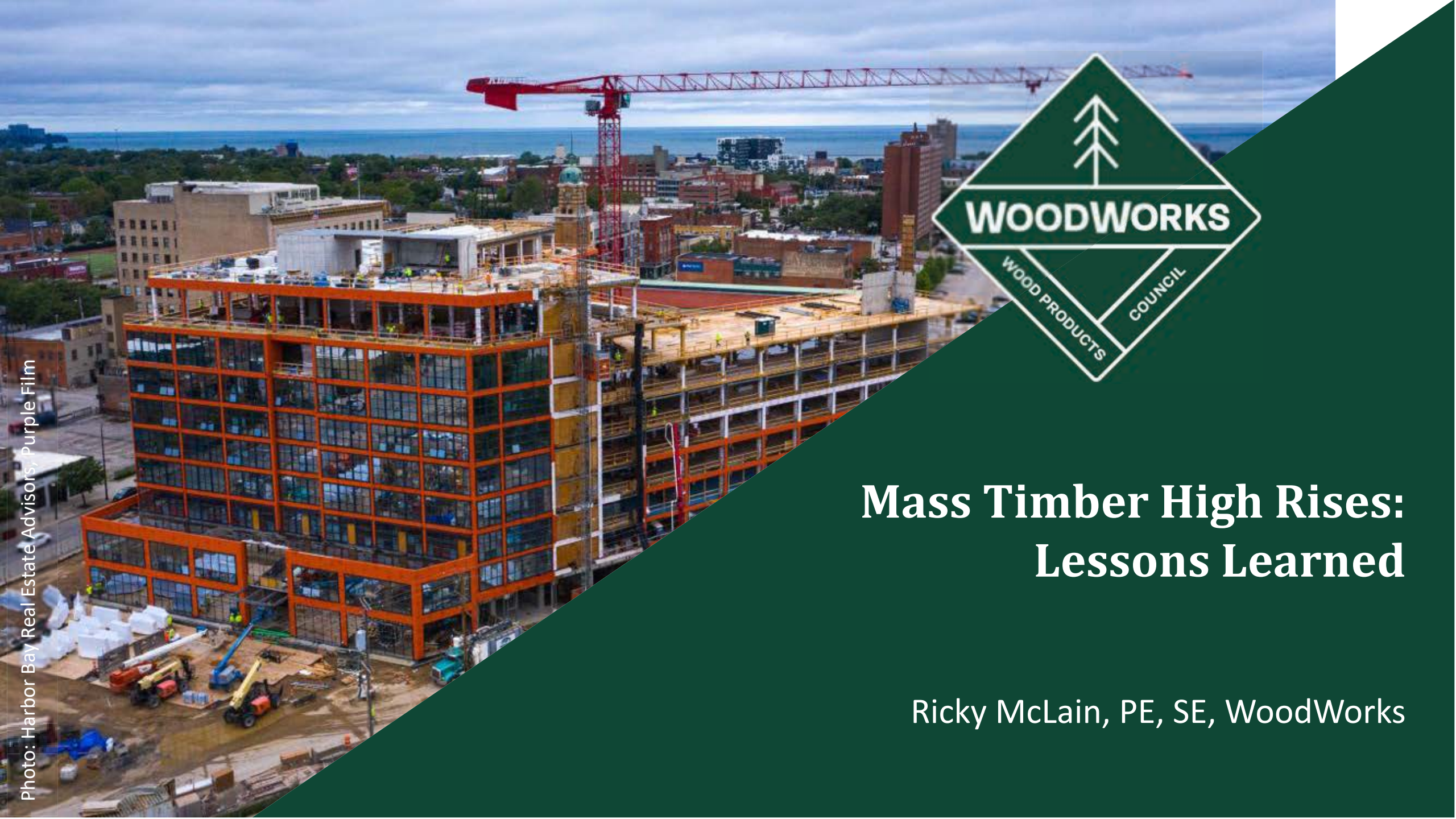

Photo: Harbor Bay Real Estate Advisors, Purple Film

Mass Timber High Rises: Lessons Learned

Ricky McLain, PE, SE, WoodWorks

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

Designing a wood building? Ask us anything.

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Course Description

The use of mass timber construction in US low- and mid-rise projects has seen remarkable growth in the past decade. Projects such as commercial and office buildings, higher education facilities and public arenas have whetted the architect's and public's palette for a new structural material that promises lower embodied carbon impacts. More recently, the push for use of mass timber in taller projects, particularly multi-family housing, has raised questions about its relative safety and sustainability performances.

