FEBRUARY 06, 2024

Ascent Tower: The Evolution of Mass Timber Construction

- Pushing the Mass Timber Envelope

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

Thornton Tomasetti

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?

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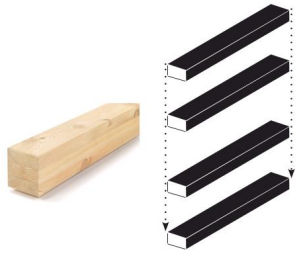
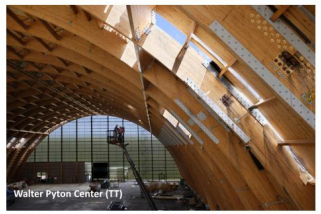
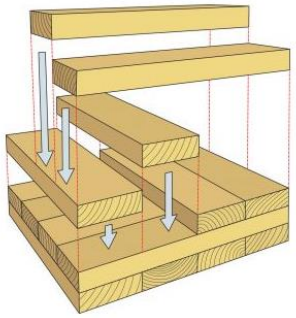
WHAT IS MASS TIMBER?



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)

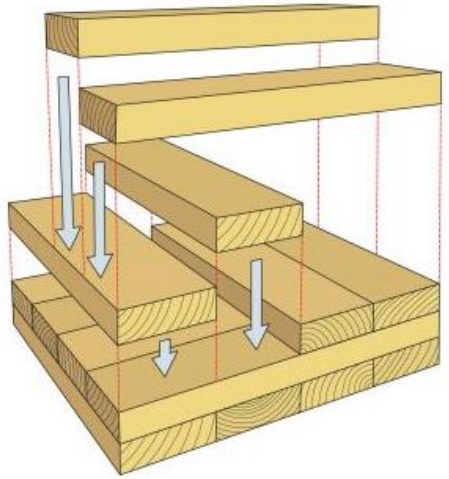
Pros:

- 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


HORIZON PAVILION



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

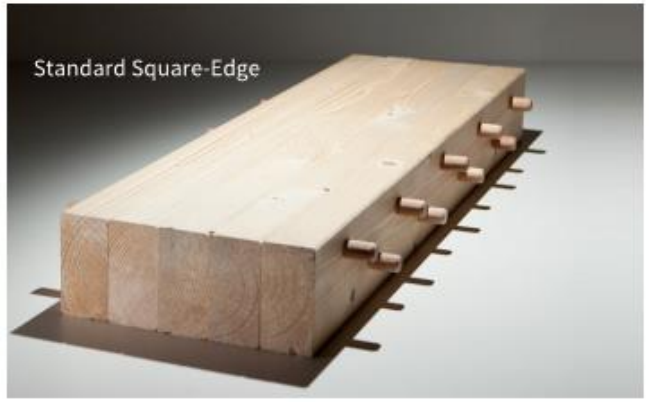
CLT Alternate #2 (DLT)

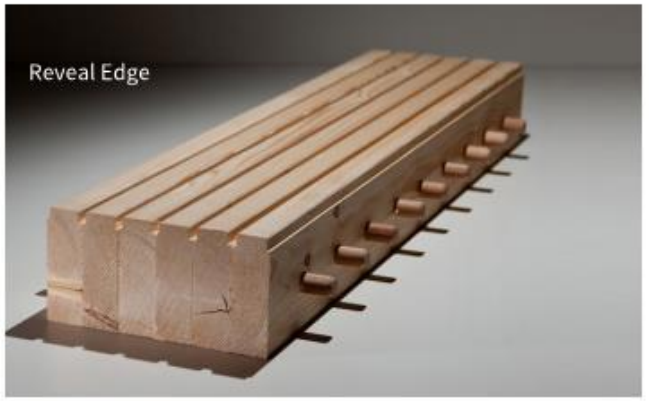
Pros:

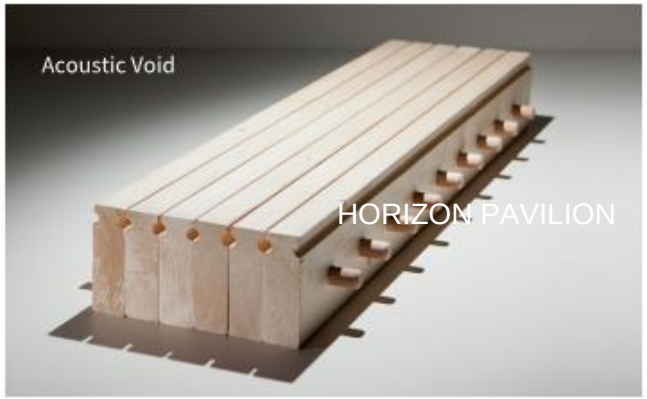
- Efficient Use of Material
- Timber Aesthetic
- “100% Wood”
- High Quality Control
- Potential Additional Acoustical Benefits

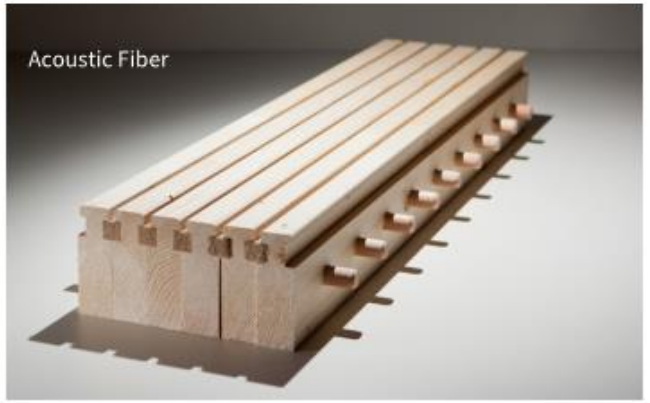
Cons:

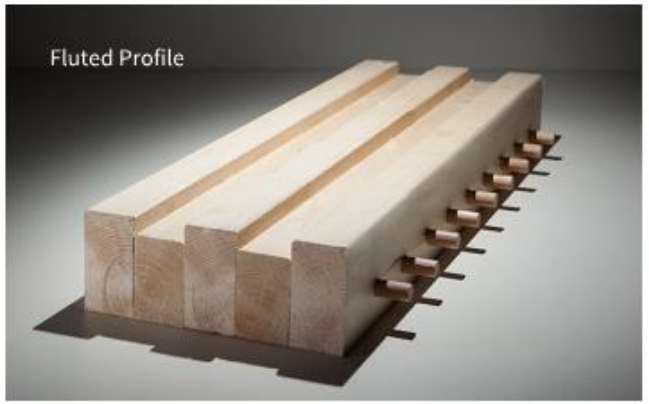
- Cost Driven by Market Availability
  - Single Manufacturer (Structurcraft)
- Panel Size Controlled by Lumber Length





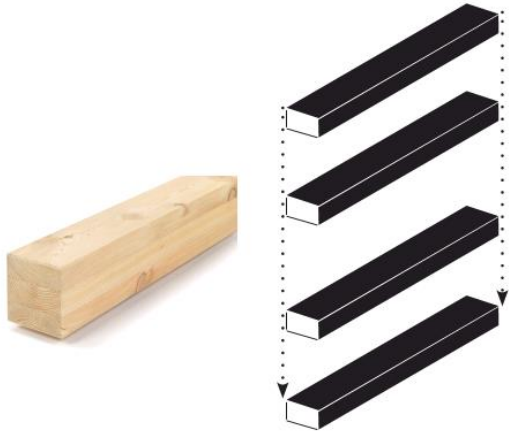




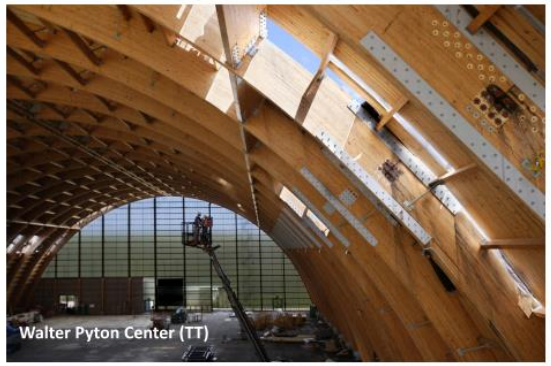


MASS TIMBER BEAMS AND COLUMNS

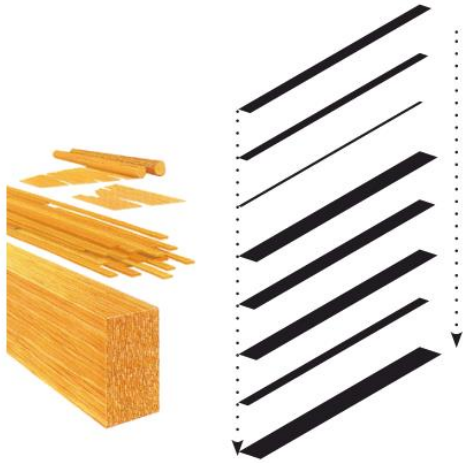
Beams and Columns



GLUED-LAMINATED TIMBER
[GLULAM]

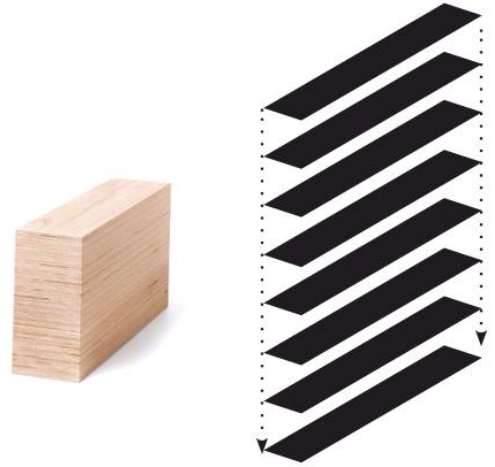


Glued-Laminated Timber
(Glulam)



PARALLEL STRAND LUMBER
[PSL]

Parallel Strand Lumber
(PSL)



LAMINATED VENEER TIMBER
[LVL]

Laminated Veneer Lumber
(LVL)

WHY MASS TIMBER?

Sustainability

- Renewable resource
- Low Fabrication Emissions

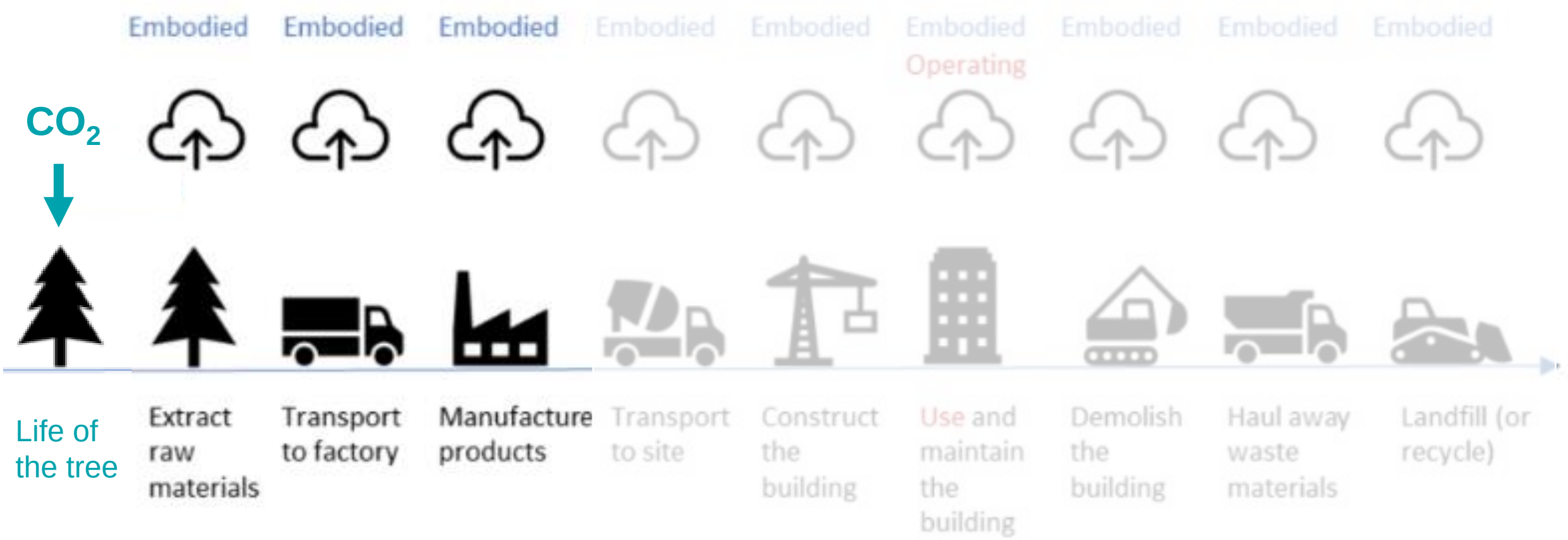
Aesthetics

- Connection to nature / biophilia
- Intrinsic Beauty and Appeal

Construction

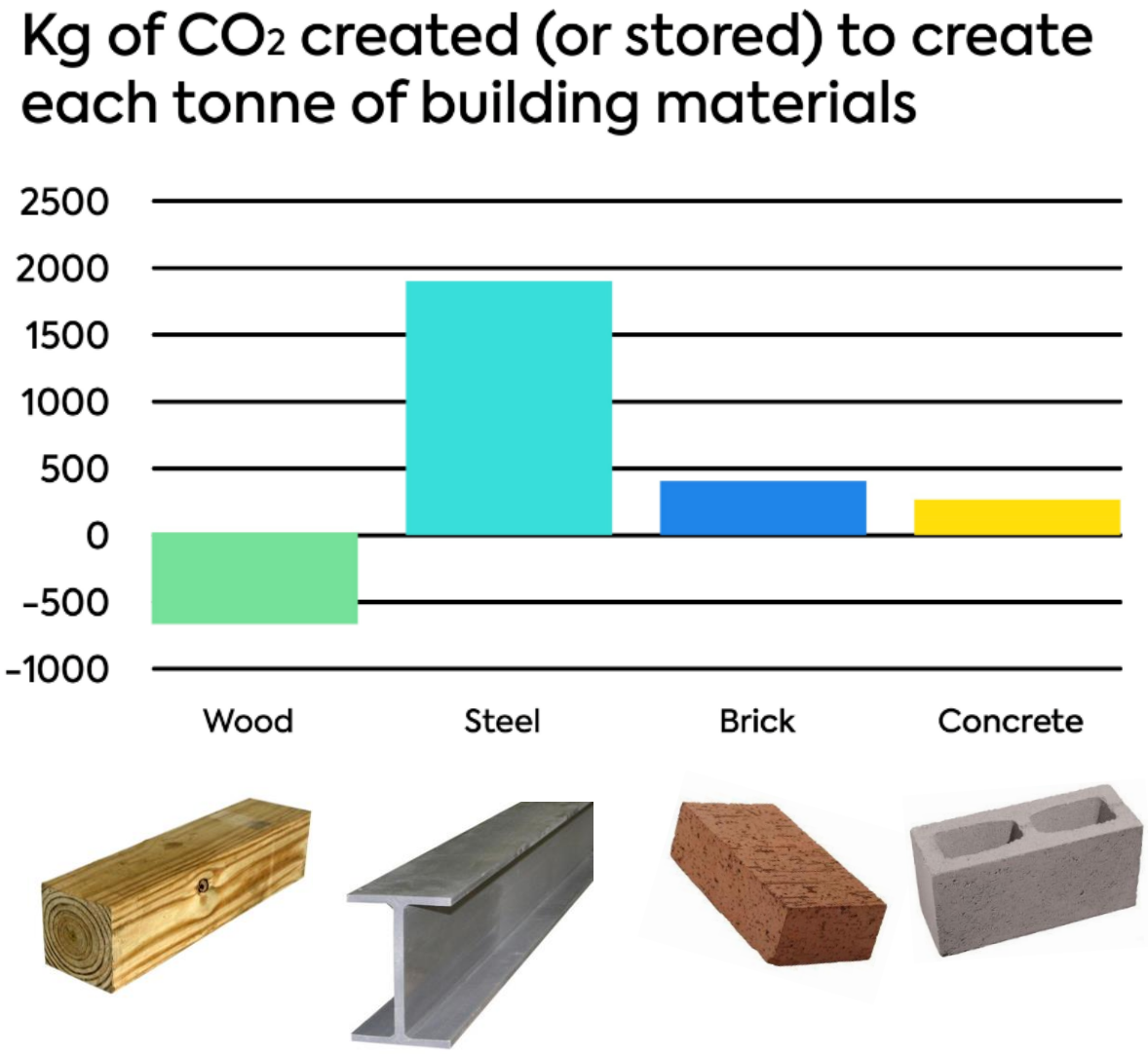
- Increased Speed of Construction
  - Prefabrication
  - Fit-Out
- Reduced Weight
  - Lighter Foundations

