12	5	5				5	5
R-4	NS ^{d, h}	UL	11	4	4	4	4	4	3	2
	S13R	4	4						4	3
	S	UL	12	5	5				5	5

OFFICE

RESIDENTIAL

IBC 2015

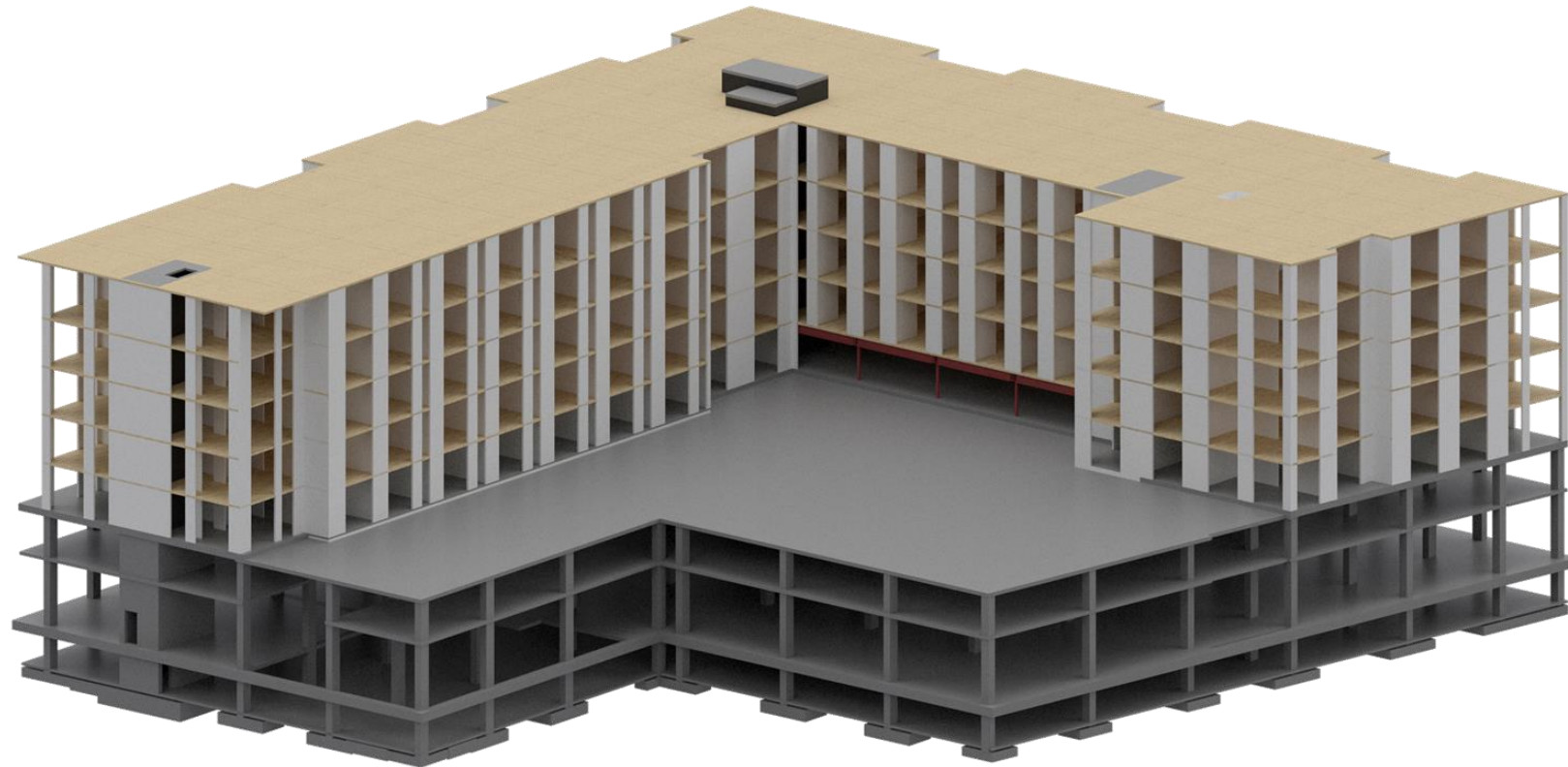
PERMITTING

IBC 2015-2018



PERMITTING

IBC 2015-2018



STICK
FRAMING
WALLS + CLT
SLABS
CONCRETE
PODIUM
CONCRETE
BASEMENT

PERMITTING

UNITED STATES APPROVALS

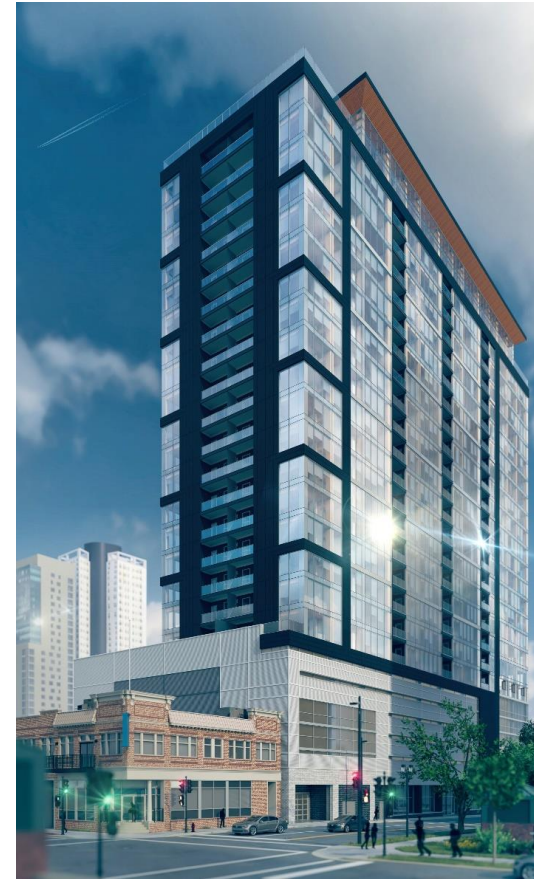


12 stories

Framework (2017)
Portland, OR



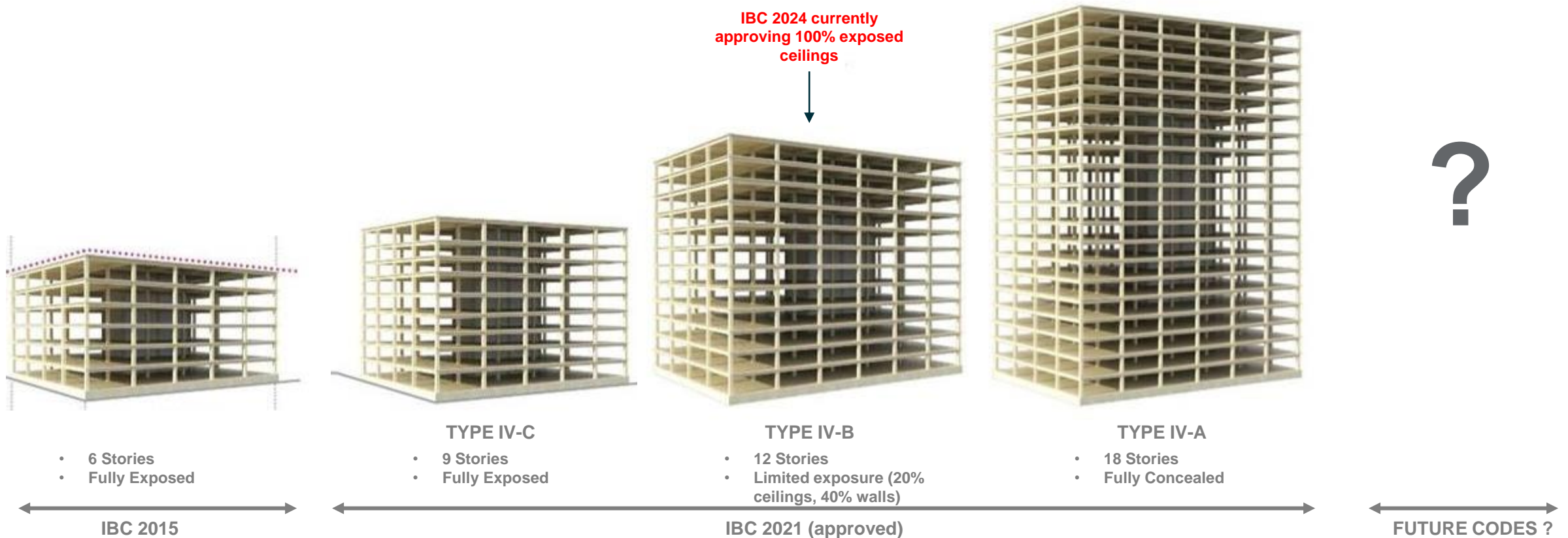
25 stories



Ascent (2020)
Milwaukee, WI

CODE DEVELOPMENT

IBC (2021 and Beyond)



Images From American Wood Council (<https://awc.org/tallmasstimber>)

PERMITTING

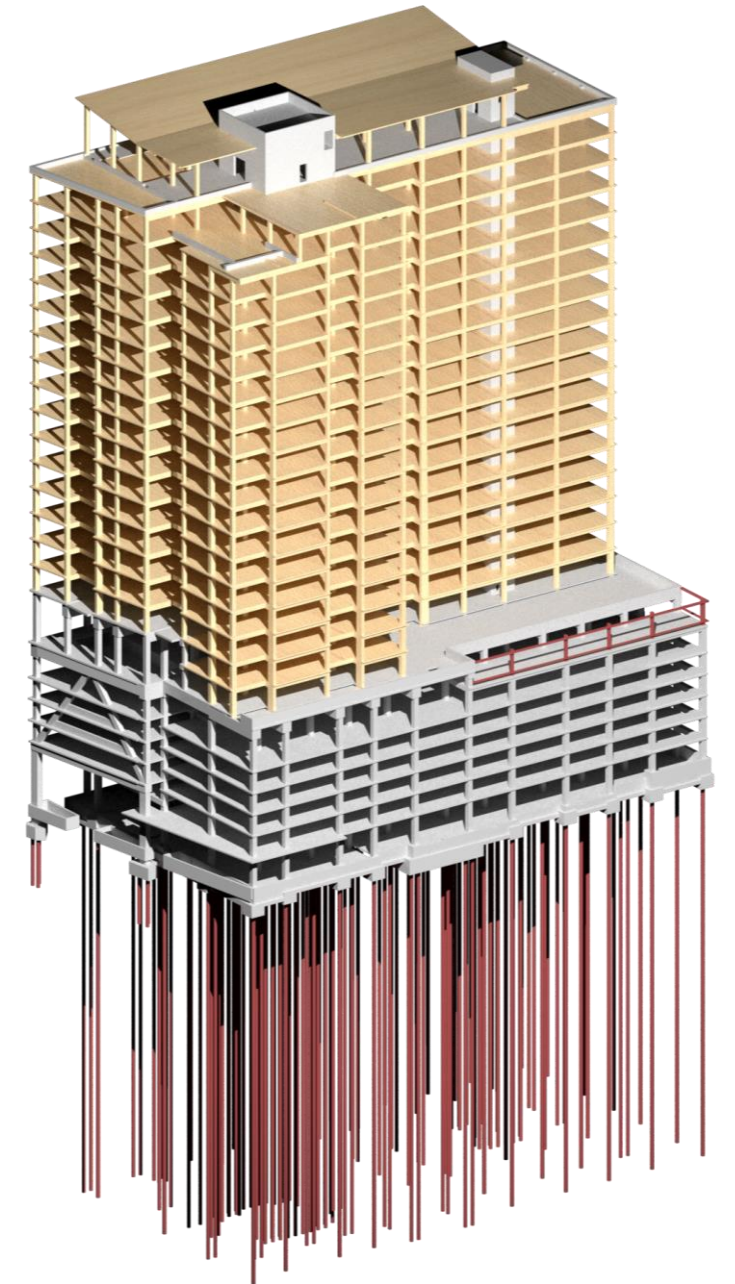
Alternate Materials

[A] **104.11 Alternative materials, design and methods of construction and equipment.** The provisions of this code are not intended to prevent the installation of any material or to prohibit any design or method of construction not specifically prescribed by this code, provided that any such alternative has been *approved*. An alternative material, design or method of construction shall be *approved* where the *building official* finds that the proposed design is satisfactory and complies with the intent of the provisions of this code, and that the material, method or work offered is, for the purpose intended, not less than the equivalent of that prescribed in this code in quality, strength, effectiveness, *fire resistance*, durability and safety. Where the alternative material, design or method of construction is not *approved*, the *building official* shall respond in writing, stating the reasons why the alternative was not *approved*.

[A] **104.11.1 Research reports.** Supporting data, where necessary to assist in the approval of materials or assemblies not specifically provided for in this code, shall consist of valid research reports from *approved* sources.