As shapers of the built environment, developers and design teams often have the opportunity—some would say responsibility—to address societal issues through their work. Globally, the groundswell of tall timber buildings has been motivated by the urgent need for housing density in urban areas, and the equally urgent need to respond to the climate crisis by reducing and offsetting carbon emissions. While other countries have been constructing tall wood buildings for a decade, the U.S. is one of the first to include provisions in its model building code allowing them prescriptively. This session will provide architects with the knowledge needed to confidently design tall timber buildings in the US, including topics such as value proposition, sustainability, fire resistance, structural layout, connections and details, occupant comfort, cost optimization, and more.

Learning Objectives

1. Review the global and US history of tall wood construction, noting the role that precedent projects have played in code developments and design techniques.

2. Explore the work and conclusions of the ICC Ad Hoc Committee on Tall Wood Buildings in establishing 17 new code provisions for the 2021 IBC that address tall wood construction.

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

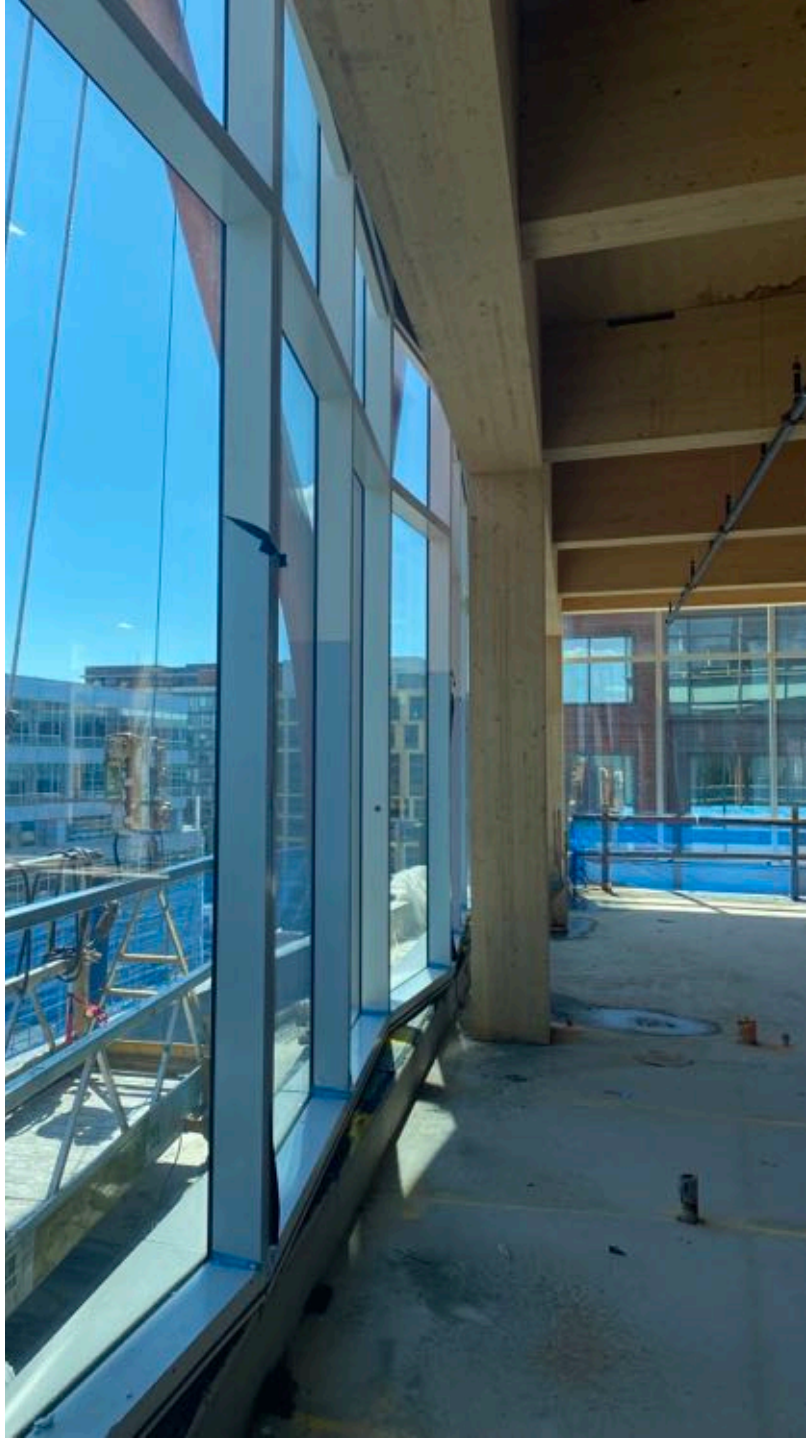
4. Highlight trends for the future use of mass timber, particularly in multi-family, mid- and high-rise projects.