Embodied Carbon: Trees Absorption of C02



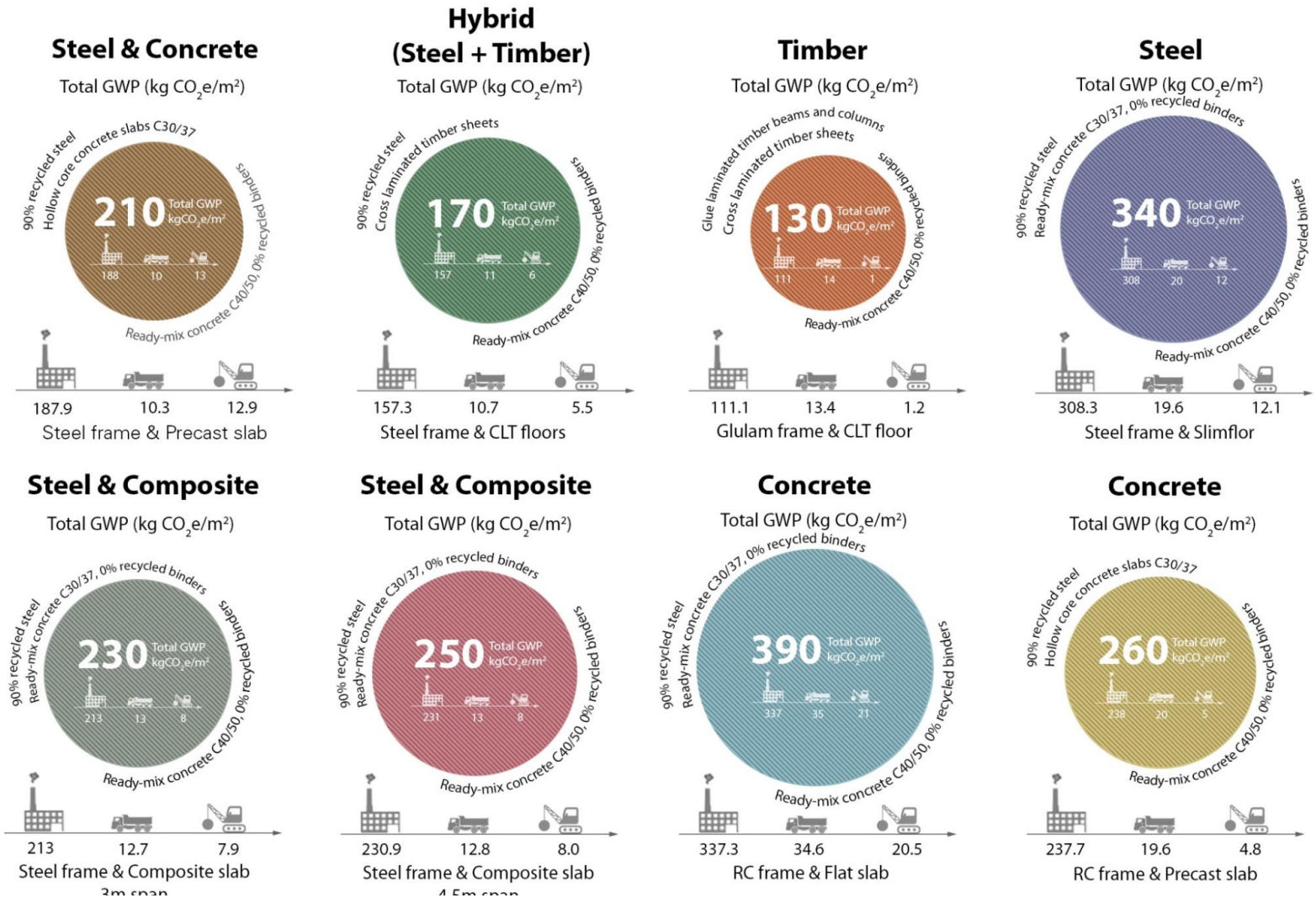
EMBODIED CARBON

Life Cycle



EMBODIED CARBON

GWP



ASCENT:
The building will sequester approximately 7,200 metric tons of CO_2.

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

This CO_2 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.

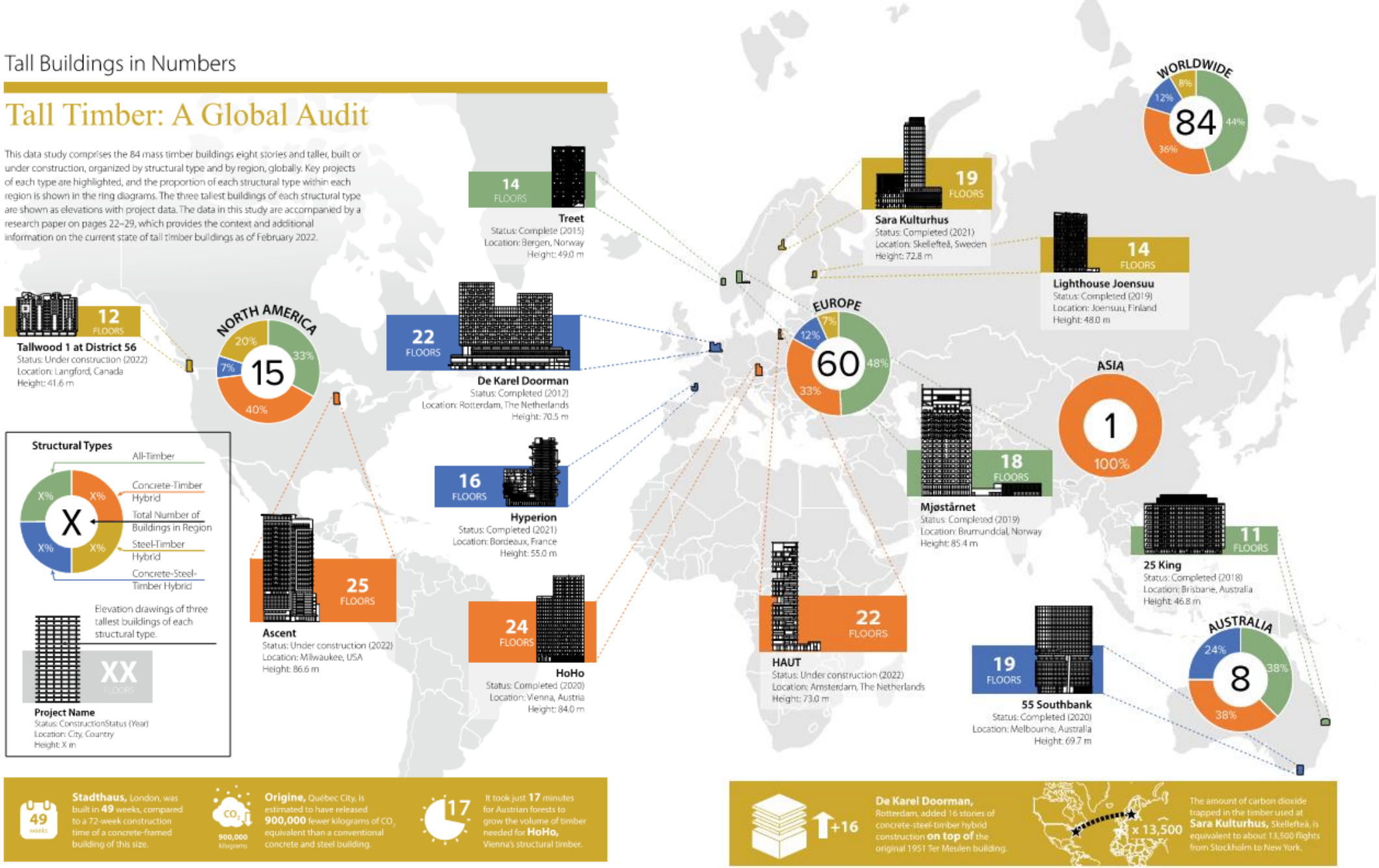


IMAGE CREDIT: CTBUH

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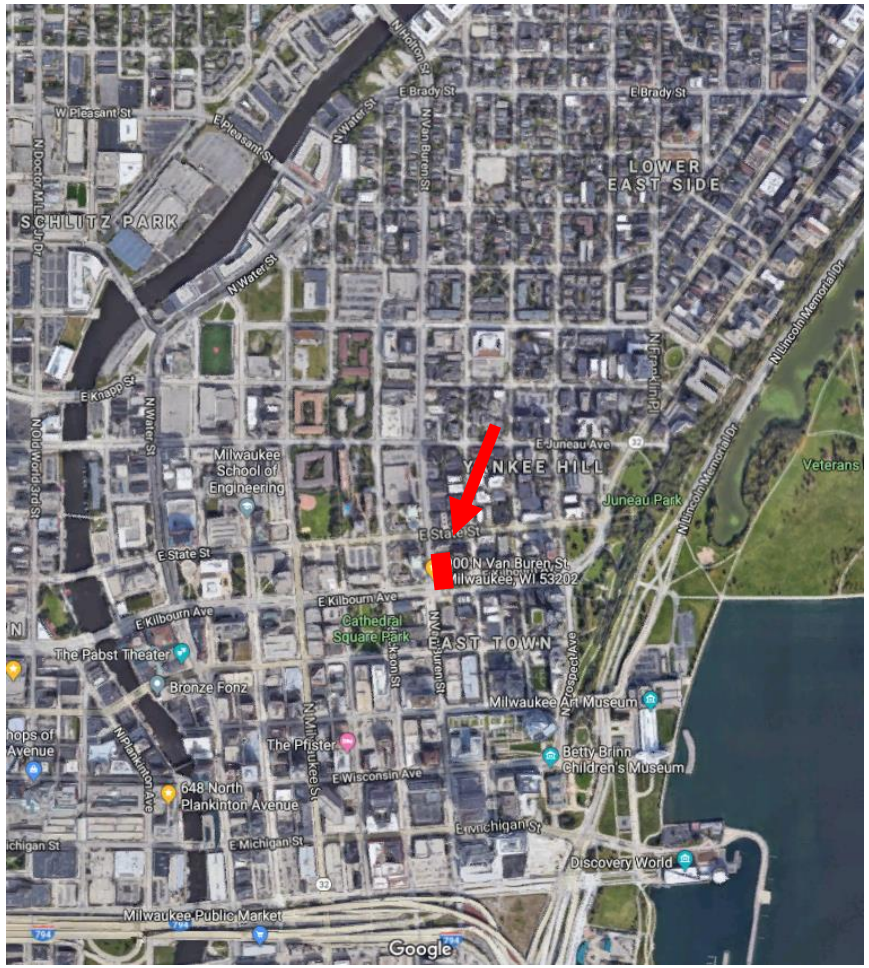
ASCENT:

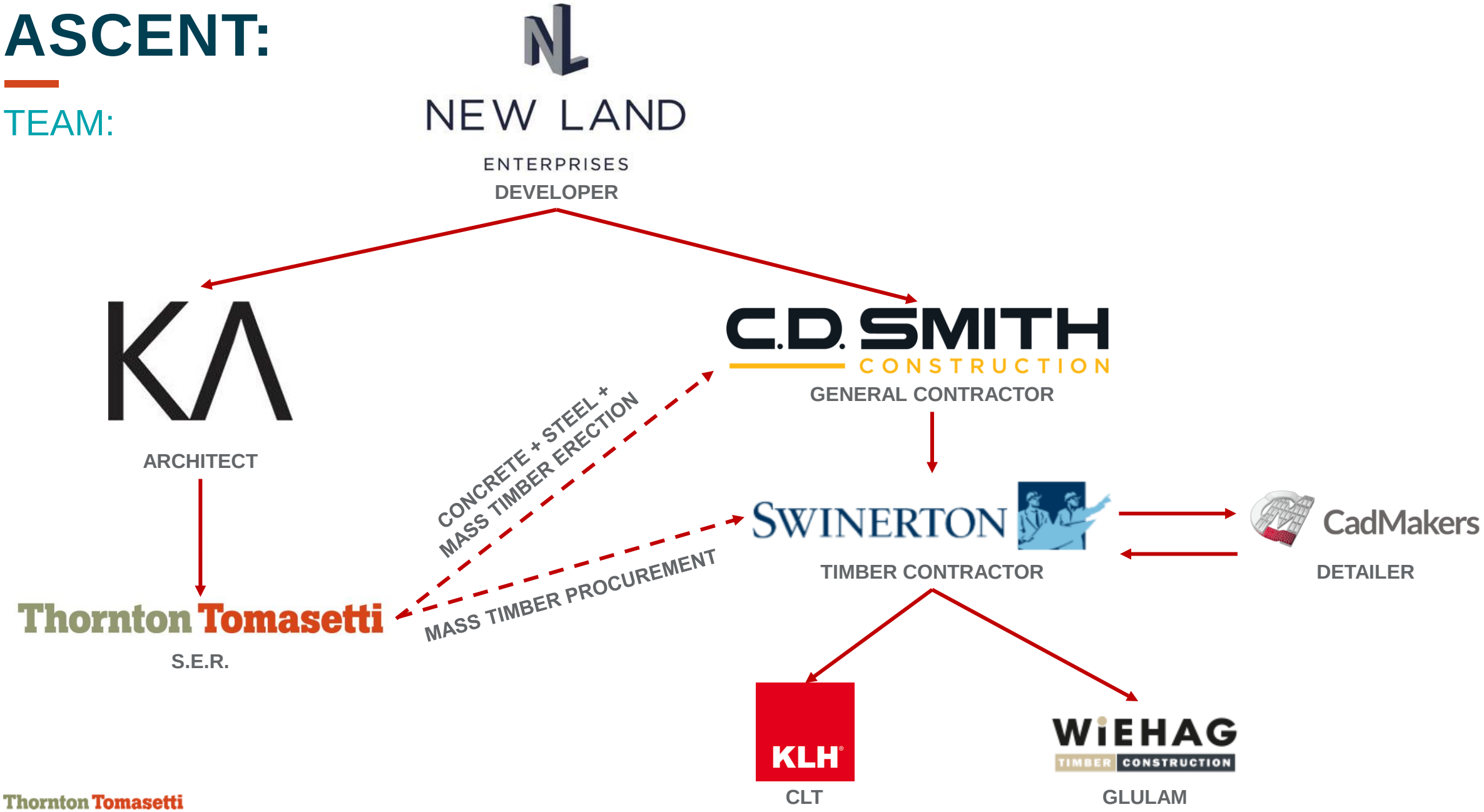
Milwaukee, WI



Korb + Associates

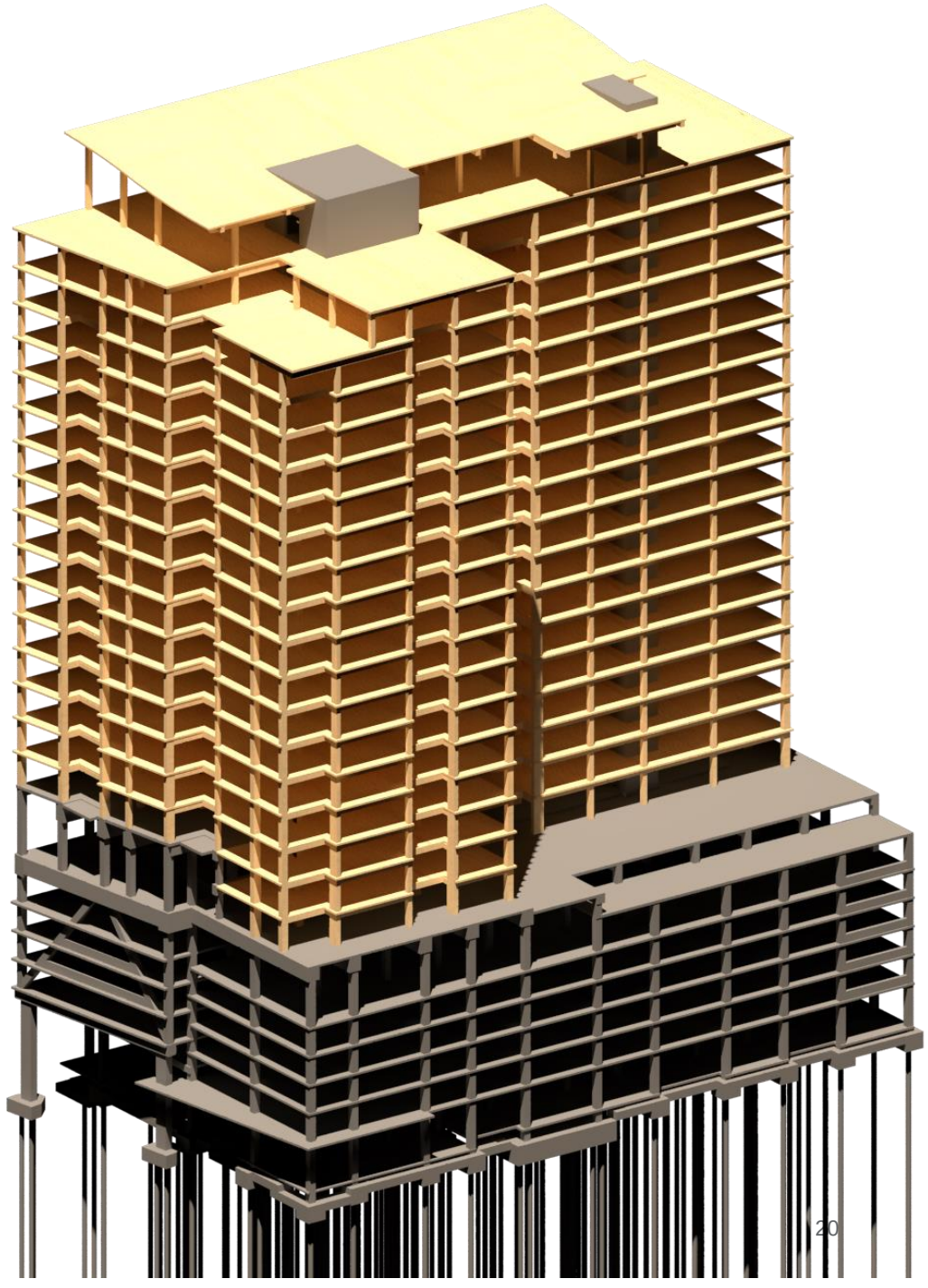
ASCENT:

TEAM:


NEW LAND
ENTERPRISES
DEVELOPER
KA
ARCHITECT
C.D. SMITH
CONSTRUCTION
GENERAL CONTRACTOR
CONCRETE + STEEL +
MASS TIMBER ERECTION
MASS TIMBER PROCUREMENT
Thornton Tomasetti
S.E.R.
SWINERTON
TIMBER CONTRACTOR
CadMakers
DETAILER
KLH
CLT
WIEHAG
TIMBER CONSTRUCTION
GLULAM

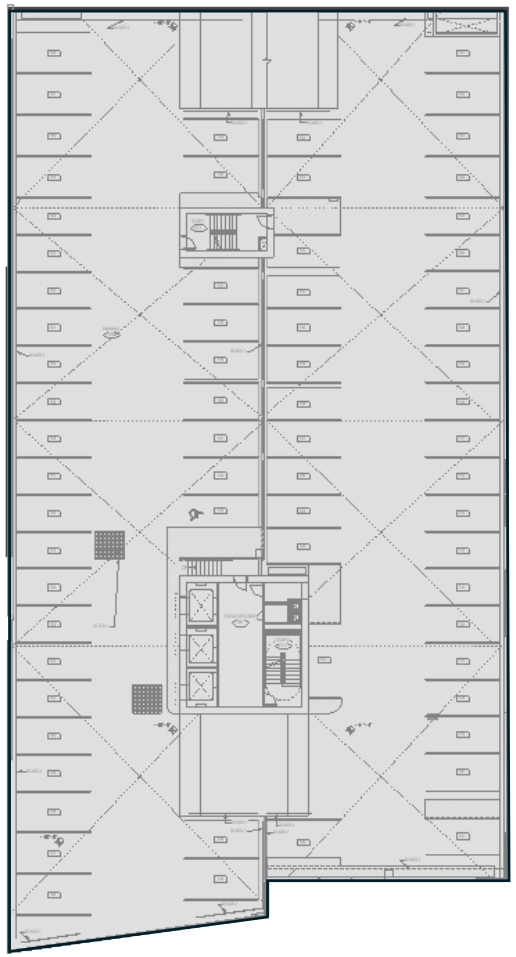
ASCENT FACTS:

- 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)

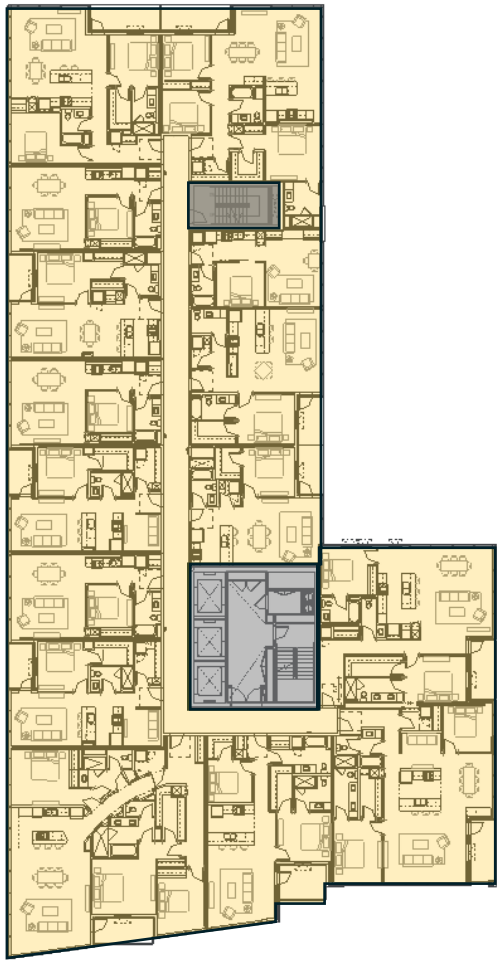


ASCENT:

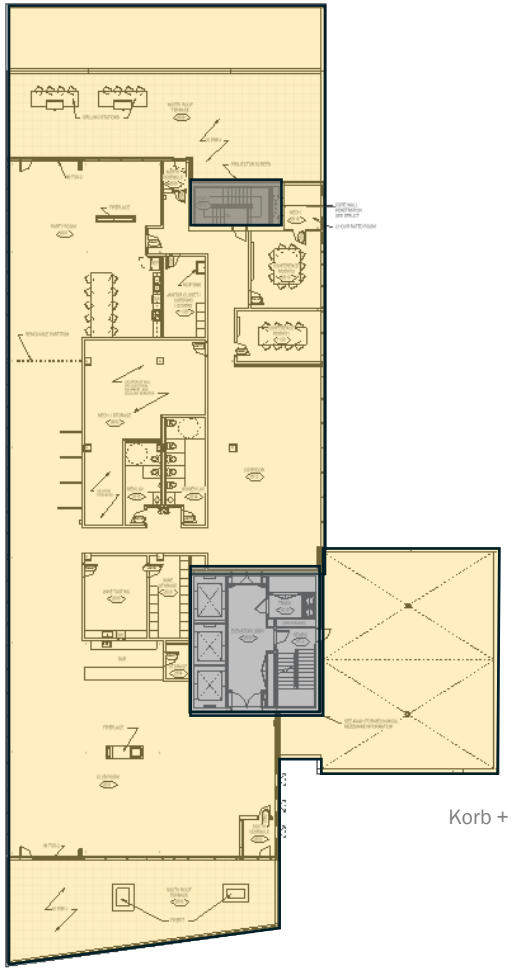
Typical Floor Plans:



TYPICAL PARKING LEVEL



TYPICAL RESIDENTIAL LEVEL



AMENITIES LEVEL (L25)