[A] **104.11.2 Tests.** Whenever there is insufficient evidence of compliance with the provisions of this code, or evidence that a material or method does not conform to the requirements of this code, or in order to substantiate claims for alternative materials or methods, the *building official* shall have the authority to require tests as evidence of compliance to be made at no expense to the jurisdiction. Test methods shall be as specified in this code or by other recognized test standards. In the absence of recognized and accepted test methods, the *building official* shall approve the testing procedures. Tests shall be performed by an *approved agency*. Reports of such tests shall be retained by the *building official* for the period required for retention of public records.

IBC 2015



PERMITTING

IBC and the Wisconsin Commercial Building Code

**TABLE 601
FIRE-RESISTANCE RATING REQUIREMENTS FOR BUILDING ELEMENTS (HOURS)**

BUILDING ELEMENT	TYPE I		TYPE II		TYPE III		TYPE IV	TYPE V	
	A	B	A	B	A	B	HT	A	B
Primary structural frame ^f (see Section 202)	3 ^a	2 ^a	1	0	1	0	HT	1	0
Bearing walls									
Exterior ^{e, f}	3	2	1	0	2	2	2	1	0
Interior	3 ^a	2 ^a	1	0	1	0	1/HT	1	0
Nonbearing walls and partitions	See Table 602								
Exterior	See Table 602								
Nonbearing walls and partitions	See Table 602								
Interior ^d	0	0	0	0	0	0	See Section 602.4.6	0	0
Floor construction and associated secondary members (see Section 202)	2	2	1	0	1	0	HT	1	0
Roof construction and associated secondary members (see Section 202)	1 1/2 ^b	1 ^{b,c}	1 ^{b,c}	0 ^c	1 ^{b,c}	0	HT	1 ^{b,c}	0

For SI: 1 foot = 304.8 mm.

- Roof supports: Fire-resistance ratings of primary structural frame and bearing walls are permitted to be reduced by 1 hour where supporting a roof only.
- Except in Group F-1, H, M and S-1 occupancies, fire protection of structural members shall not be required, including protection of roof framing and decking where every part of the roof construction is 20 feet or more above any floor immediately below. Fire-retardant-treated wood members shall be allowed to be used for such unprotected members.
- In all occupancies, heavy timber shall be allowed where a 1-hour or less fire-resistance rating is required.
- Not less than the fire-resistance rating required by other sections of this code.
- Not less than the fire-resistance rating based on fire separation distance (see Table 602).
- Not less than the fire-resistance rating as referenced in Section 704.10.

IBC 2015

Chapter SPS 361 ADMINISTRATION AND ENFORCEMENT

Subchapter I — Scope and Application

(6) Alternatives. Nothing in chs. SPS 361 to 366 is intended to prohibit or discourage the design and utilization of new building products, systems, components, or alternate practices, provided written approval from the department is obtained first.

Note: Chapter SPS 361, subch. VI contains requirements for approval of building products and alternate standards.

Subchapter VI — Product and Standard Review and Approval

SPS 361.50 Building product approvals.

(1) Voluntary approval.

(a) Materials, equipment, and products regulated under chs. SPS 361 to 366 may receive a written approval from the department indicating code compliance.

(b)

1. Approval of materials, equipment, and products shall be based on sufficient data, tests, and other evidence that prove the material, equipment, or product is in compliance with the standards specified in chs. SPS 361 to 366.

2. Tests, compilation of data, and calculations shall be conducted by a qualified independent third party.

(2) Alternate approval.

(a) Materials, equipment, and products that meet the intent of chs. SPS 361 to 366 and which are not approved under sub. (1) shall be permitted if approved in writing by the department.

(b)

1. Approval of materials, equipment, and products shall be based on sufficient data, tests, and other evidence that prove the material, equipment, or product meets the intent of the standards specified in chs. SPS 361 to 366.

2. Tests, compilation of data, and calculations shall be conducted by a qualified independent third party.

WISCONSIN COMMERCIAL BUILDING CODE

PERMITTING

Fire Rating

- Char
 - Calculations (Char Method)
 - Element (Member) Testing
 - 1st Ever 3 Hour Test!
 - Connection Testing

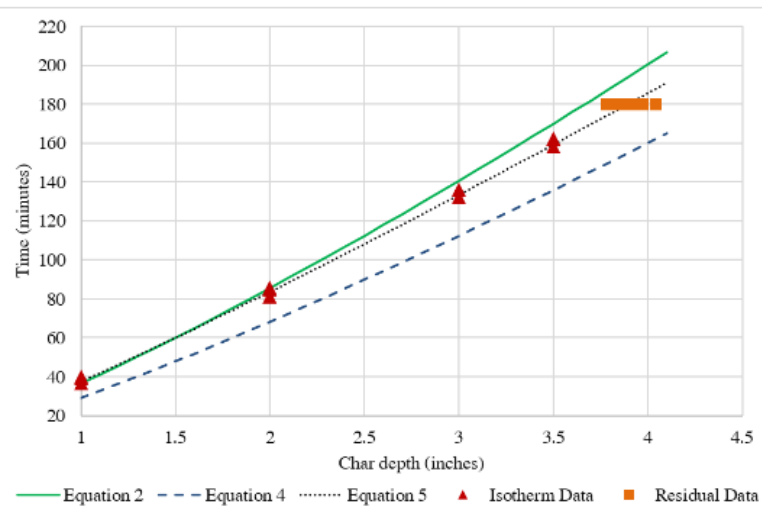
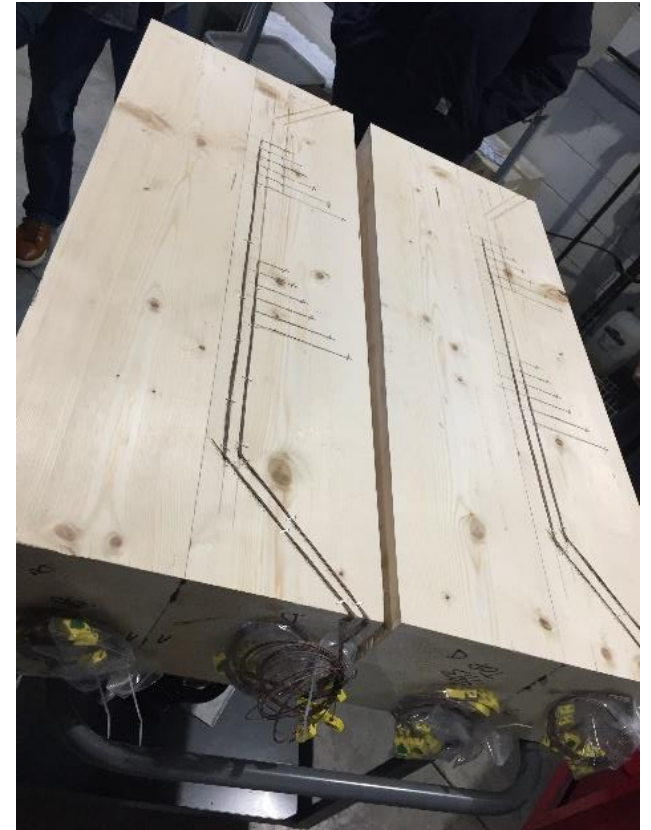


Figure 8: Data from the 300°C Isotherm combined with data from the residual cross sections compared with 3 models.