80 M ST, WASHINGTON, DC

3 STORY VERTICAL ADDITION
7 STORY EXISTING BUILDING

Photo: WoodWorks | Architect: Hickok Cole

80 M ST, WASHINGTON, DC



100,000 SF

2 NEW LEVELS OF CLASS A OFFICE SPACE
OCCUPIED PENTHOUSE
17’-0” CEILING HEIGHTS

APEX PLAZA
CHARLOTTESVILLE, VA

187,000 SF

Photo: WoodWorks | Architect: William McDonough + Partners

APEX PLAZA
CHARLOTTESVILLE, VA

8 STORIES
6 TIMBER OVER 2 PODIUM, 100 FT

PRIMARILY OFFICE SPACE

Photo: William McDonough + Partners | Architect: William McDonough + Partners

11 E LENOX, BOSTON, MA

7 STORIES

70 FT

Passive House

Multi-Family

Credit: H + O Structural Engineering

Credit: Monte French Design Studio

11 E LENOX, BOSTON, MA

Credit: H + O Structural Engineering

ASCENT, MILWAUKEE

Photo: Korb & Associates Architects |
Architect: Korb & Associates Architects

493,000 SF

259 APARTMENTS, MIXED-USE

ASCENT, MILWAUKEE

Tallest Mass Timber Building in the World

Photo: CD Smith Construction |
Architect: Korb & Associates Architects

2018 IBC and All Previous Editions:

- Prescriptive Code Limit - 6 stories (B occupancy) or 85 feet
- Over 6 Stories - Alternate Means and Methods Request (AMMR) through performance based design
- Based on the 1910 Heights and Areas Act

Photo: Alex Schreyer

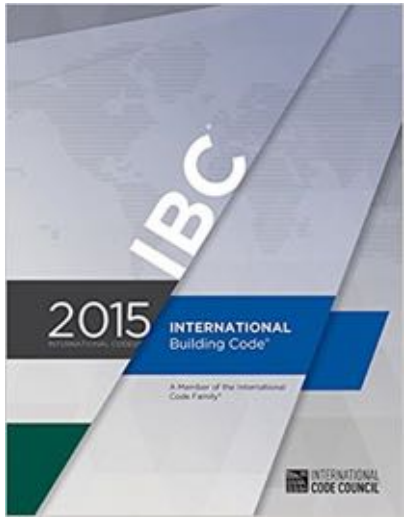
Photo: Blaine Brownell

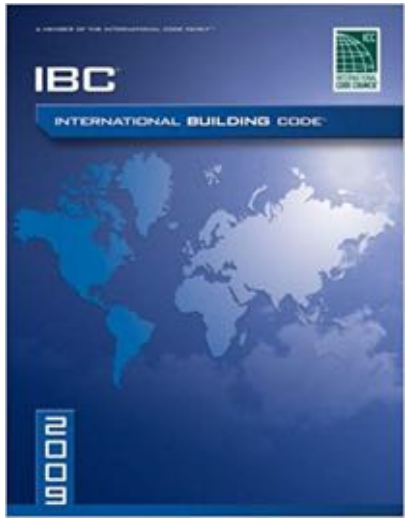
Photo: Christian Columbres

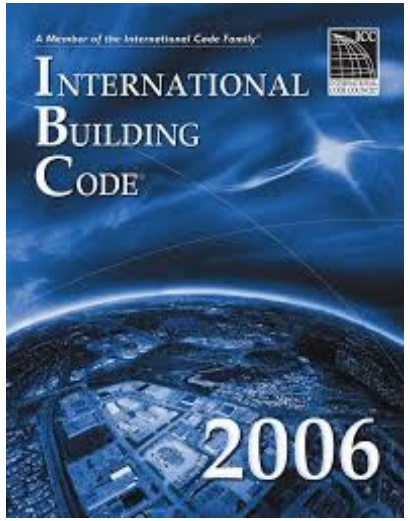
ICE Block I, RMW Architecture & Interiors, Buehler Engineering, Bernard André Photography