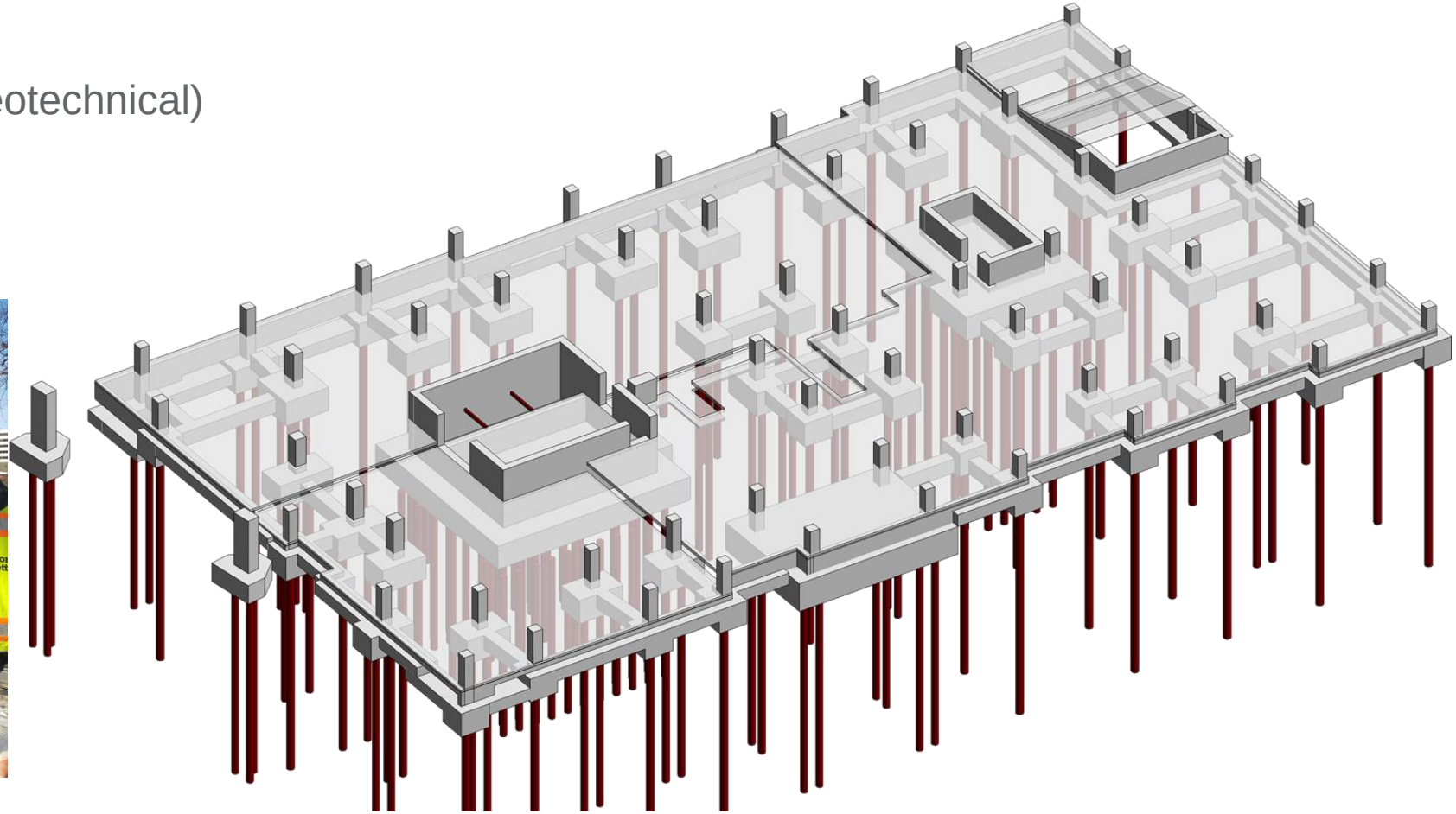
Korb + Associates

Thornton Tomasetti

ASCENT STRUCTURE

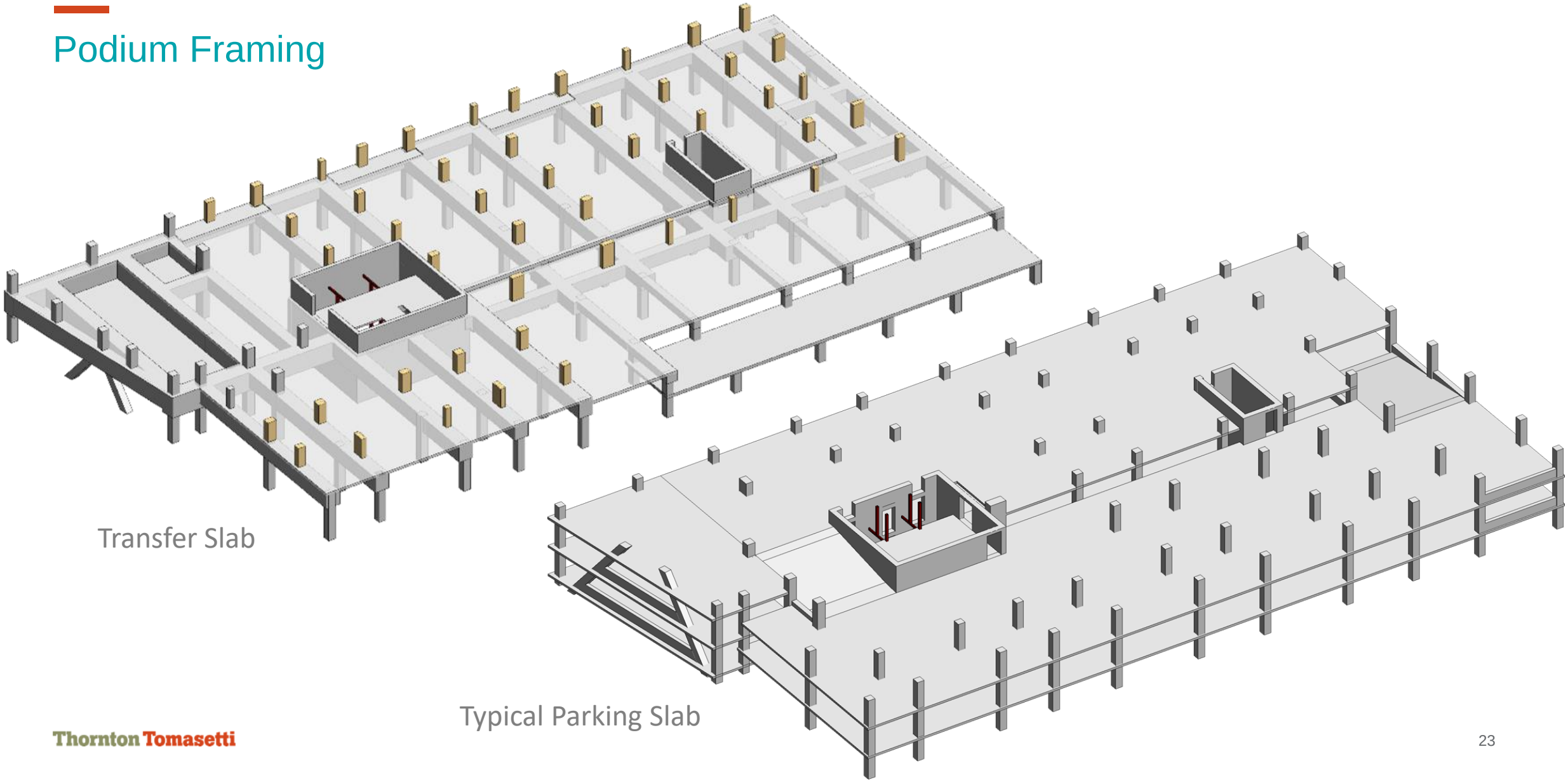
Foundation

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



ASCENT STRUCTURE

Podium Framing

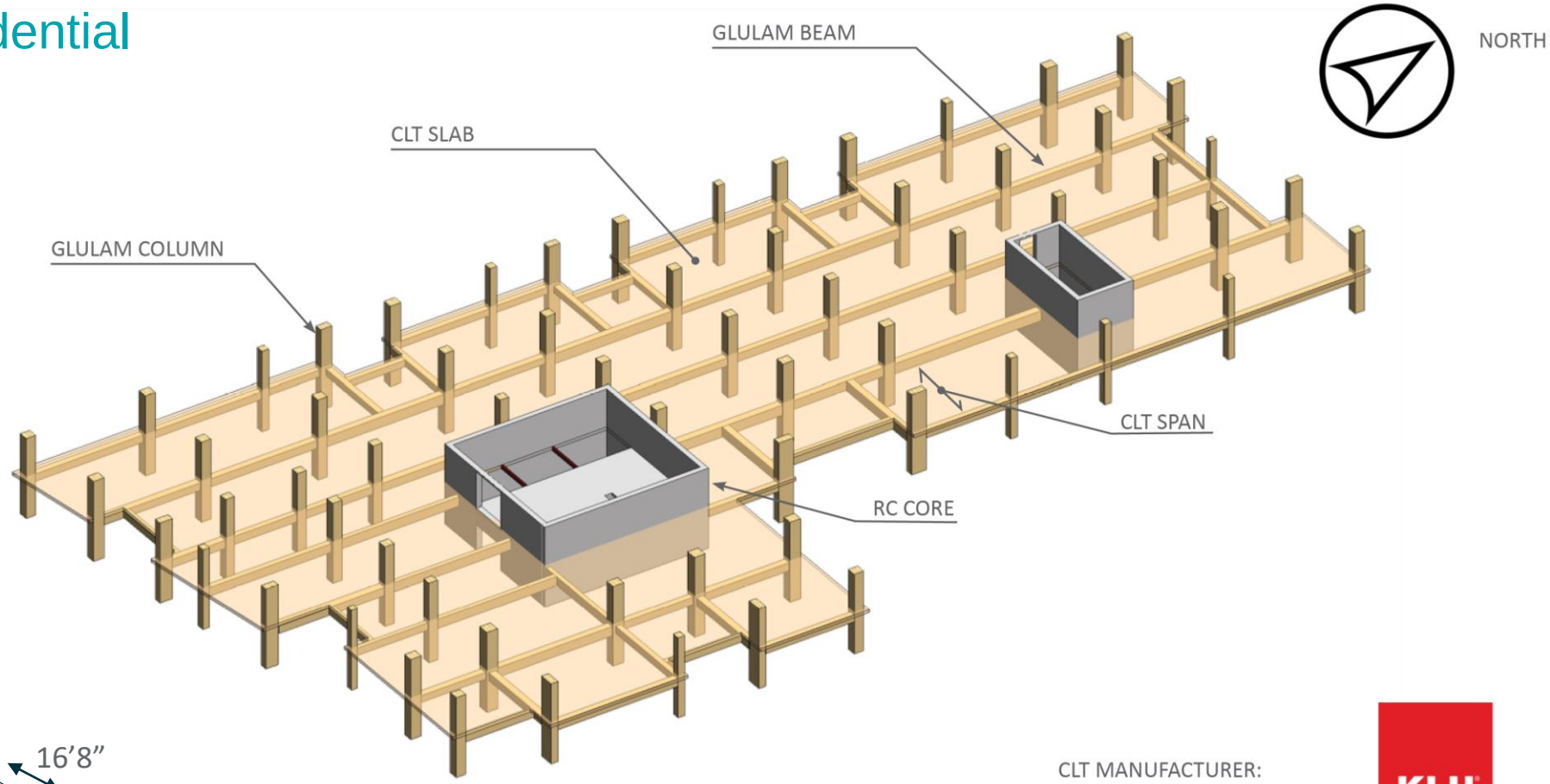


Transfer Slab

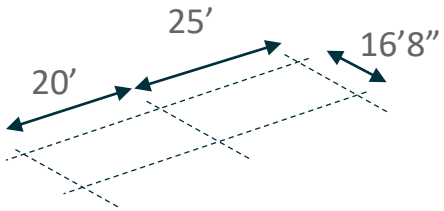
Typical Parking Slab

ASCENT STRUCTURE

Typical Residential



TYPICAL GRID

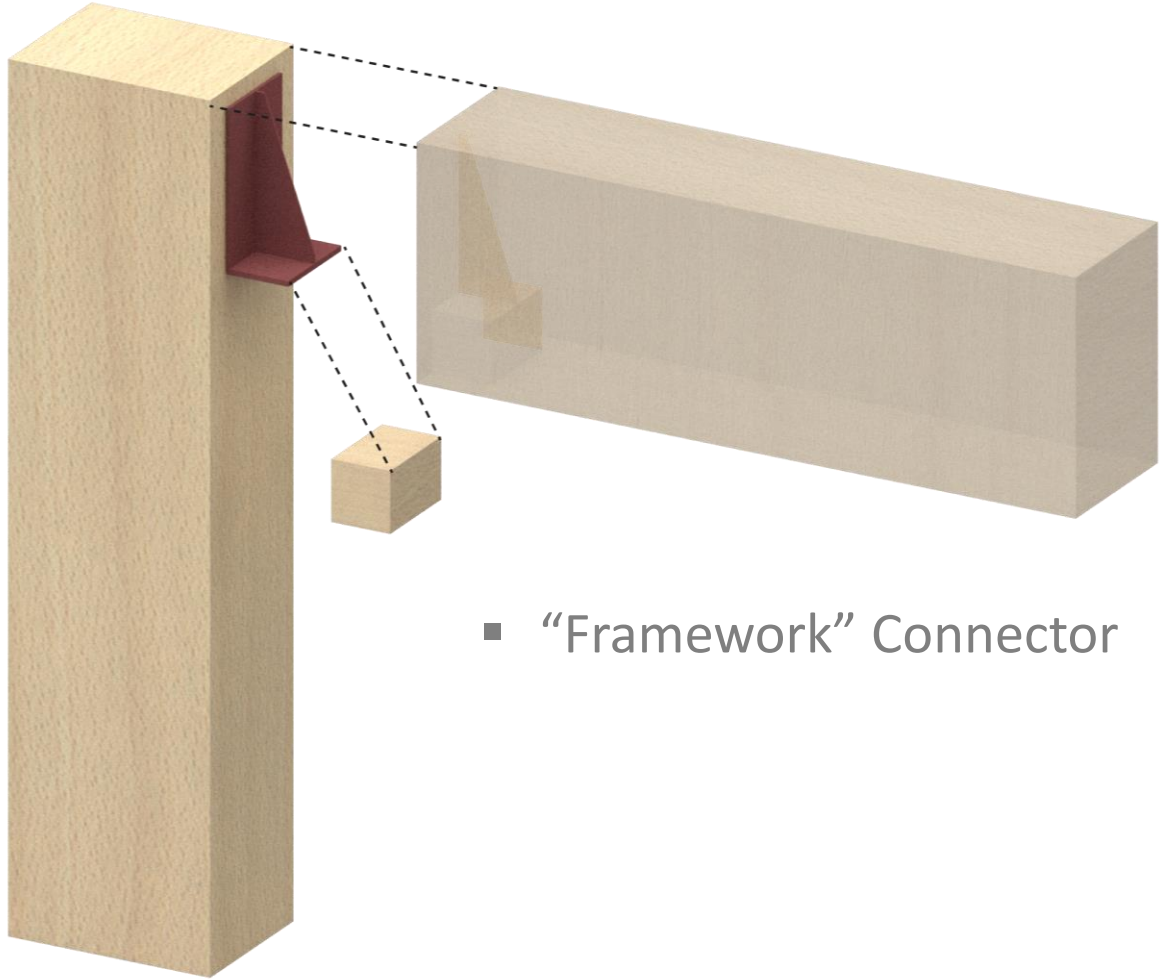


CLT MANUFACTURER: KLH

GLULAM MANUFACTURER: WIEHAG TIMBER CONSTRUCTION

ASCENT CONNECTIONS

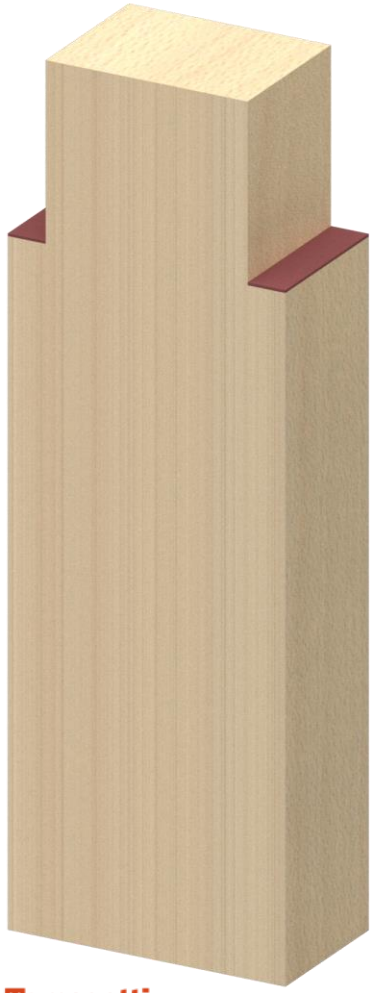
Exposed

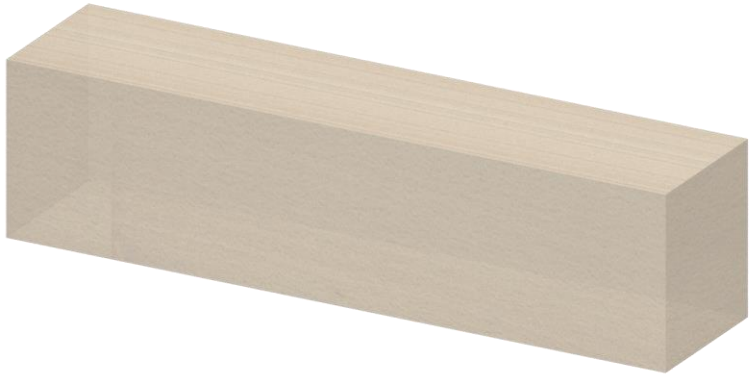


- “Framework” Connector

ASCENT CONNECTIONS

Concealed

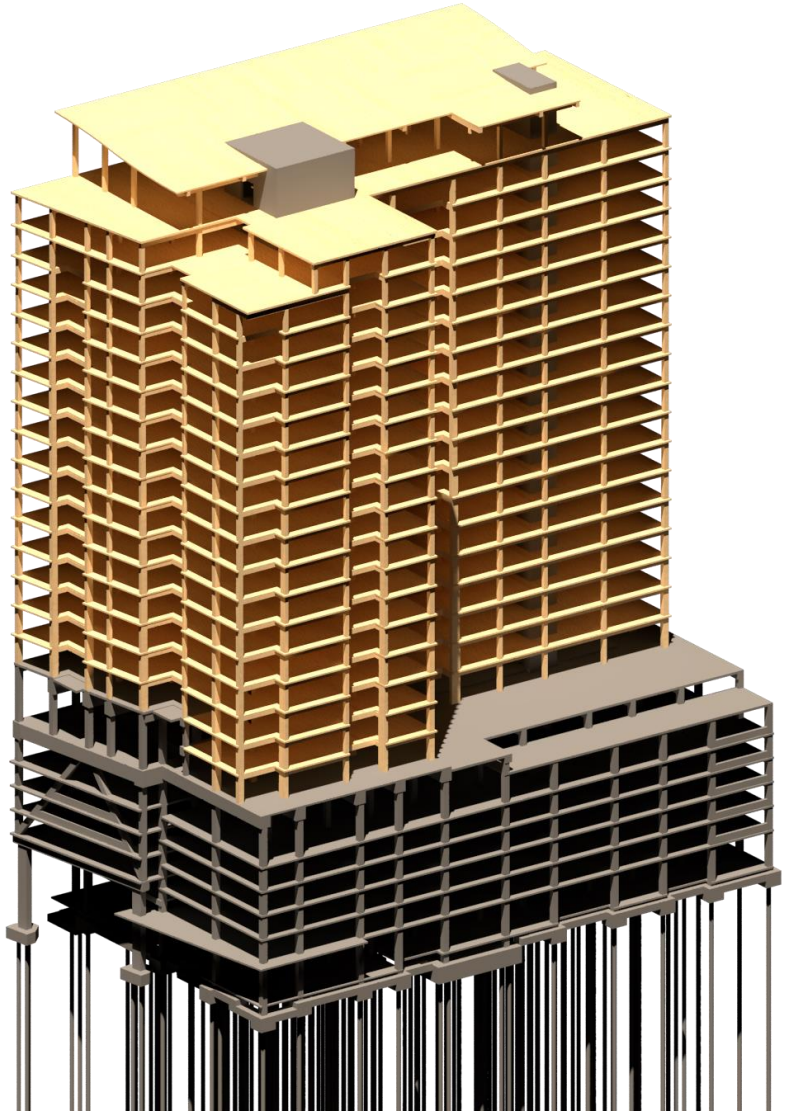


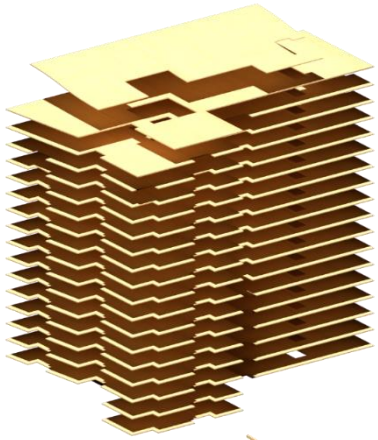


- Wood-Wood Bearing

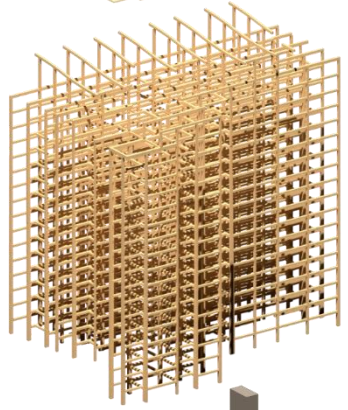
ASCENT STRUCTURE

Systems

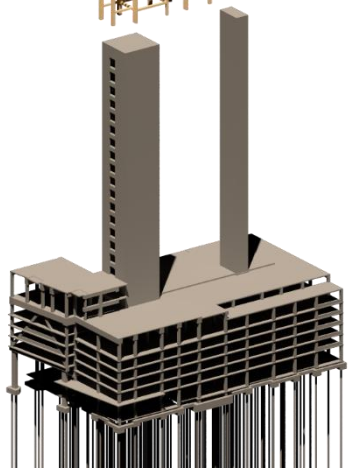




SLABS (CLT)



BEAMS + COLUMNS (GLULAM)



PODIUM AND LATERAL SYSTEM (CONCRETE)

CONSTRUCTION SEQUENCE

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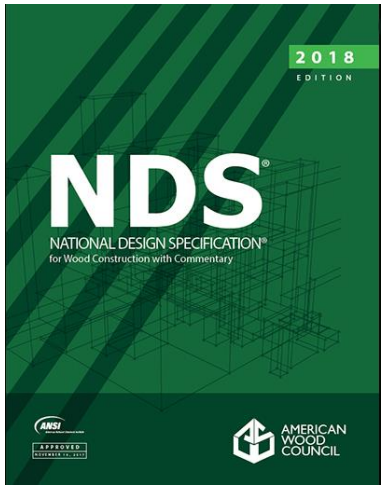
MASS TIMBER

Material Considerations

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



Spruce

Douglas Fir

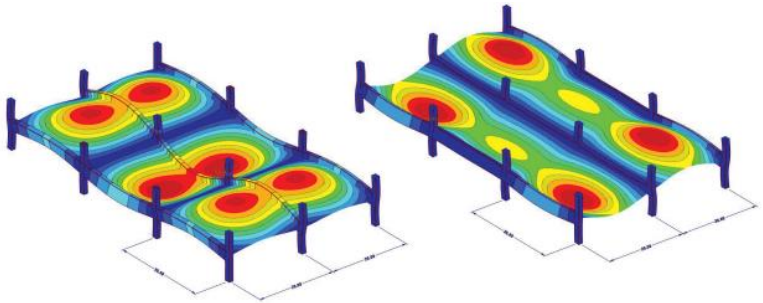
Yellow Pine

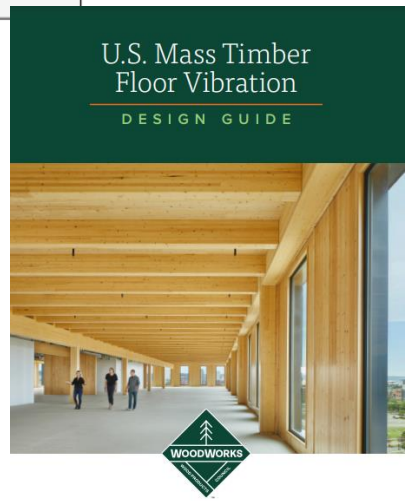
Smartlam

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.