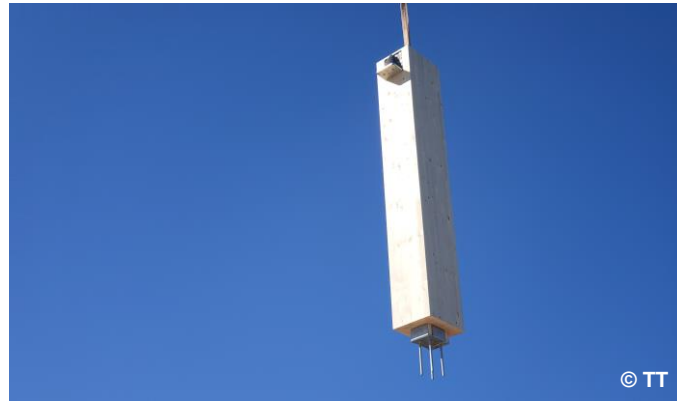


PERMITTING

Fire Rating (Members)



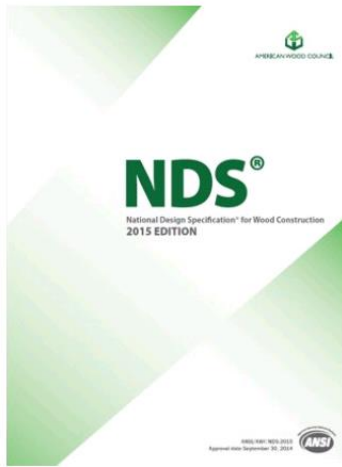
BEAMS



COLUMNS



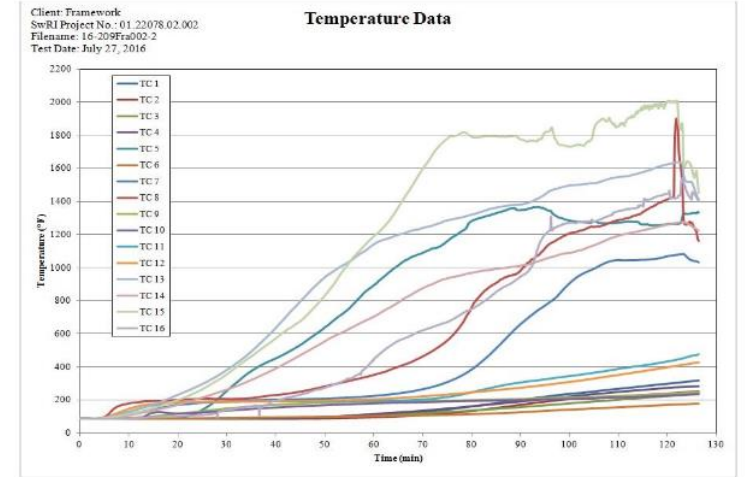
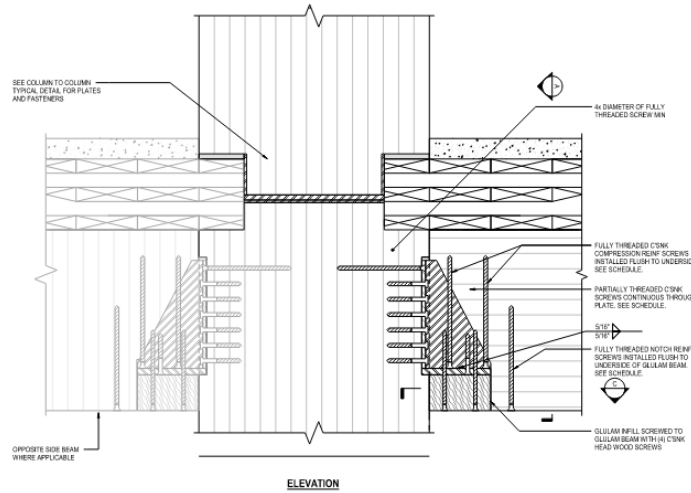
CLT



PERMITTING

Fire Rating (Connections)