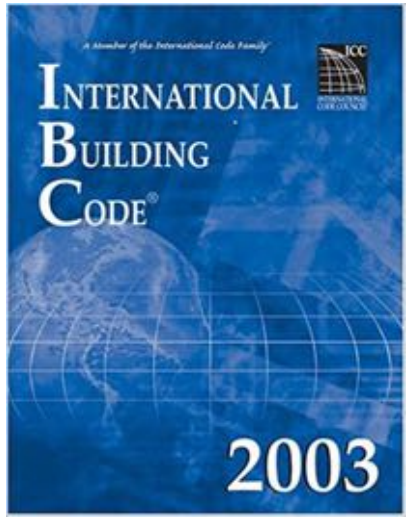

Photo: Swinerton

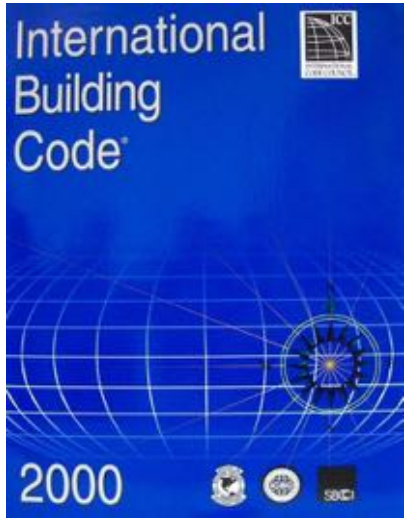
3 YEAR CODE CYCLE











Source: ICC

Photo: LendLease

Photo: LendLease

Photo: LendLease

Photo: LendLease

Photo: LendLease

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

Type IV-C

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

TYPE IV-C

Credit: Susan Jones, atelierjones

Photos: Baumberger Studio/PATH Architecture/Marcus Kauffman

Type IV-C Protection vs. Exposed

Credit: Susan Jones, atelierjones

Credit: Kaiser+Path, Ema Peter

All Mass Timber surfaces may be exposed

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

Type IV-C Height and Area Limits

Occupancy	# of Stories	Height	Area per Story	Building Area
A-2	6	85 ft	56,250 SF	168,750 SF
B	9	85 ft	135,000 SF	405,000 SF
M	6	85 ft	76,875 SF	230,625 SF
R-2	8	85 ft	76,875 SF	230,625 SF

Areas exclude potential frontage increase

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

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

Credit: Susan Jones, atelierjones

Type IV-B

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

TYPE IV-B

Credit: Susan Jones, atelierjones

Credit: LEVER Architecture

Type IV-B Protection vs. Exposed

Credit: Susan Jones, atelierjones

Credit: Kaiser+Path

NC protection on all surfaces of Mass Timber except limited exposed areas

~20% of Ceiling or ~40% of Wall can be exposed, see code for requirements

Type IV-B Height and Area Limits

Credit: Susan Jones, atelierjones

Occupancy	# of Stories	Height	Area per Story	Building Area
A-2	12	180 ft	90,000 SF	270,000 SF
B	12	180 ft	216,000 SF	648,000 SF
M	8	180 ft	123,000 SF	369,000 SF
R-2	12	180 ft	123,000 SF	369,000 SF

Areas exclude potential frontage increase

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

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

RISE Tests, 2020
Photo: RISE

Type IV-A

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

TYPE IV-A

Credit: Susan Jones, atelierjones

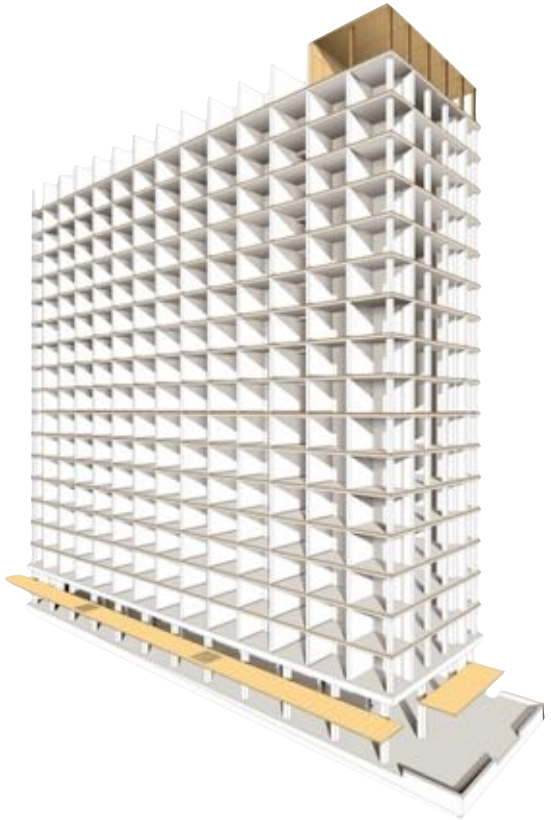
Photos: Structurlam, naturally:wood, Fast + Epp, Urban One