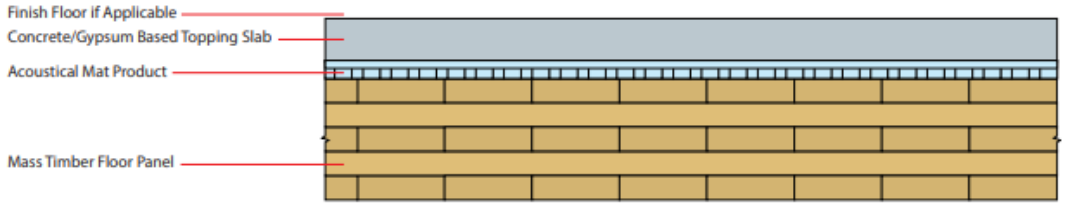


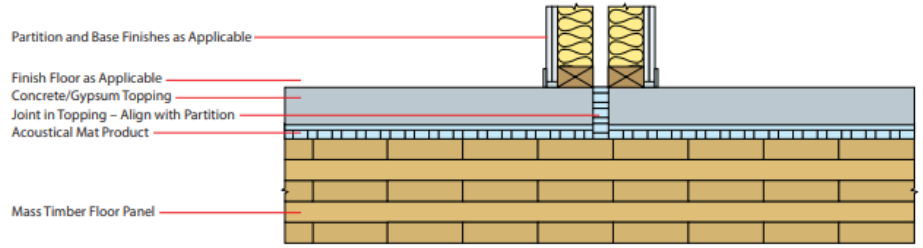


Acoustical floor underlayments

Typical Mass Timber Floor Assembly

Section View

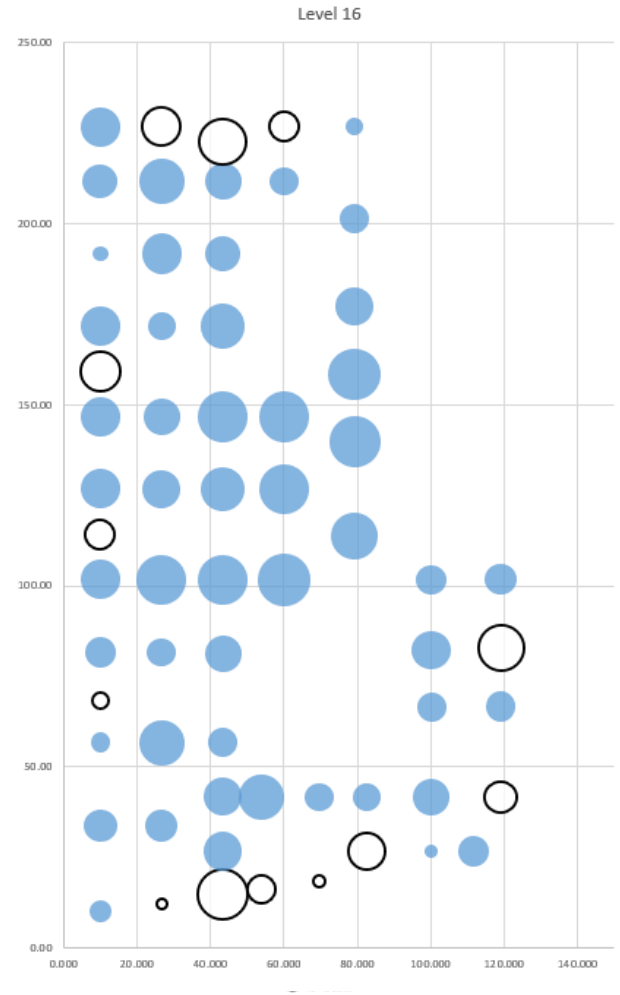


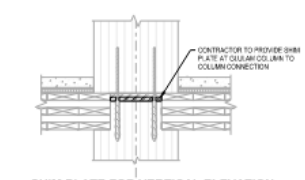


Richard McLain - Woodworks

MASS TIMBER

Vertical Compensation and Surveying





SHIM PLATE FOR VERTICAL ELEVATION ADJUSTMENT
2 NOT TO SCALE

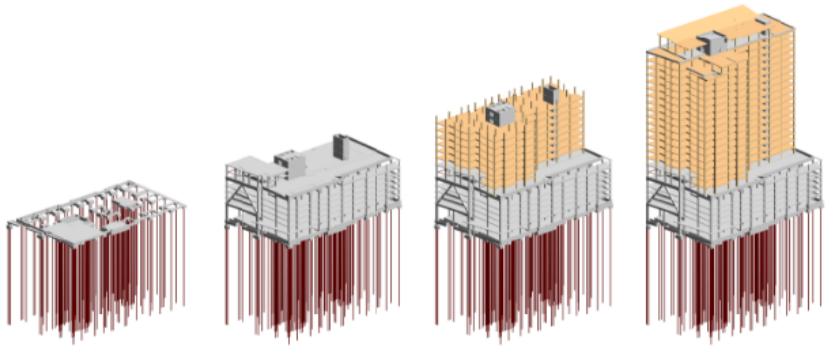
SHIM PLATE THICKNESS SCHEDULE

LOCATION / SLAB LEVEL	TYPE-1	TYPE-2	TYPE-3	TYPE-4	TYPE-5	TYPE-6	TYPE-7	TYPE-8
ROOF	-	-	-	-	-	-	-	-
LEVEL 25	1/16"	1/16"	1/16"	1/16"	1/32"	1/16"	-	1/16"
LEVEL 24	1/16"	1/32"	1/32"	1/32"	1/32"	1/16"	-	1/16"
LEVEL 23	1/16"	1/16"	1/16"	1/16"	1/32"	1/16"	-	1/16"
LEVEL 22	1/16"	1/32"	1/32"	1/32"	1/32"	1/16"	1/16"	1/16"
LEVEL 21	1/16"	1/16"	1/16"	1/16"	1/32"	1/16"	1/32"	3/32"
LEVEL 20	1/16"	1/32"	1/32"	1/32"	1/32"	1/16"	1/32"	3/32"
LEVEL 19	1/16"	1/16"	1/16"	1/16"	1/32"	1/16"	1/16"	3/32"
LEVEL 18	1/16"	1/32"	1/32"	1/32"	1/32"	1/16"	1/32"	3/32"
LEVEL 17	1/16"	1/16"	1/16"	1/16"	1/32"	1/16"	1/32"	3/32"
LEVEL 16	1/16"	1/32"	1/32"	1/32"	1/32"	1/16"	1/16"	3/32"
LEVEL 15	1/16"	1/16"	1/16"	1/16"	1/32"	1/16"	1/32"	3/32"
LEVEL 14	1/16"	1/32"	1/32"	1/32"	1/32"	1/16"	1/32"	3/32"
LEVEL 13	1/16"	1/16"	1/16"	1/16"	1/32"	1/16"	1/16"	3/32"
LEVEL 12	1/16"	1/32"	1/32"	1/16"	1/32"	1/16"	1/32"	3/32"
LEVEL 11	1/16"	1/16"	1/16"	1/16"	1/32"	1/16"	1/32"	3/32"
LEVEL 10	1/16"	1/32"	1/32"	1/16"	1/32"	1/16"	1/16"	3/32"
LEVEL 09	1/16"	1/16"	1/16"	1/16"	1/32"	1/8"	1/32"	1/8"
LEVEL 08	1/16"	1/32"	1/32"	1/16"	1/32"	1/8"	1/32"	1/8"
LEVEL 01-07	-	-	-	-	-	-	-	-

TABLE LEGEND - COLUMN SHIM GROUPS

TYPE-1:	B2, C1, C2, D3.2, C.7/5.7, D2, D3.2, D.3/5.7, E3.2, E.4/4.3, F.0.2, F.R.3, F12, G.S/7, H2, H.5/7, J2, K5, K.5/7
TYPE-2:	A.4/1, A.4/2, A.4/4.3, A.4/5.7, B/4.3, D1, D.5/1, F/1, F.5/1, F.G/5.7, G/7, G/6, G.8/8, H.5/1, H.5/1, K/6, K/5.2, K.5/1, L/7.5, L/7.7, M.1/2, L/3.2, G.8/1
TYPE-3:	B/3.2, C/2, D1, G1, G/3.2, G/4.3, G/2, H/3.2, J1, J3.2, K/4.3, M.1/4
TYPE-4:	E.3/5.7, K/7, K/8
TYPE-5:	L/7, L.7/1, M.1/5, M.1/3.2
TYPE-6:	B.5/5.7, H.5/8, L/6
TYPE-7:	B/1
TYPE-8:	A.7/3.2

NOTES:
1. SHIM TYPES ARE ASSIGNED TO COLUMNS AS NOTED IN THE TABLE LEGEND.
2. SEE 250400 FOR SHIM PLATE DETAILS.
3. COLUMNS TO BE FABRICATED TO THE THEORETICAL LENGTH BASED ON FLOOR TO FLOOR HEIGHTS PER 1/S-210 AND 1/S-211.
4. ALL SHIM PLATES SHALL BE BUILT OF 1/32" AND 1/64" THICK INCH PLATES FOR ADJUSTMENT FLEXIBILITY.



TOWER CONSTRUCTION ANALYSIS

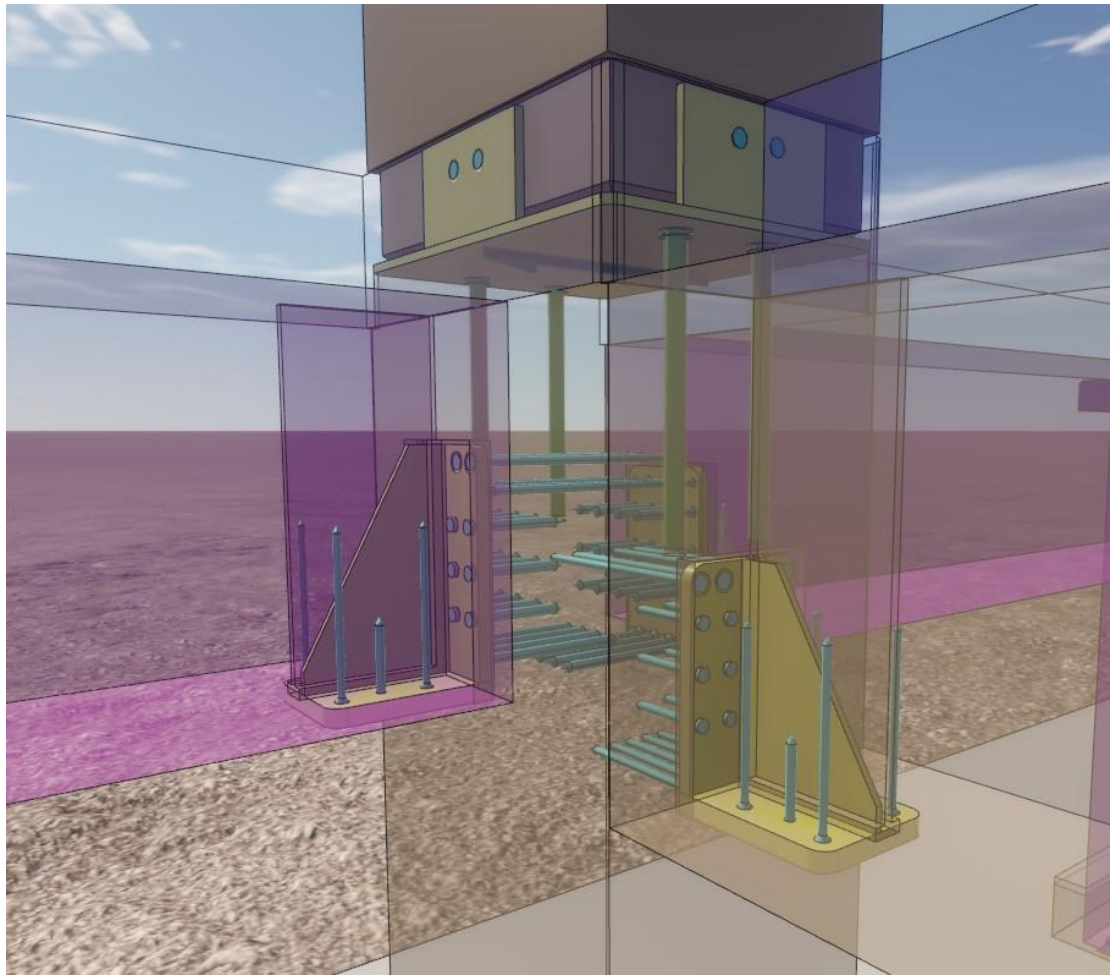
STAGE ID	LEVEL COMPLETED	STAGE START TIME (DAY)
1	FOUNDATIONS	-280
2	LEVEL 71.60	-60
3	START N/T CONST.	0
4	LEVEL 5 MT	10
5	LEVEL 9 MT	20
6	LEVEL 13 MT	30
...	...	+10 DAYS
28	LEVEL 24 MT	170 DAYS
29	LEVEL 25 MT	180 DAYS
30	ROOF MT	190 DAYS
x	x	x
x	x	x
x	x	x
x	x	x
x	x	x

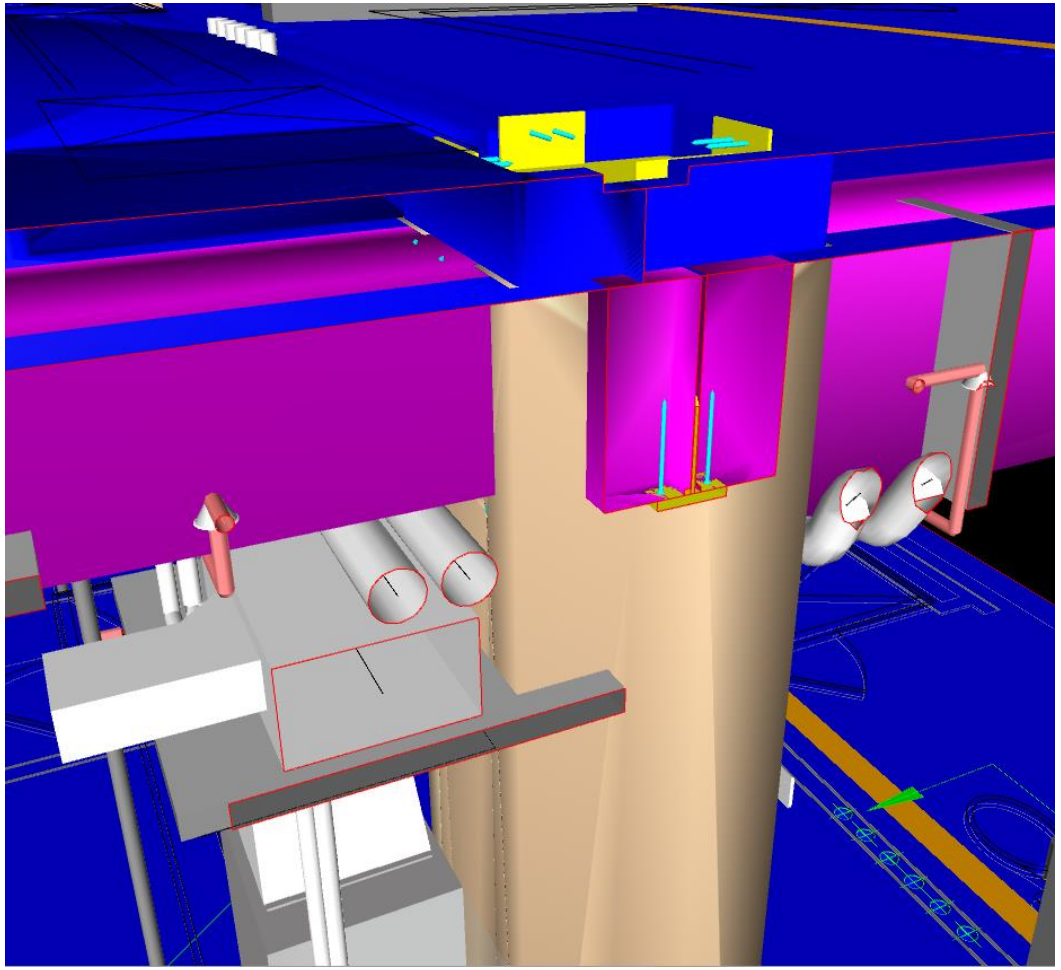
NOTES:
1) FACADE INSTALLATION IS ASSUMED TO OCCUR 60 DAYS AFTER CONSTRUCTION OF MASS TIMBER LEVELS, TYPICAL
2) CONCRETE TOPPING POURS ARE ASSUMED TO OCCUR 180 DAYS AFTER CONSTRUCTION OF MASS TIMBER LEVELS, TYPICAL
3) IT IS ASSUMED TOWER CORE CONSTRUCTION WILL LEAD MASS TIMBER CONSTRUCTION BY 3 FLOORS
4) TIMELINE BASED ON CONSTRUCTION SCHEDULED DATED 02-SEP-25

ASSUMED CONSTRUCTION SCHEDULE FOR PRECONSTRUCTION ANALYTICAL PREDICTION OF ELASTIC AND LONG-TERM CREEP ADN SHRINKAGE EFFECTS
3 NOT TO SCALE