- “Framework Connector”
- Encapsulation



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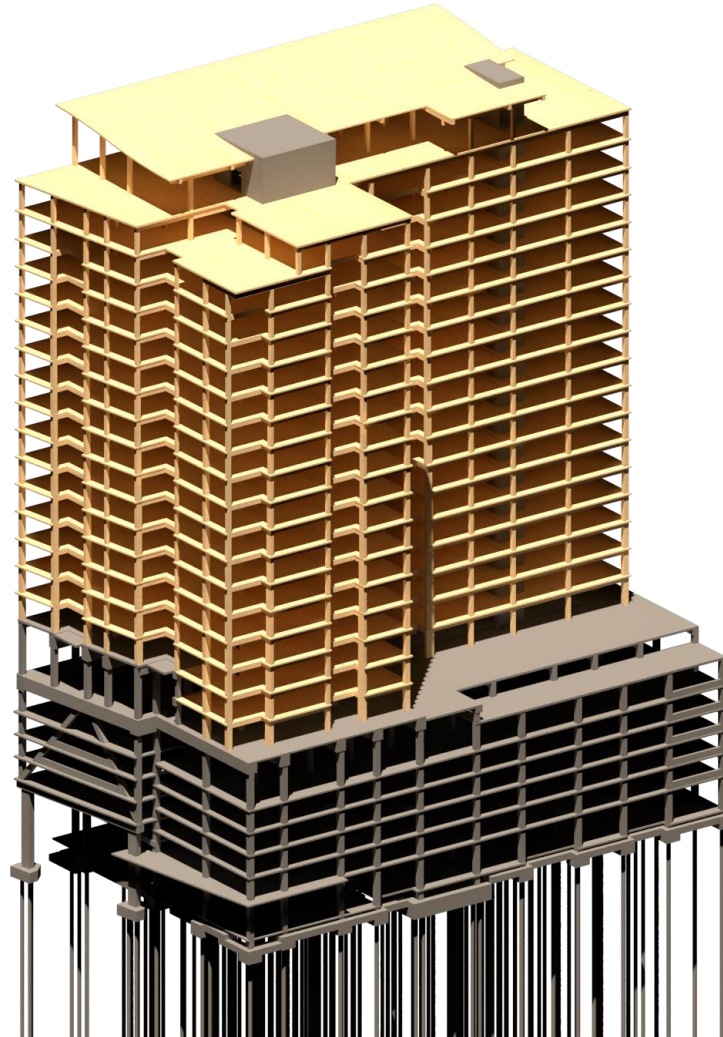
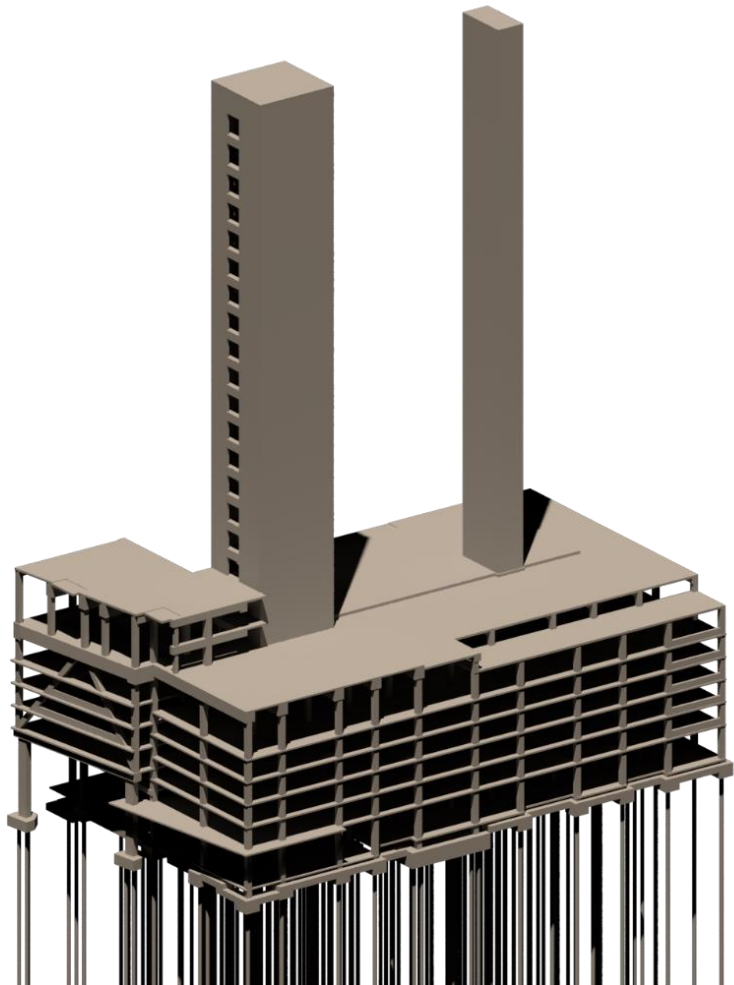


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“FRAMWORK CONNECTOR”

PERMITTING

Ascent – AHJ Agreements



- **SPECIAL INSPECTIONS**
 - (not required in WI)
- Concrete cores
- Automatic sprinkler system
- Dual Water Supply to Fire Pump
- Standpipe in Each Stair
- Smoke detection
- FD Vehicle Access on Two Roads
- Electronically Supervised Valves
- Fire Command Center
- Fire Dept Communications Support
- Voice Communications
- Stair Pressurization

AGENDA

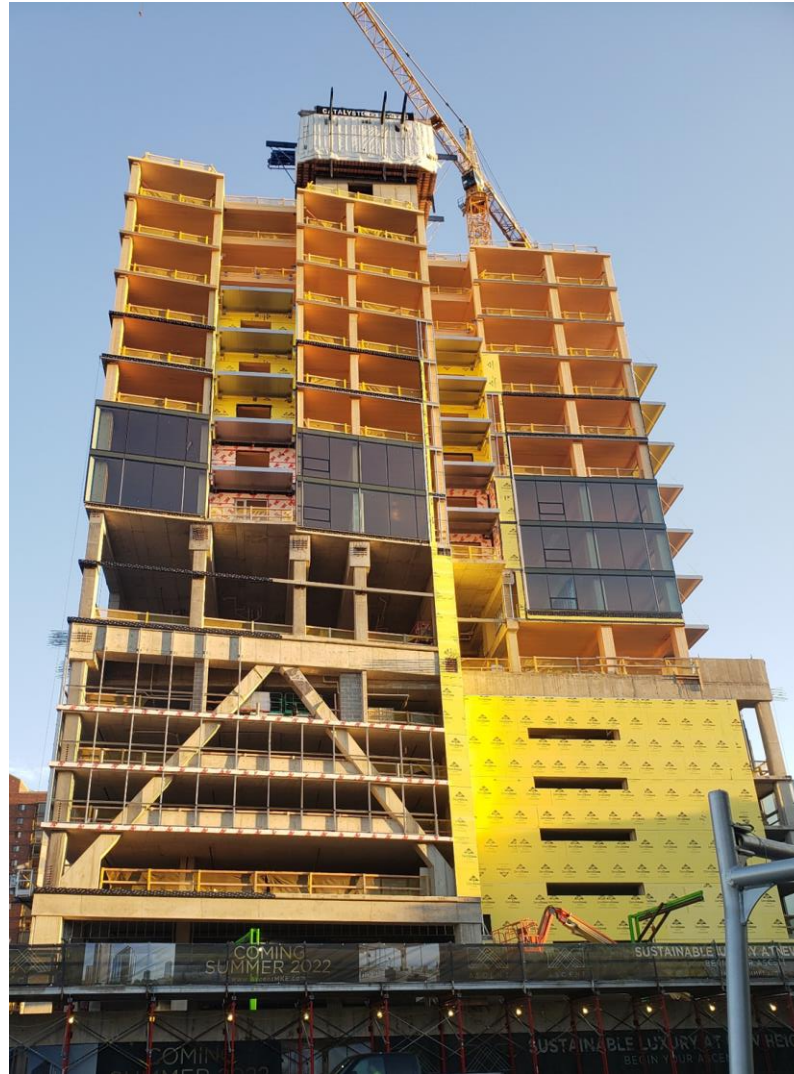
1. Introduction to Mass Timber
2. Introduction to Ascent
3. Mass Timber Design Considerations
4. Ascent Permitting Process
5. Ascent Construction
6. The Future of Mass Timber?