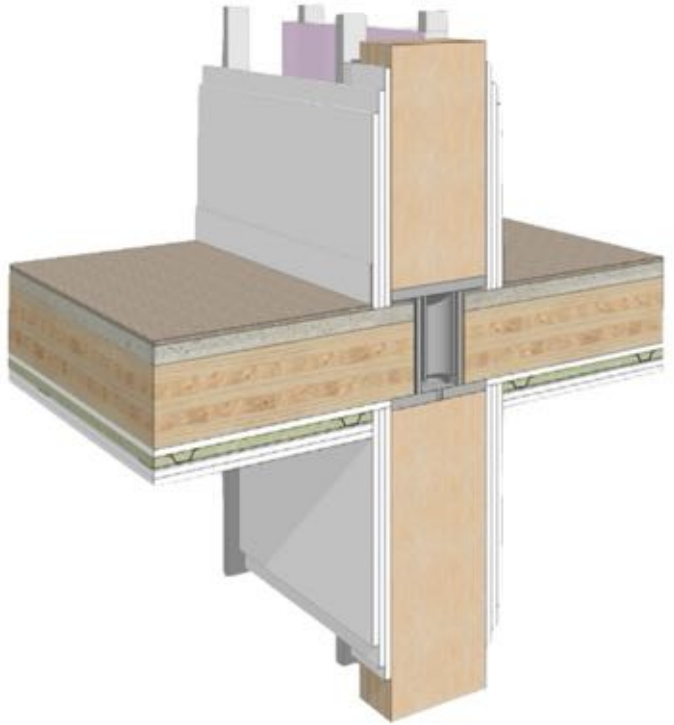
Type IV-A Protection vs. Exposed

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

TYPE IV-A

Credit: Susan Jones, atelierjones





100% NC protection on all surfaces of Mass Timber

Credit: Acton Ostry Architects, Fast + Epp

Type IV-A Height and Area Limits

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

Areas exclude potential frontage increase

In most cases, Type IV-A height & story allowances = 1.5 * Type I-B height & story allowances

Type IV-A area = 3 * Type IV-HT area

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

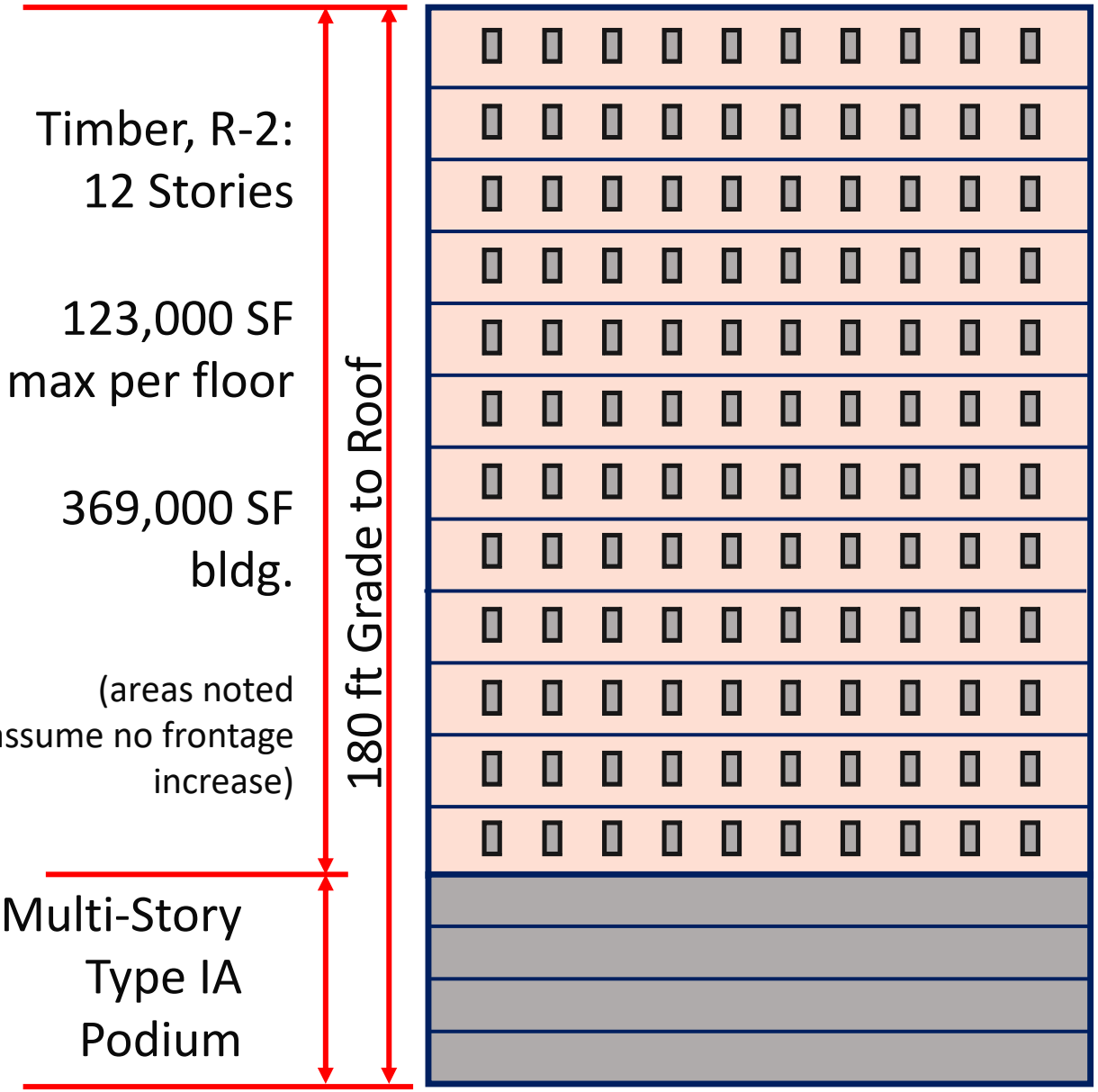
Not Likely to Utilize Podium Due to Overall Building Height Limit (85 ft) Relative to # of Timber Stories (8)