MASS TIMBER

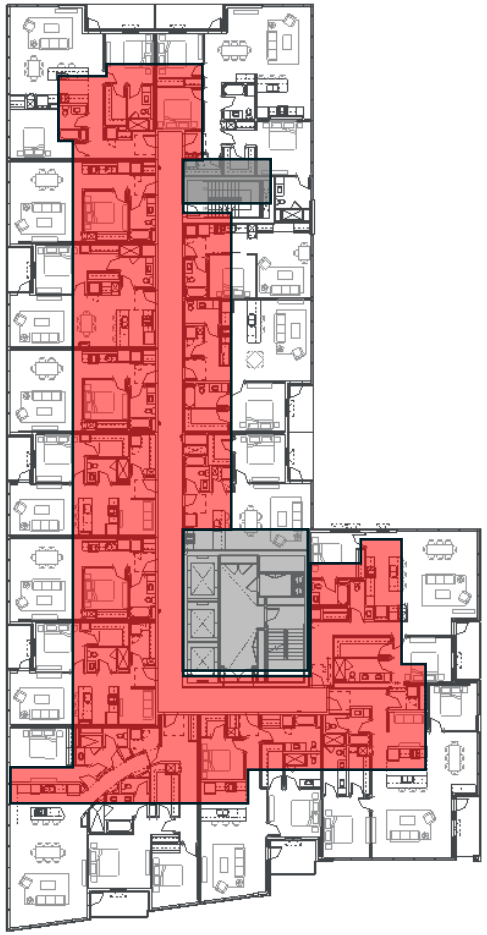
Modeling



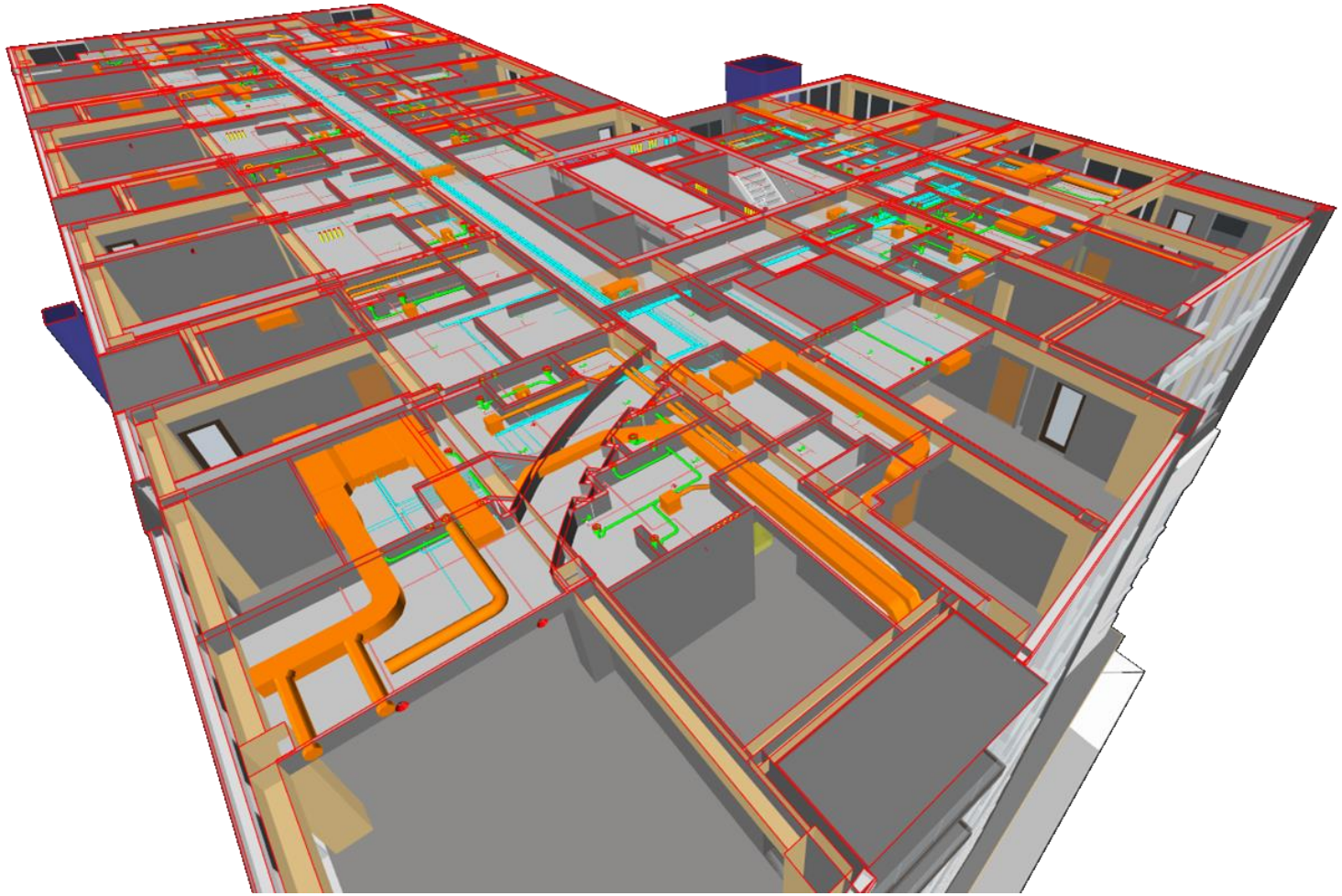


MASS TIMBER

Coordination



TYPICAL RESIDENTIAL LEVEL



Thornton Tomasetti

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 β_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

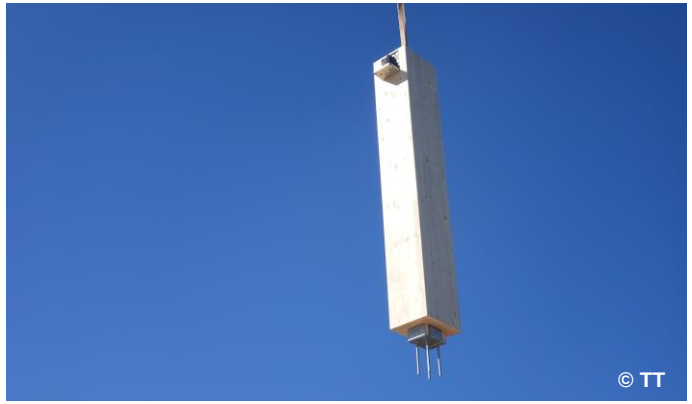
Table 16.2.2 Adjustment Factors for Fire Design[1]

			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

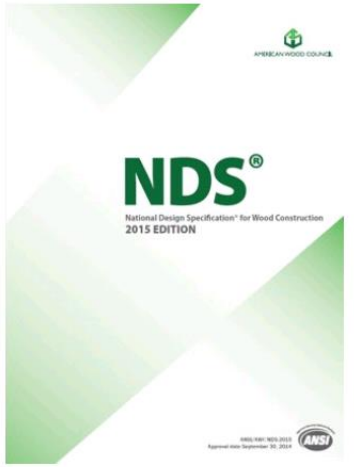
Fire Performance



BEAMS

COLUMNS

CLT



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?

PRECEDENTS

T3, Minneapolis, USA

(7 stories)

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.

IBC 2015

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

OFFICE

RESIDENTIAL

IBC 2015

PERMITTING

IBC 2015-2018

TABLE 504.4[a, b]—continued
ALLOWABLE NUMBER OF STORIES ABOVE GRADE PLANE

OCCUPANCY CLASSIFICATION	SEE FOOTNOTES	TYPE OF CONSTRUCTION								
		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	5	4	3
R-2	NS[d, h]	UL	11	4	4	4	4	4	3	2
	S13R	4	4	4					4	3
	S	UL	12	5	5	5	5	5	4	3
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	5	4	4
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	5	4	3

OFFICE

RESIDENTIAL

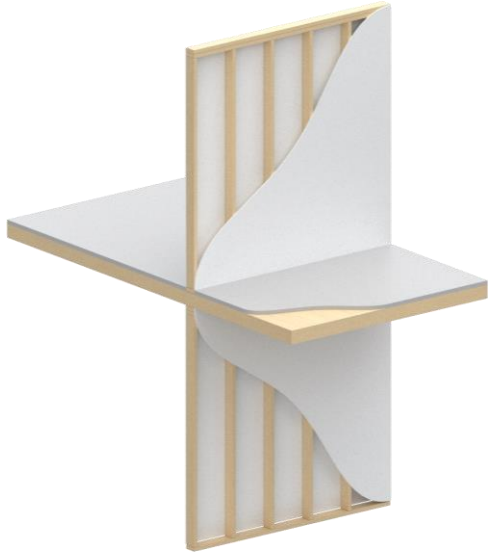
IBC 2015

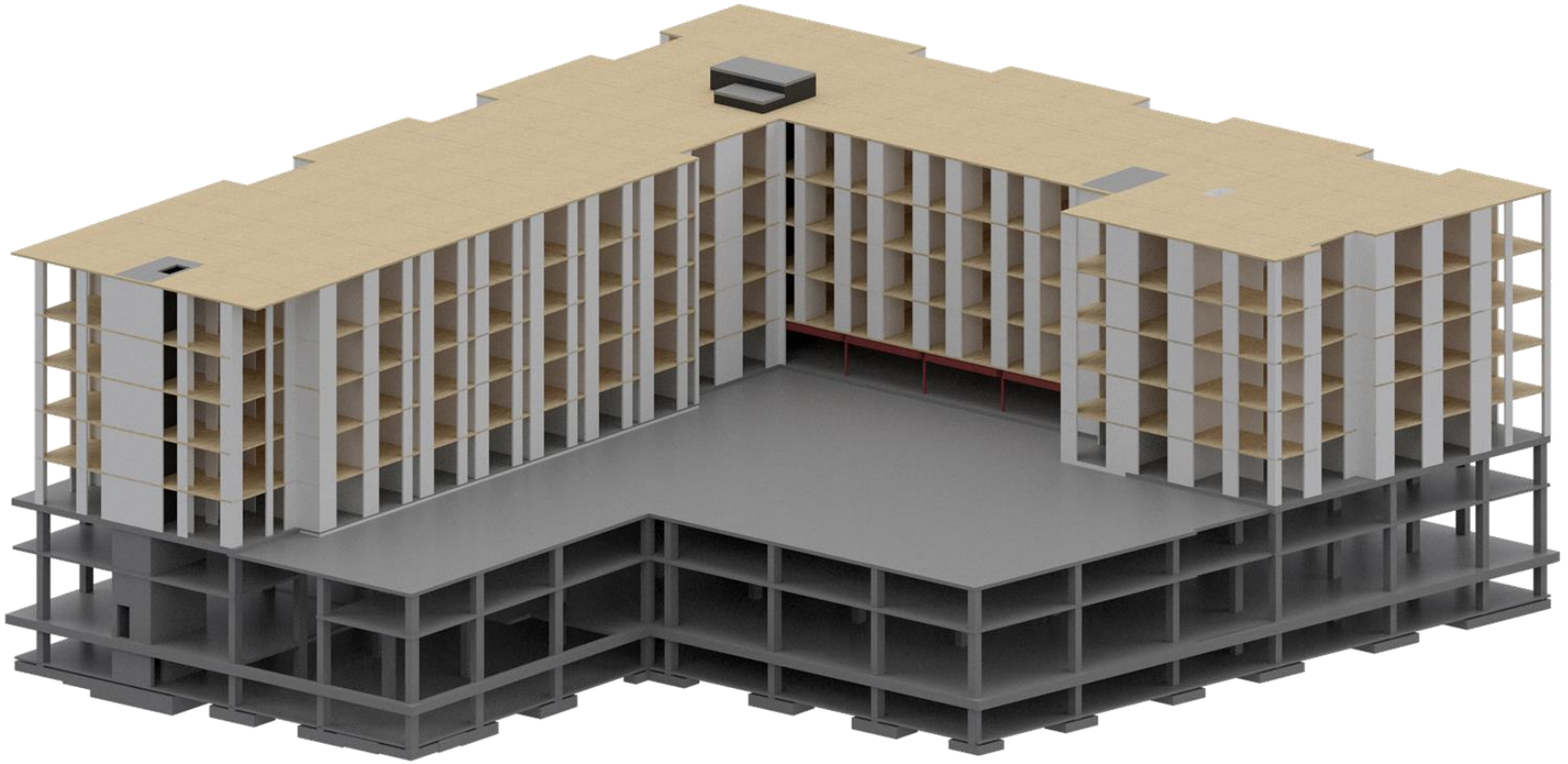
PERMITTING

IBC 2015-2018

PERMITTING

IBC 2015-2018





STICK FRAMING WALLS + CLT SLABS

CONCRETE PODIUM

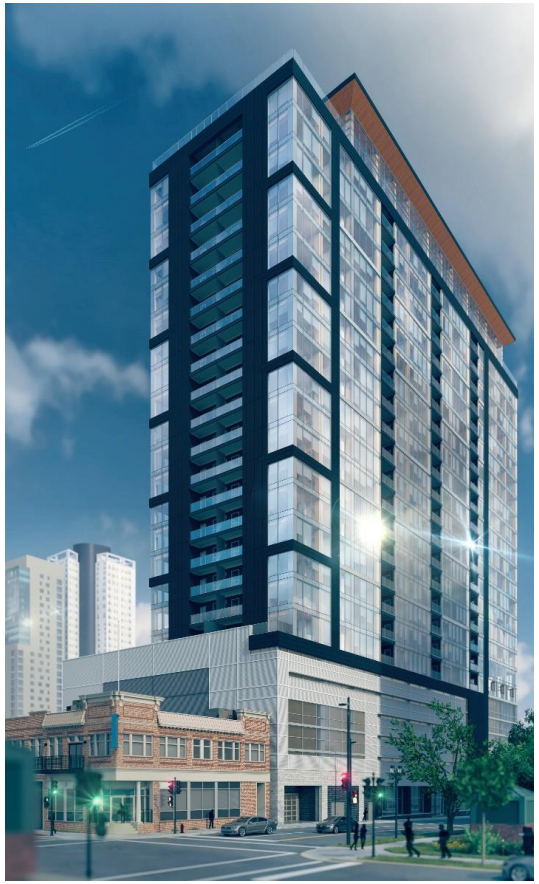
CONCRETE BASEMENT

PERMITTING

UNITED STATES APPROVALS

12 stories

25 stories



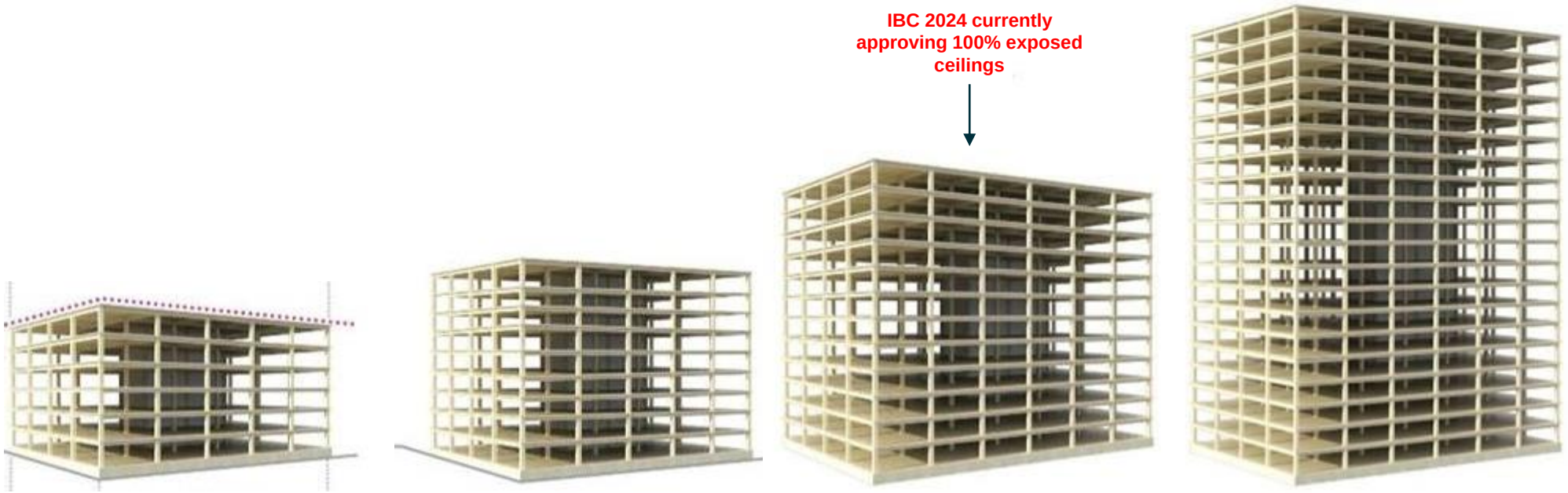
Framework (2017)
Portland, OR

Ascent (2020)
Milwaukee, WI

CODE DEVELOPMENT

IBC (2021 and Beyond)

IBC 2024 currently approving 100% exposed ceilings



?

- 6 Stories
- Fully Exposed

IBC 2015

TYPE IV-C

- 9 Stories
- Fully Exposed

TYPE IV-B

- 12 Stories
- Limited exposure (20% ceilings, 40% walls)

TYPE IV-A

- 18 Stories
- Fully Concealed

IBC 2021 (approved)

FUTURE CODES ?