ASCENT

Construction Progress



Start of Timber Construction
(June 2021)



Level 17 Complete
(September 2021)



Level 26 (Roof) Topped Out
(December 2021)

ASCENT

Primary Mass Timber Structural Components



**GLULAM
COLUMNS**



**GLULAM
BEAMS**



CLT PANELS



**TIMBER
SCREWS**





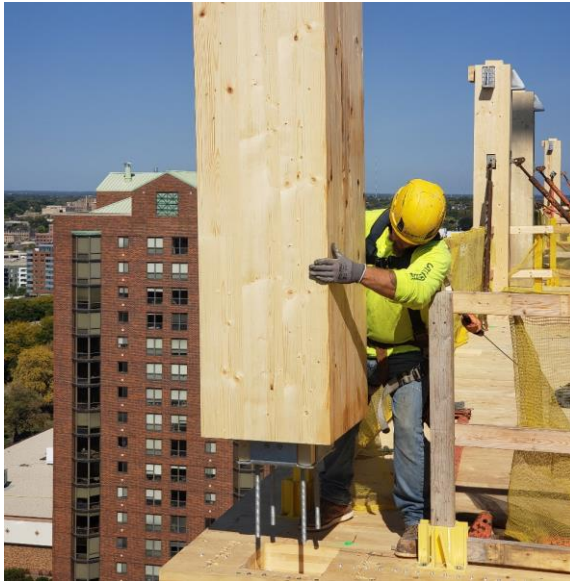




ASCENT

Primary Mass Timber Connections

CORE-
CLT/GLB



COL-COL
(EPOXY)



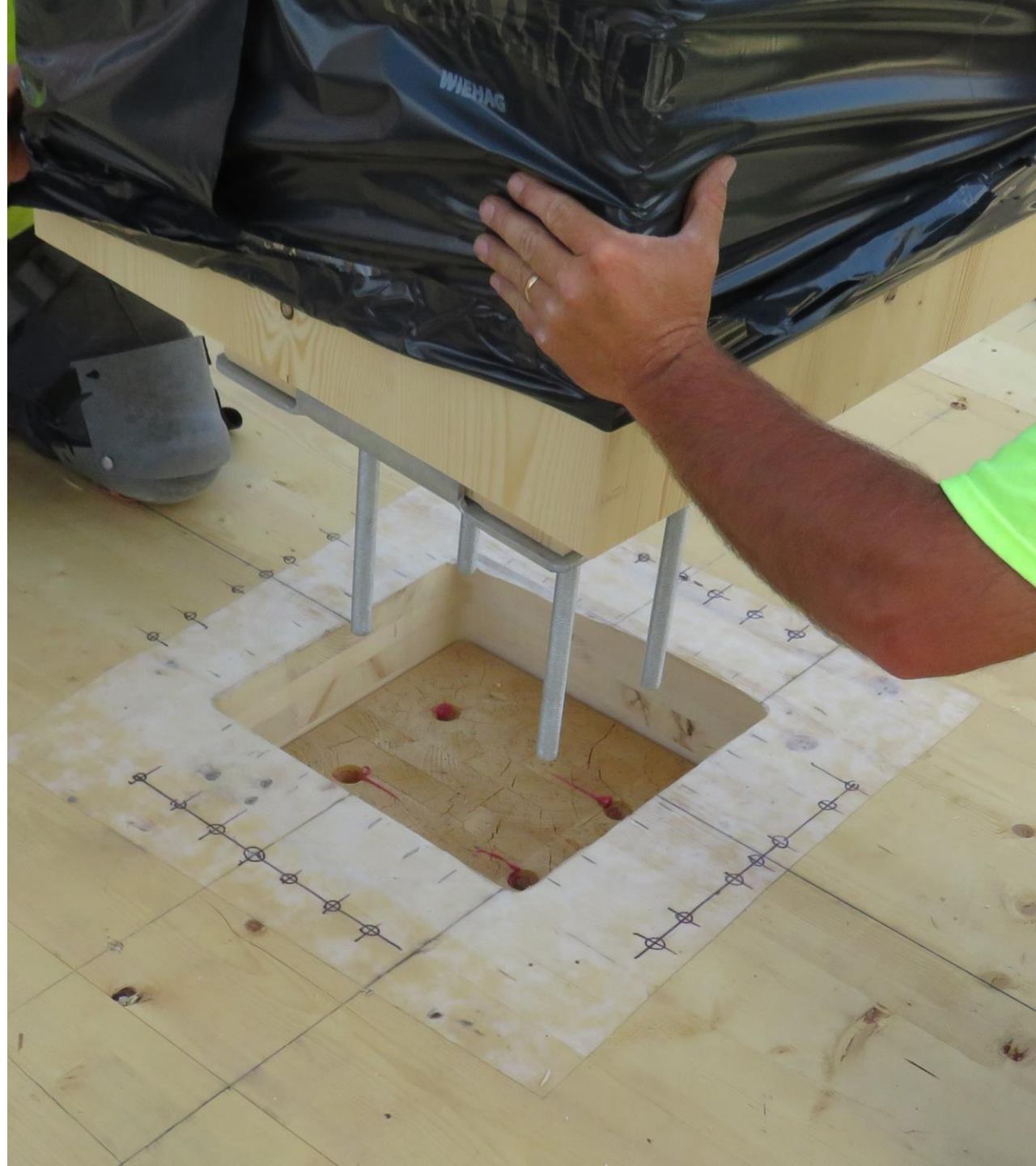
COL-COL
(INTERIOR)



BEAM-COL
(HANGER)



BEAM-COL
(BEARING)





