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

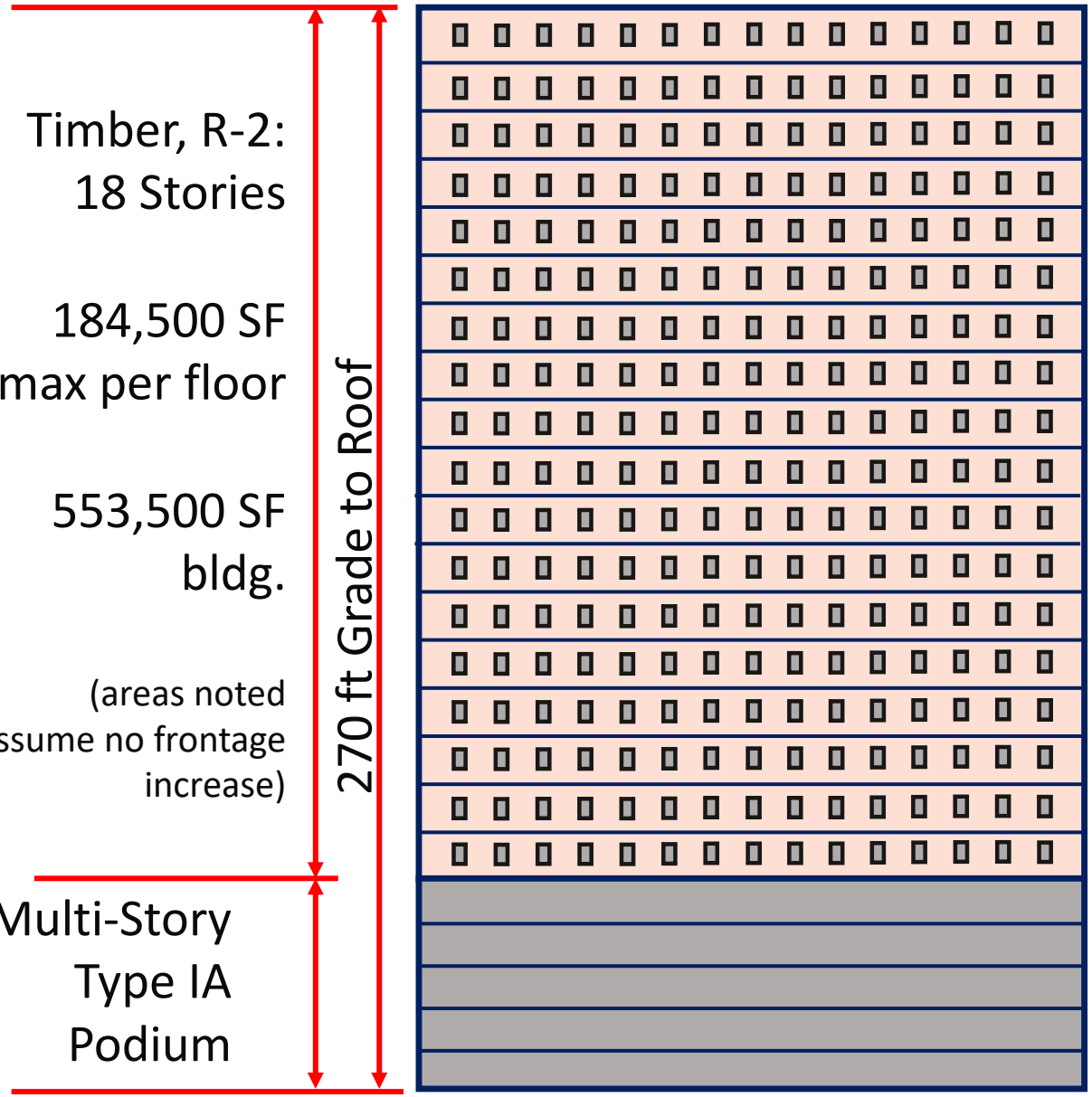
Likely to Utilize Podium Due to Overall Building Height Limit (180 ft) Relative to # of Timber Stories (12)