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

PERMITTING

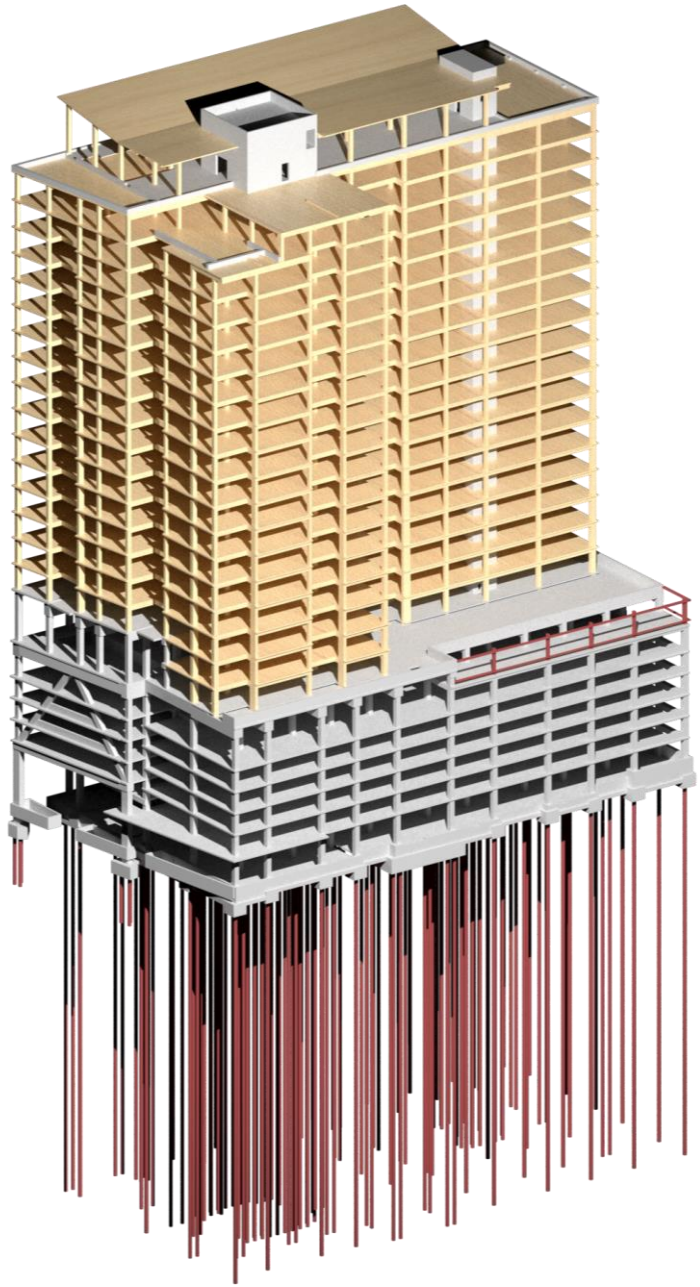
Alternate Materials

[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] Interior	3 3[a]	2 2[a]	1 1	0 0	2 1	2 0	2 1/HT	1 1	0 0
Nonbearing walls and partitions Exterior	See Table 602								
Nonbearing walls and partitions 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.

a. 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.

b. 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.

c. In all occupancies, heavy timber shall be allowed where a 1-hour or less fire-resistance rating is required.

d. Not less than the fire-resistance rating required by other sections of this code.

e. Not less than the fire-resistance rating based on fire separation distance (see Table 602).

f. 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**

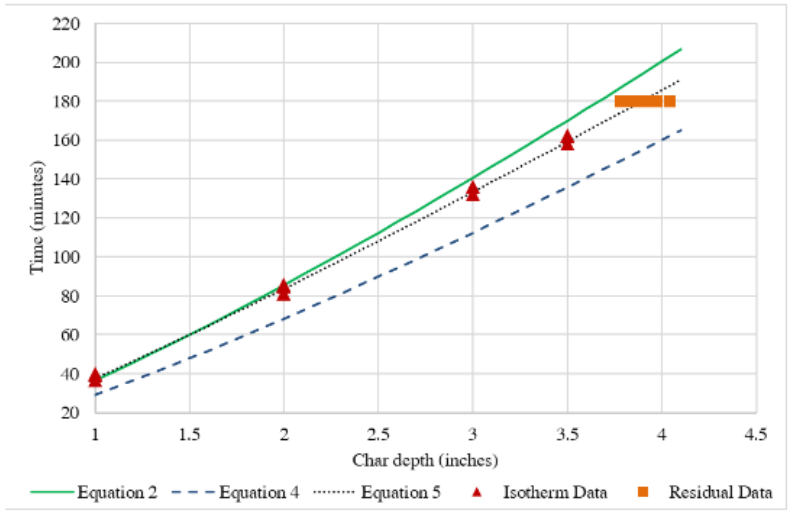
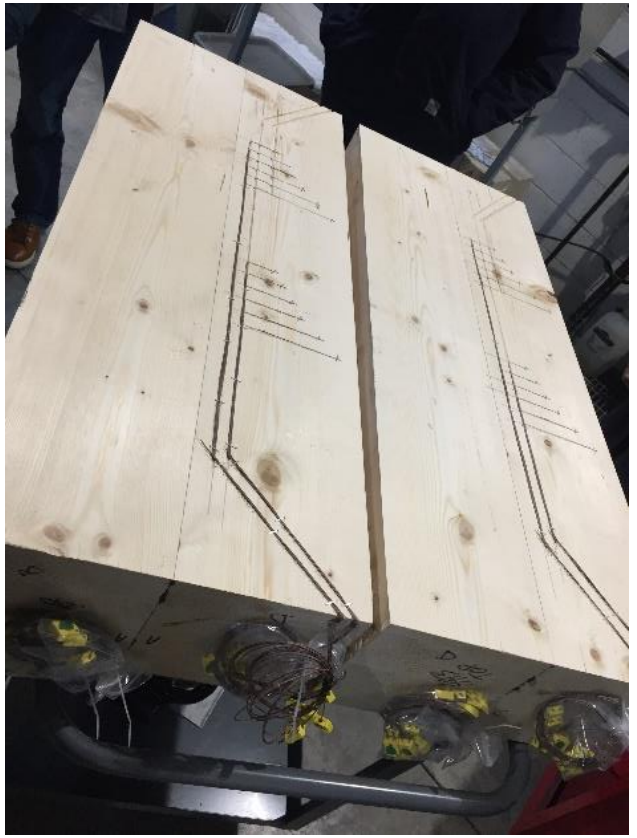


Figure 8: Data from the 300°C Isotherm combined with data from the residual cross sections compared with 3 models.

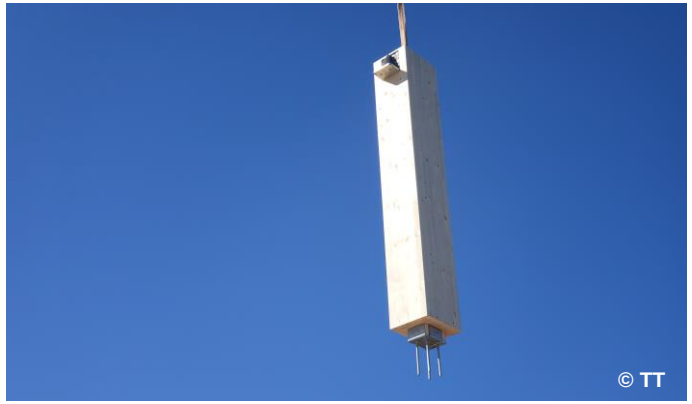
USDA FOREST PRODUCTS LABORATORY



Thornton Tomasetti

PERMITTING

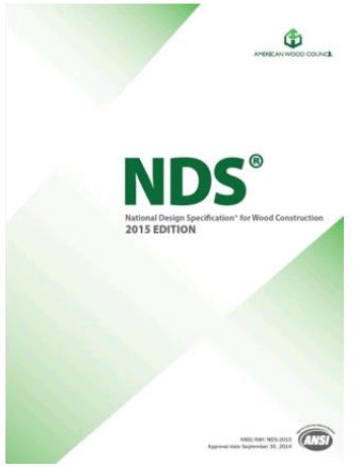
Fire Rating (Members)



BEAMS

COLUMNS

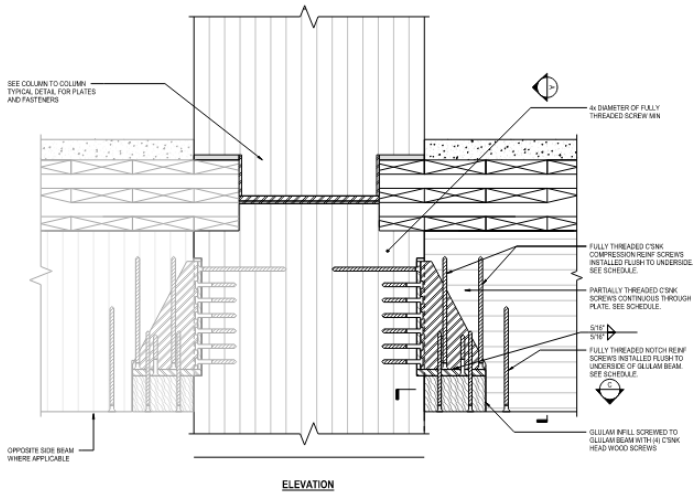
CLT

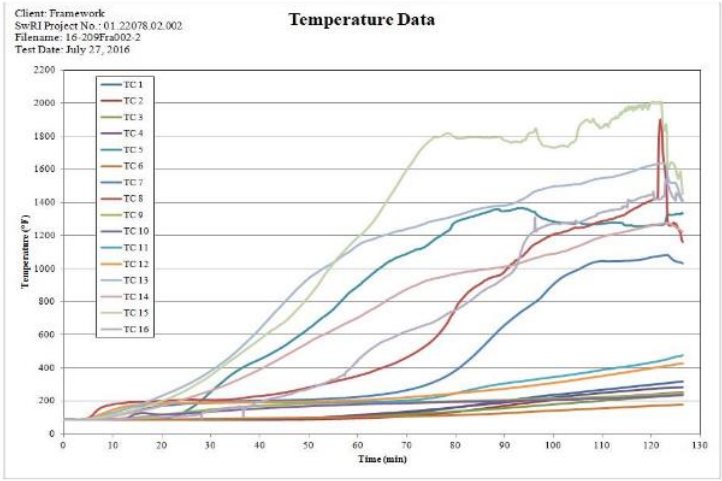


PERMITTING

Fire Rating (Connections)

- “Framework Connector”
- Encapsulation

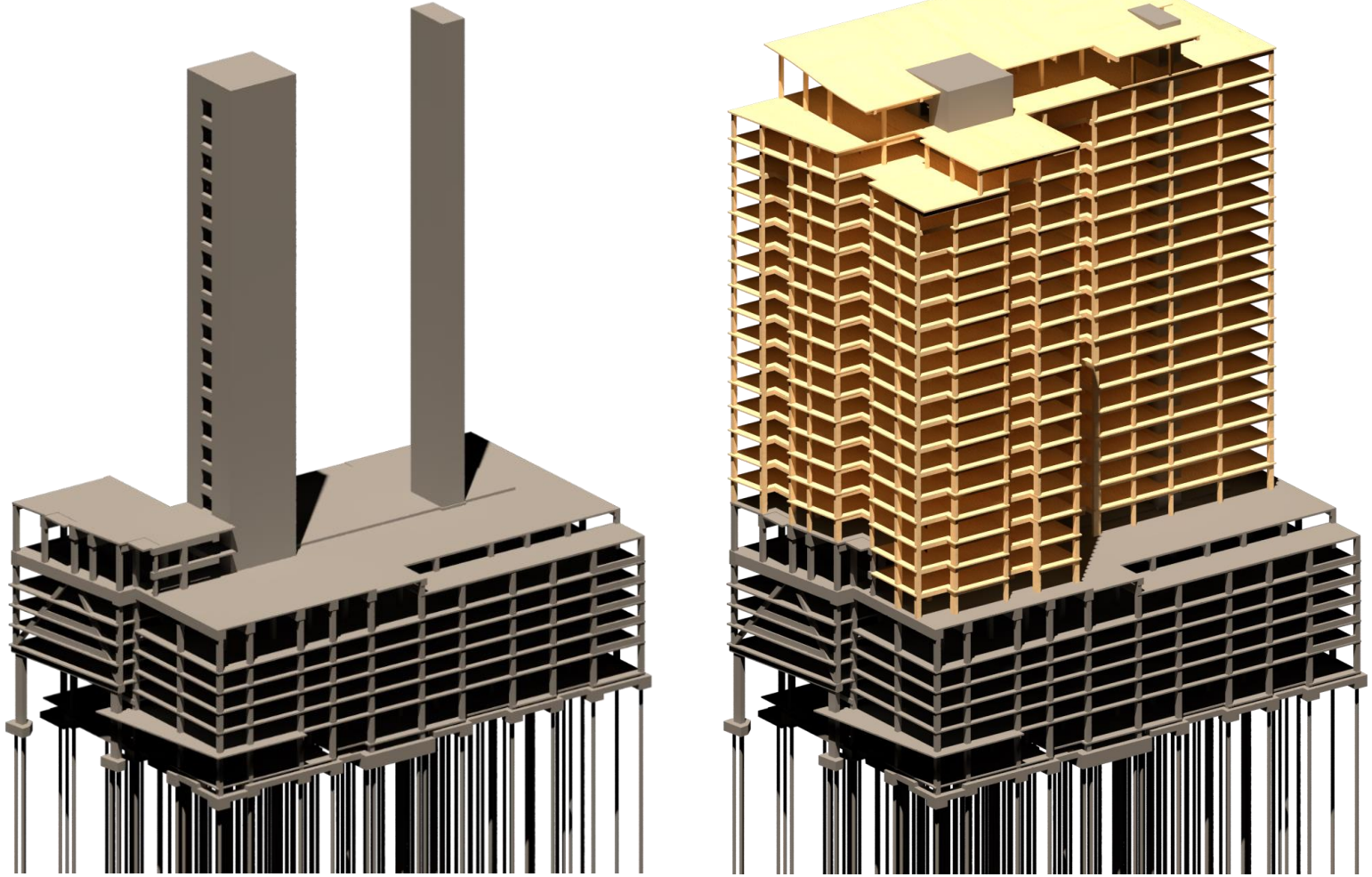




“FRAMWORK CONNECTOR”

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**

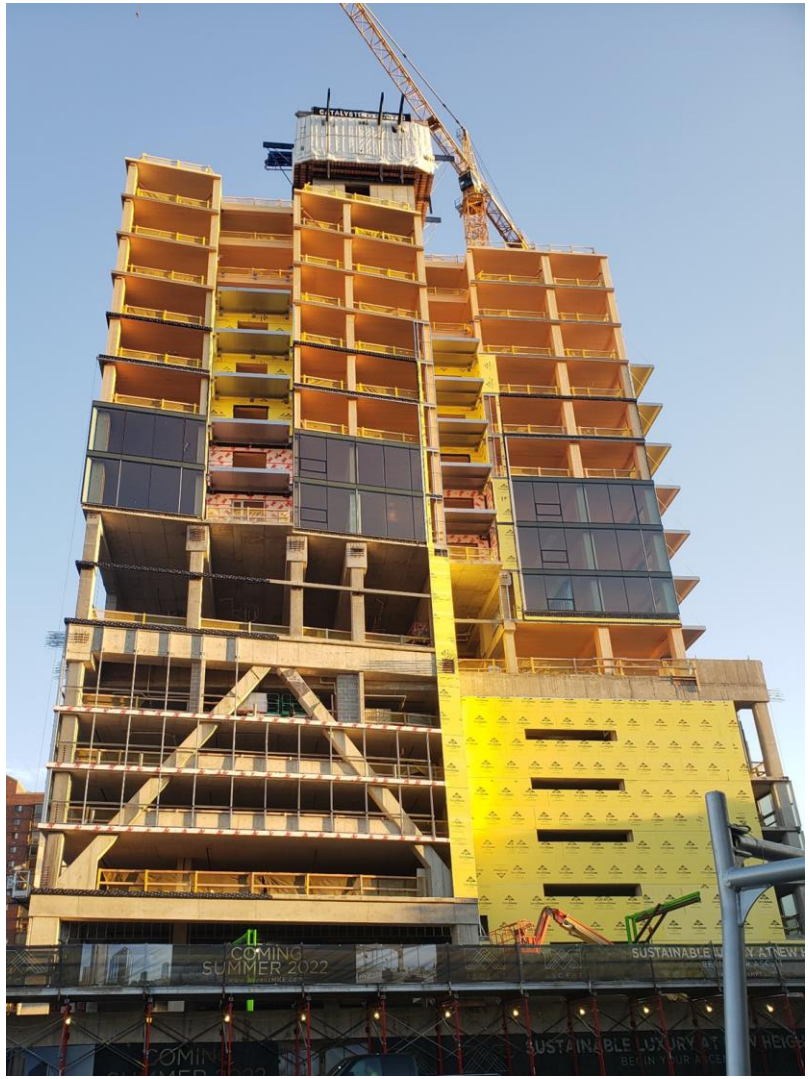
AGENDA

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)

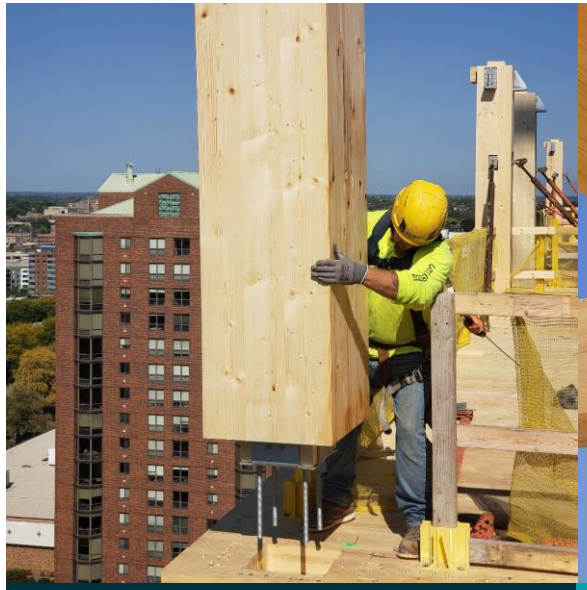


Level 17 Complete
(September 2021)

Level 26 (Roof) Topped Out
(December 2021)