skyjack
SJ3219



ASCENT



ASCENT

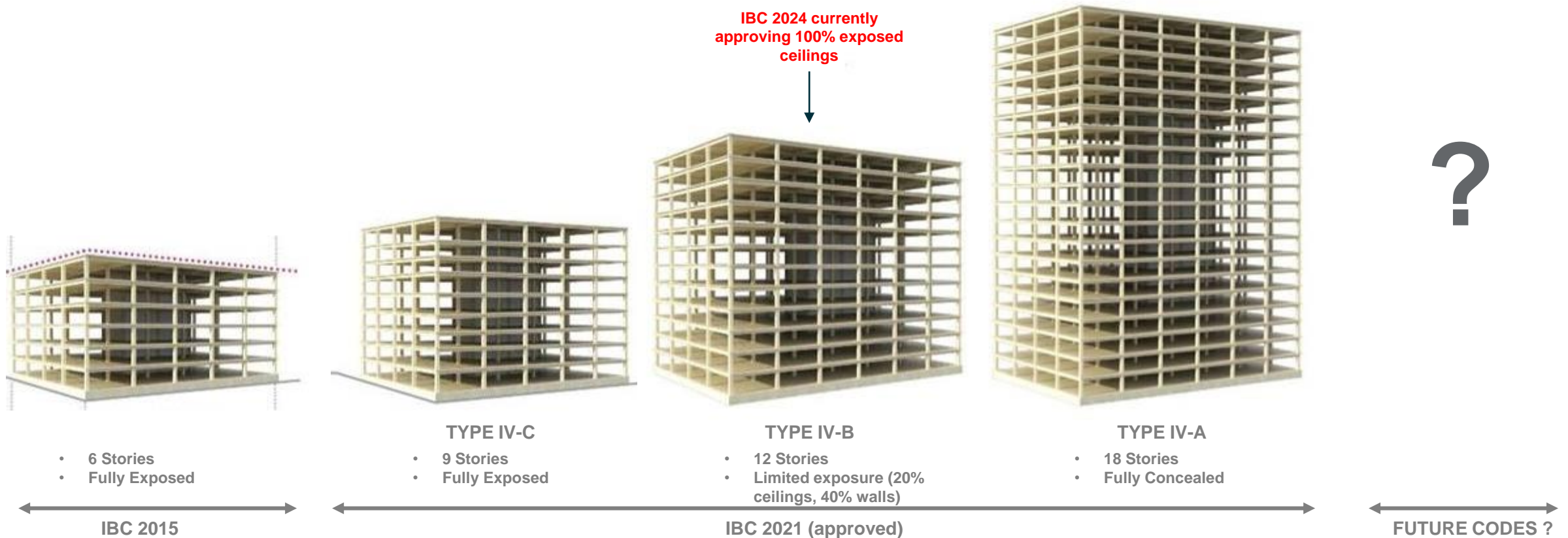


AGENDA

1. Introduction to Mass Timber
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CODE DEVELOPMENT

IBC (2021 and Beyond)



Images From American Wood Council (<https://awc.org/tallmasstimber>)

FIRE TESTING

IBC 2021 - 2024



Quantitative Overview

Costs				
Total project cost		\$130,000,000		
		\$501,930/ unit		
Land		\$6,250,000	@ appraised value	
		Market Standard*	Pro Forma**	Realized***
Construction costs (normalized wo/COVID)		\$200 / GSF	\$190 / GSF	\$190 / GSF****
NOI				
	Apartment	Market	Realized***	
Rental rates				
	1-BR	\$1,850	\$2,046	~11% higher
	2-BR	\$3,500	\$3,956	~13% higher
	3-BR	\$5,500	\$8,551	~55% higher
Occupancy at stabilization		95%	54%	Property still in lease up
	Parking Revenue	Market	Pro Forma**	Realized***
In addition to lease		\$175	\$185	\$175
	Retail	Market	Pro Forma**	Realized***
Retail rental rates		\$25 / RSF/YR	\$21 / RSF/YR	\$TBD/ COVID
Rent type (e.g., NNN)		Modified Gross	NNN	TBD
Tenant improvement allowance		Varies	\$86 / SF	\$TBD / SF
Occupancy after 12 months		Varies	100%	TBD%

Market rental rates for apartments sourced from a CoStar report dated September 2022

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

**Pro forma dated early 2020

***Realized metrics as of October 2022

****Average unit size is larger than the market contributing to lower cost per square foot. Mass timber was a slight premium. A longer iterative design process proved beneficial in maximizing efficiencies, thereby driving down costs to make mass timber competitive.

Return Performance			
	Market	Pro Forma**	Realized***
Yield on cost – untrended	6.00%	5.85%	TBD / on track
Cap rate (mkt vs. appraisal subject conclusion)	5.00%	4.70%	TBD
Value per unit	\$500,000	\$594,000	TBD / on track
Leverage	65%	70%	50%
Mezzanine leverage	15%	15%	20%

Timeline		
	Date	Context/Comment
Date of conception (first dollar spent)	April 2018	Mid cycle
Date underwriting finalized (go/no-go decision)	May 2020	Mid cycle
Date equity capital secured	June 2020	Late cycle
Permitting duration	6 months	Longer (started early & ran concurrent w/design)
GMP in place	July 2020	
Construction start	Aug 2020	
Duration of construction (anticipated without delays)	22 months	Faster (by 4 months)
Duration of construction (realized w/ delays)	24 months	Delays due to COVID + Suez Canal obstruction
Construction completed	Aug 2022	Two phases of completion: July 15 & Aug 31
Date stabilized (80% occupancy, NOI, or at pro forma or refinanced)	TBD	Projected June 2023

Project Context	
Economic case made by demand	
<ul style="list-style-type: none"> Lease up velocity averaging 20 units/month is better than the market's typical average of 14 units/month (per the appraisal) and better than the pro forma expectations Superior luxury product with minimal comps in Milwaukee market 	

Mass Timber Business Case Study

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.

CODE DEVELOPMENT

2100 N Southport



- Approved through Standards and Test
- 9-stories
- Approved using portions of IBC 2021 Type IV-B
- Based on previous testing
- Concrete cores

COMPOSITE MASS TIMBER

Panel Composite Action



CONNECTIONS

2-hour Fire Rating



MTC

Double Ricon/Megan: 16.6 kips
(1.5 hours)

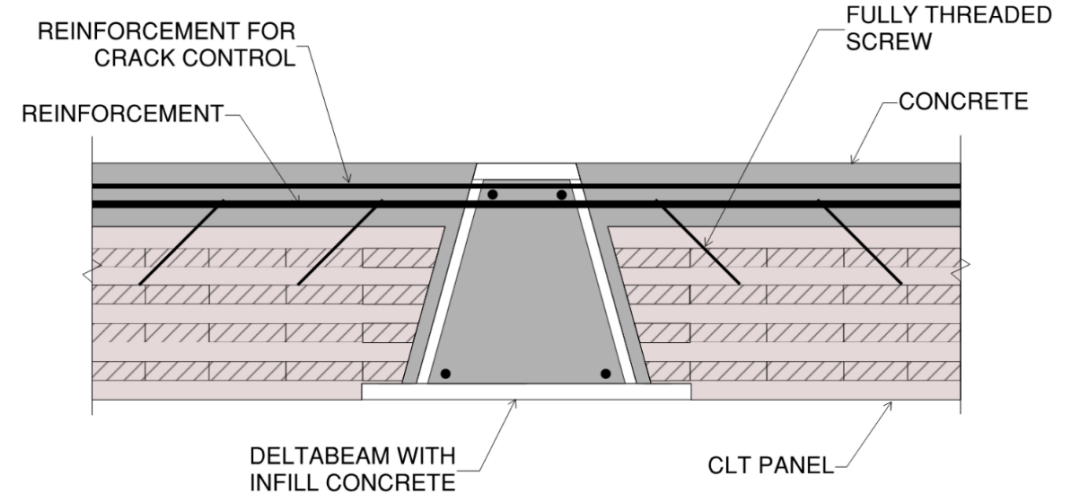


Simpson Strong-Tie

CBH2.37x9.97: 36kips
(2 hours)