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

Materials Permitted

602.4 Type IV. Type IV construction is that type of construction in which the building elements are mass timber or noncombustible materials and have fire resistance ratings in accordance with Table 601. Mass timber elements shall meet the fire resistance rating requirements of this section based on either the fire resistance rating of the noncombustible protection, the mass timber, or a combination of both and shall be determined in accordance with Section 703.2 or 703.3. The minimum dimensions and permitted materials for building elements shall comply with the provisions of this section and Section 2304.11. Mass timber

Exterior load-bearing walls and nonload-bearing walls shall be mass timber construction, or shall be of noncombustible construction.

Exception: Type IV-HT Construction in accordance with Section 602.4.4.

The interior building elements, including nonload-bearing walls and partitions, shall be of mass timber construction or of noncombustible construction.

Exception: Type IV-HT Construction in accordance with Section 602.4.4..

Tall Wood Fire Resistance Ratings (FRR)

FRR Requirements for Tall Mass Timber Structures (hours)

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

Source: 2021 IBC Table 601

Noncombustible Protection (NC)

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

Required Noncombustible Contribution to FRR

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

Source: 2021 IBC Section 722.7

Floor Surface Protection

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


Credit: Maxxon

MT Fire Resistance Ratings (FRR)

IBC 722.7

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

+

= FRR

Type IV-B Fire Resistance Ratings (FRR)