ASCENT

Primary Mass Timber Structural Components



GLULAM COLUMNS

GLULAM BEAMS

CLT PANELS

TIMBER SCREWS


WIEHAG
F-826


usbank


SKYJACK
SJ3219
RAPIDFOLD
ECOTRAY

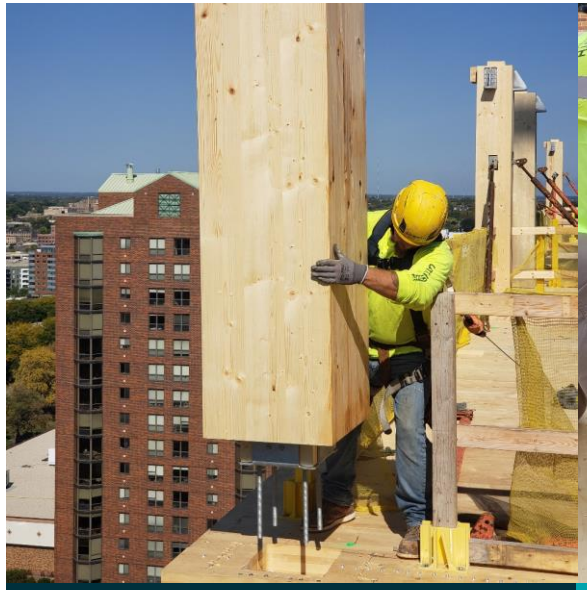

CD SMITH


SUMMER JAM

ASCENT

Primary Mass Timber Connections

CORE-CLT/GLB



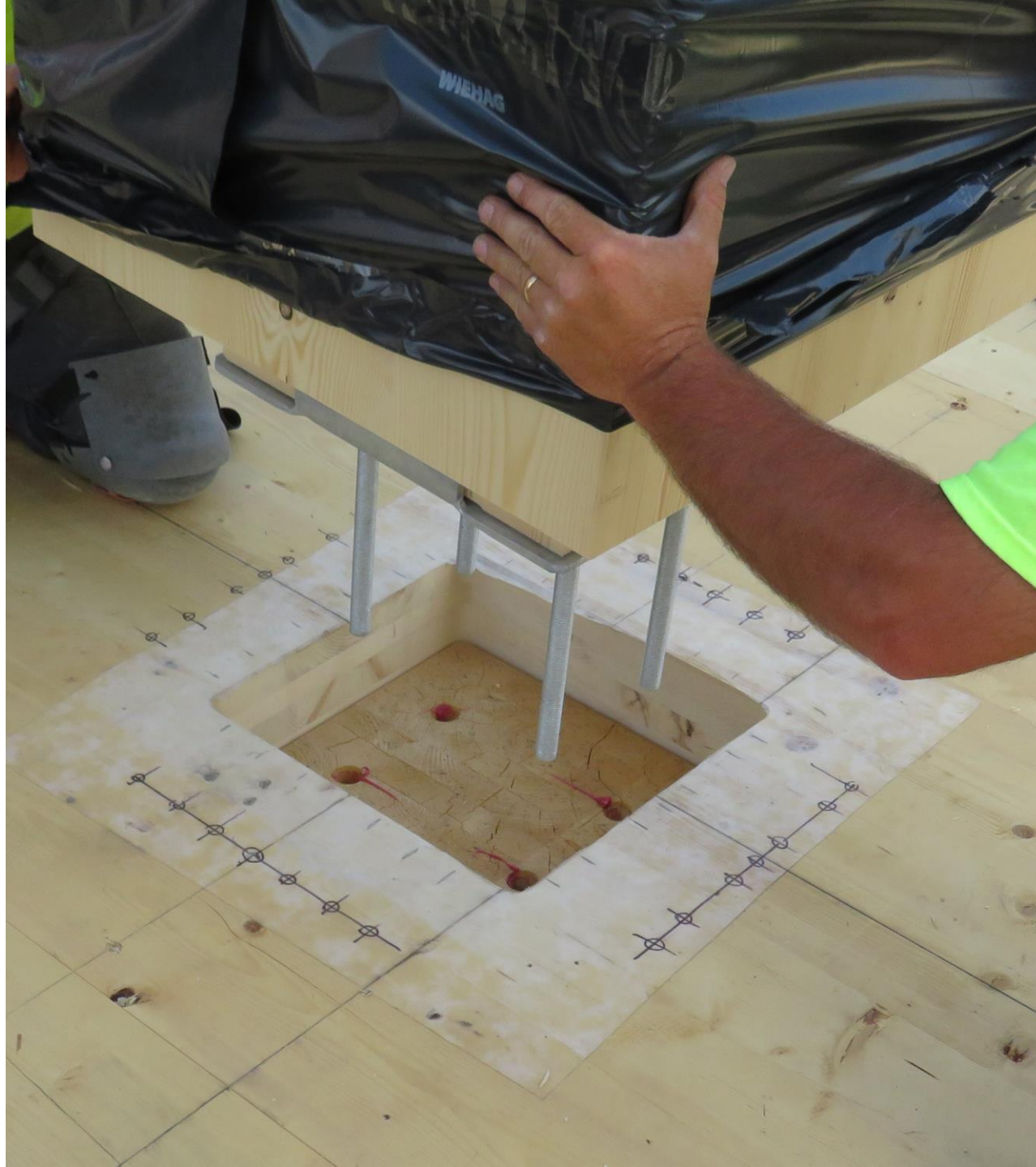
COL-COL (EPOXY)

COL-COL (INTERIOR)

BEAM-COL (HANGER)

BEAM-COL (BEARING)


F-1833

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HOLE
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FABICK RENTS
1.800.RENT.CAT
CAT Rental


SKYJACK
SJ3219


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ASCENT

ASCENT

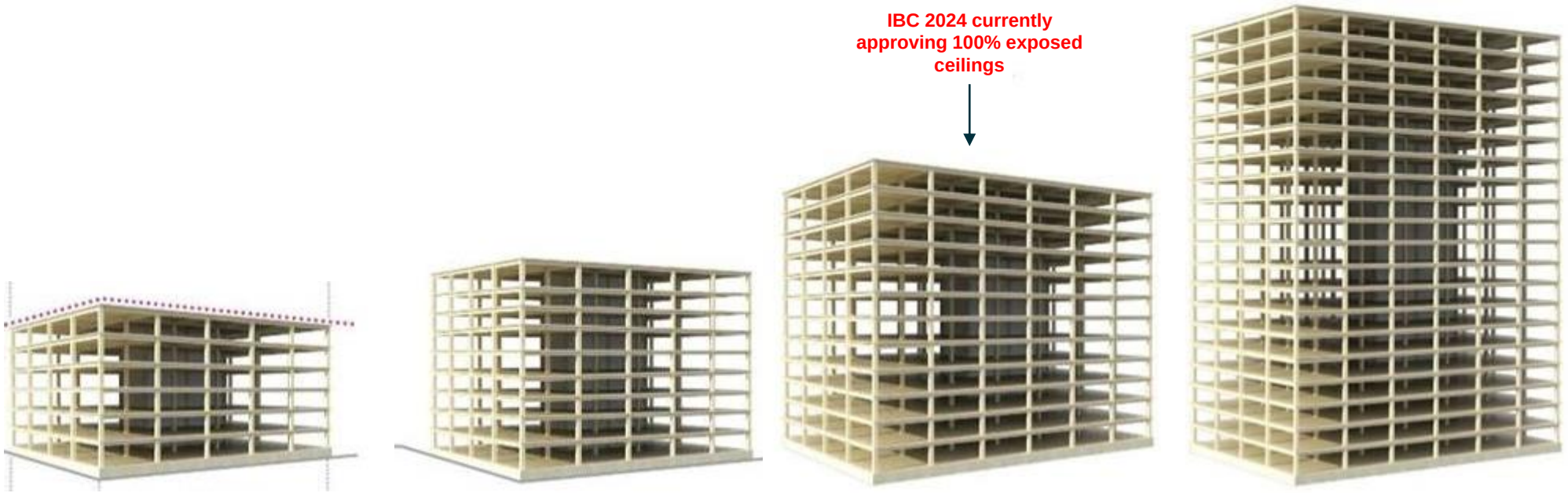
AGENDA

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?

CODE DEVELOPMENT

IBC (2021 and Beyond)

IBC 2024 currently approving 100% exposed ceilings



?

- 6 Stories
- Fully Exposed

IBC 2015

TYPE IV-C

- 9 Stories
- Fully Exposed

TYPE IV-B

- 12 Stories
- Limited exposure (20% ceilings, 40% walls)

TYPE IV-A

- 18 Stories
- Fully Concealed

IBC 2021 (approved)

FUTURE CODES ?

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

FIRE TESTING

IBC 2021 - 2024

ASCENT

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

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

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
• 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

*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.

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)

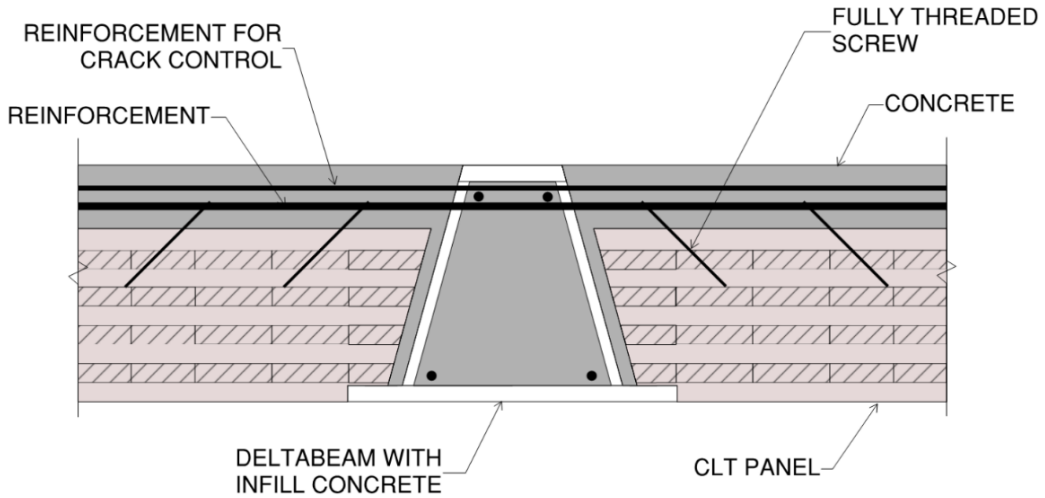
Simpson Strong-Tie

CBH2.37x9.97: 36kips

(2 hours)

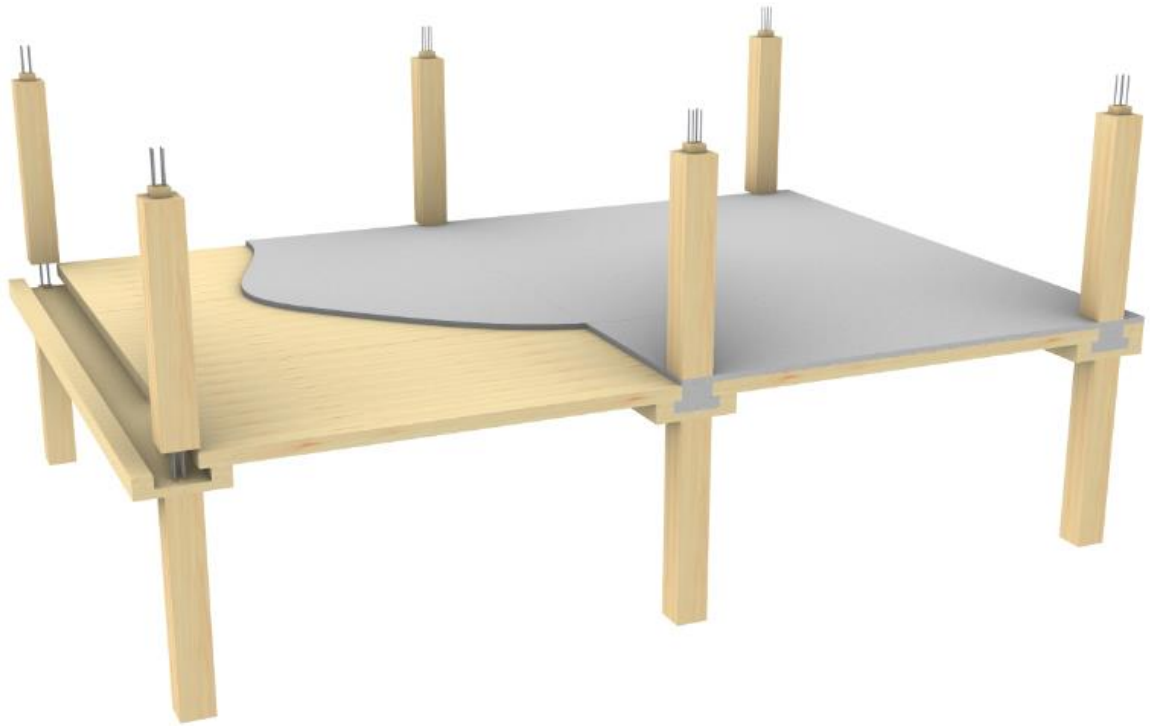
HYBRID STRUCTURES

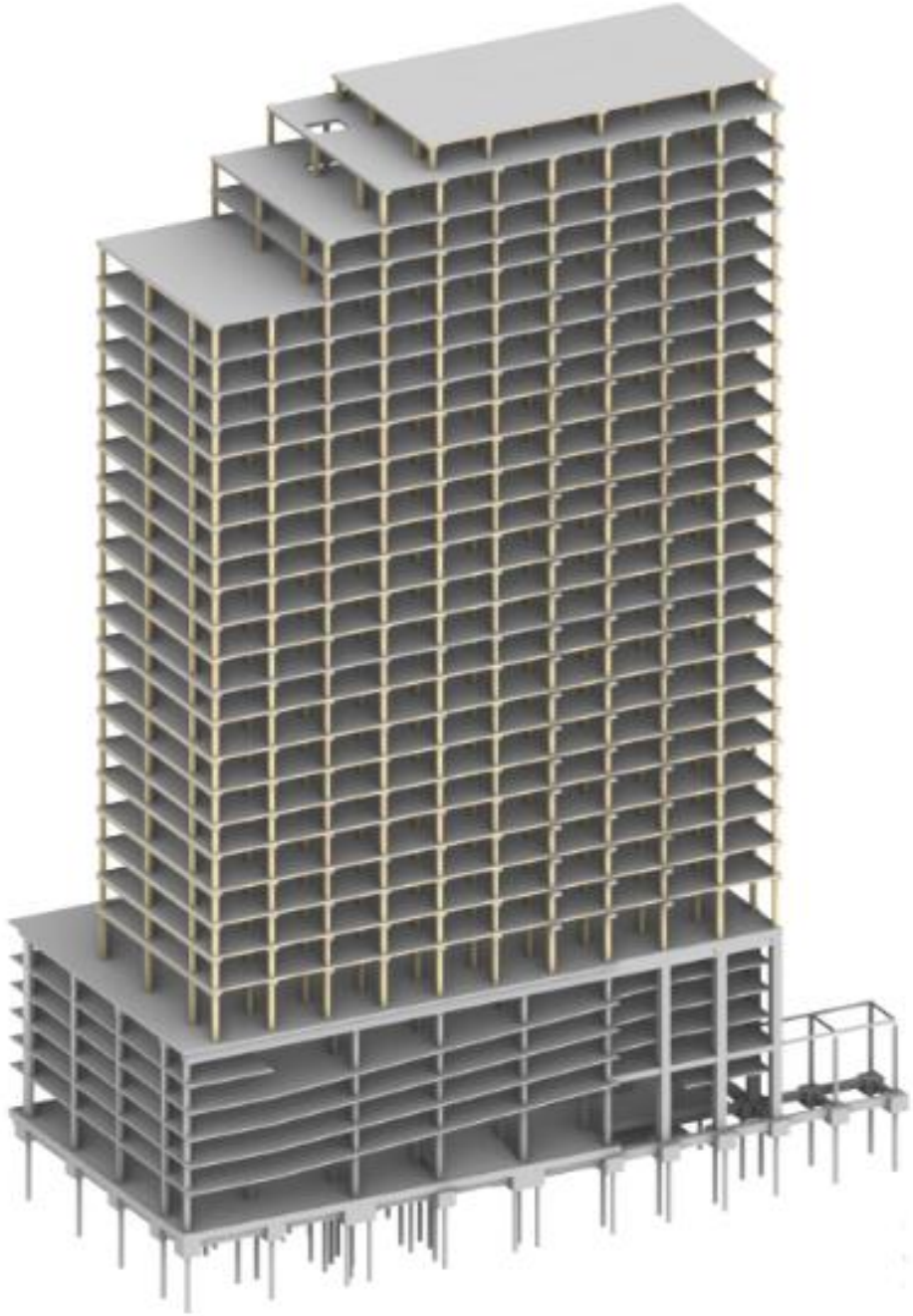
Mass Timber - Steel



HYBRID STRUCTURES

Mass Timber - Concrete





THANK YOU

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