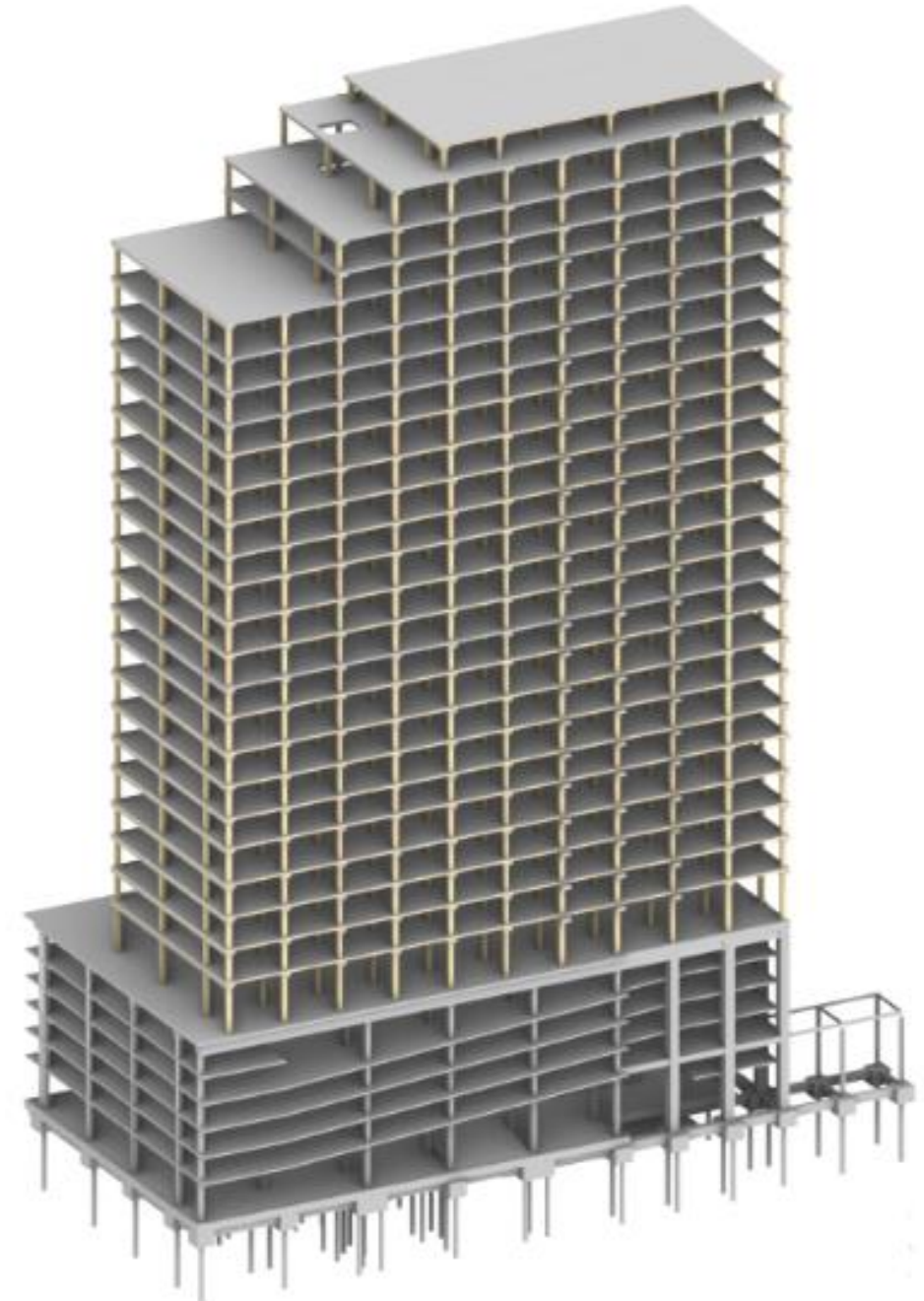
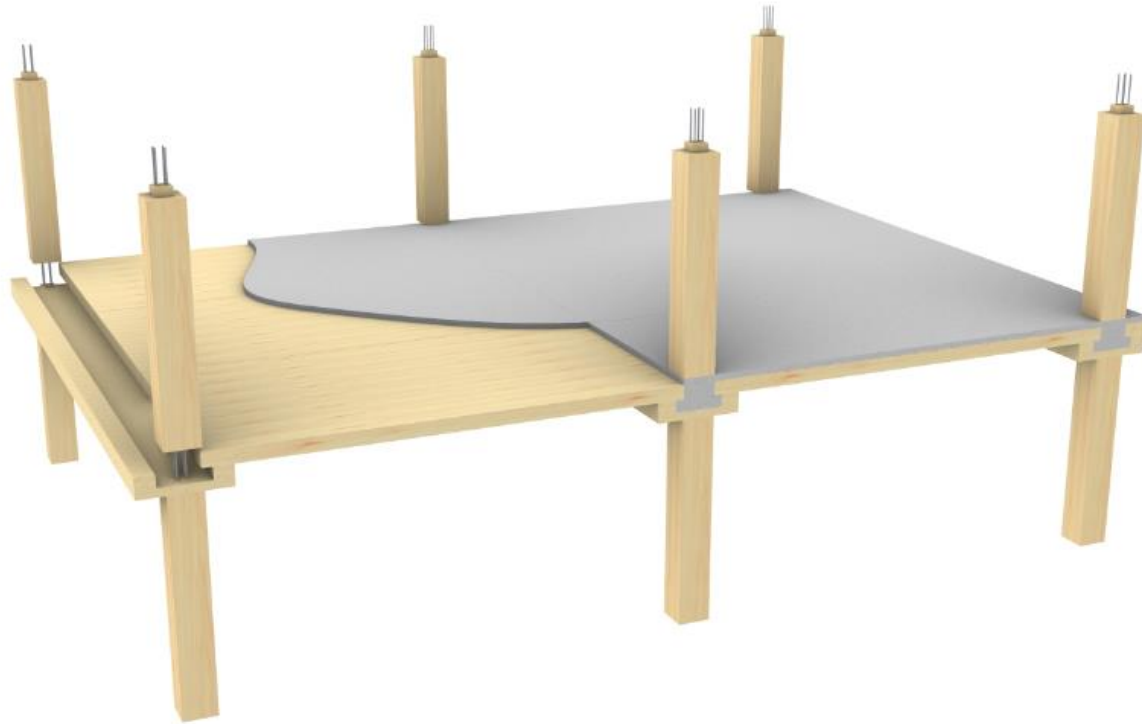
HYBRID STRUCTURES

Mass Timber - Steel



HYBRID STRUCTURES

Mass Timber - Concrete



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THANK YOU



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