IV-B

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

Minimum 1" noncombustible material

Mass timber floor panel

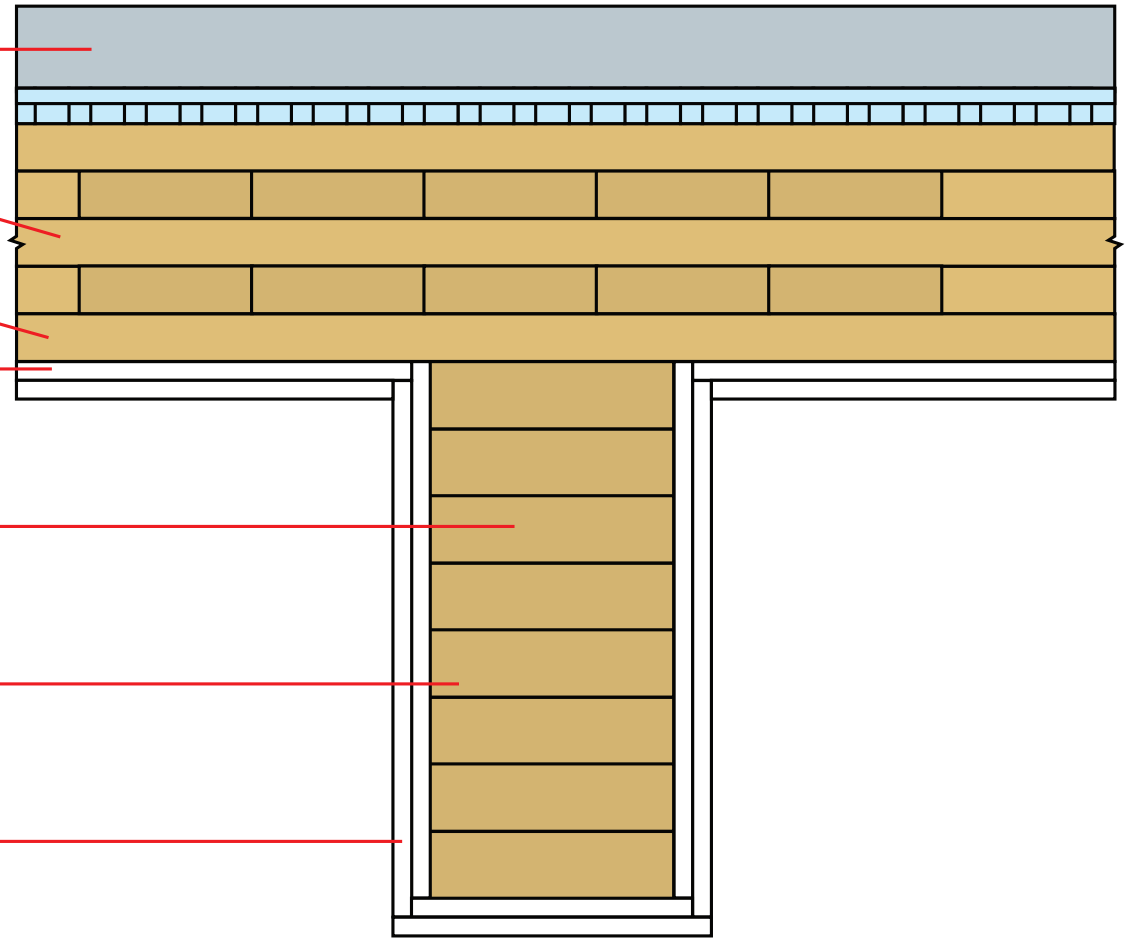
40 minutes of MT FRR

2 layers 5/8" Type X gypsum

Glulam beam (primary structural frame)

40 minutes of MT FRR

Two layers 5/8" Type X gypsum



Type IV-B Fire Resistance Ratings (FRR)

IV-B

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

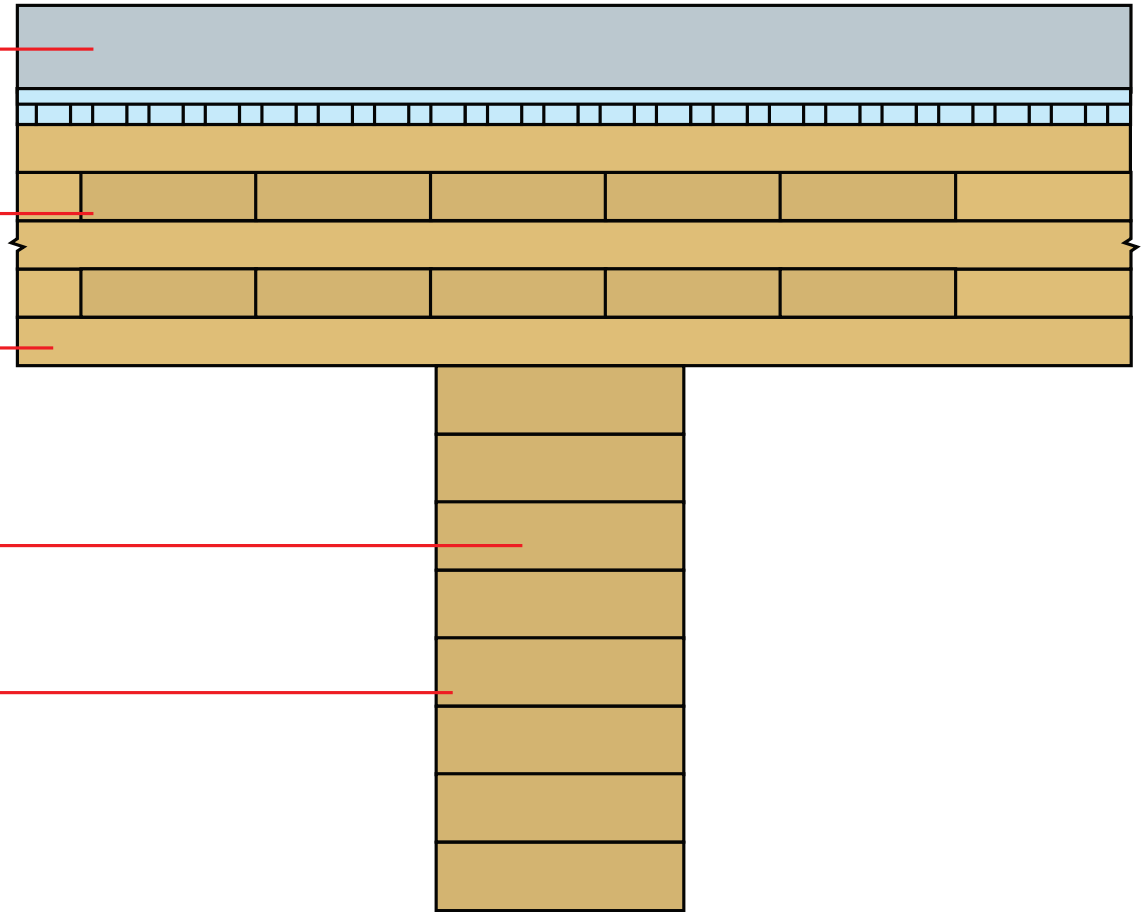
Minimum 1" noncombustible material

Mass timber floor panel

2-hr of MT FRR;
noncombustible material not required

Glulam beam (primary structural frame)

2-hr of MT FRR;
Noncombustible material not required



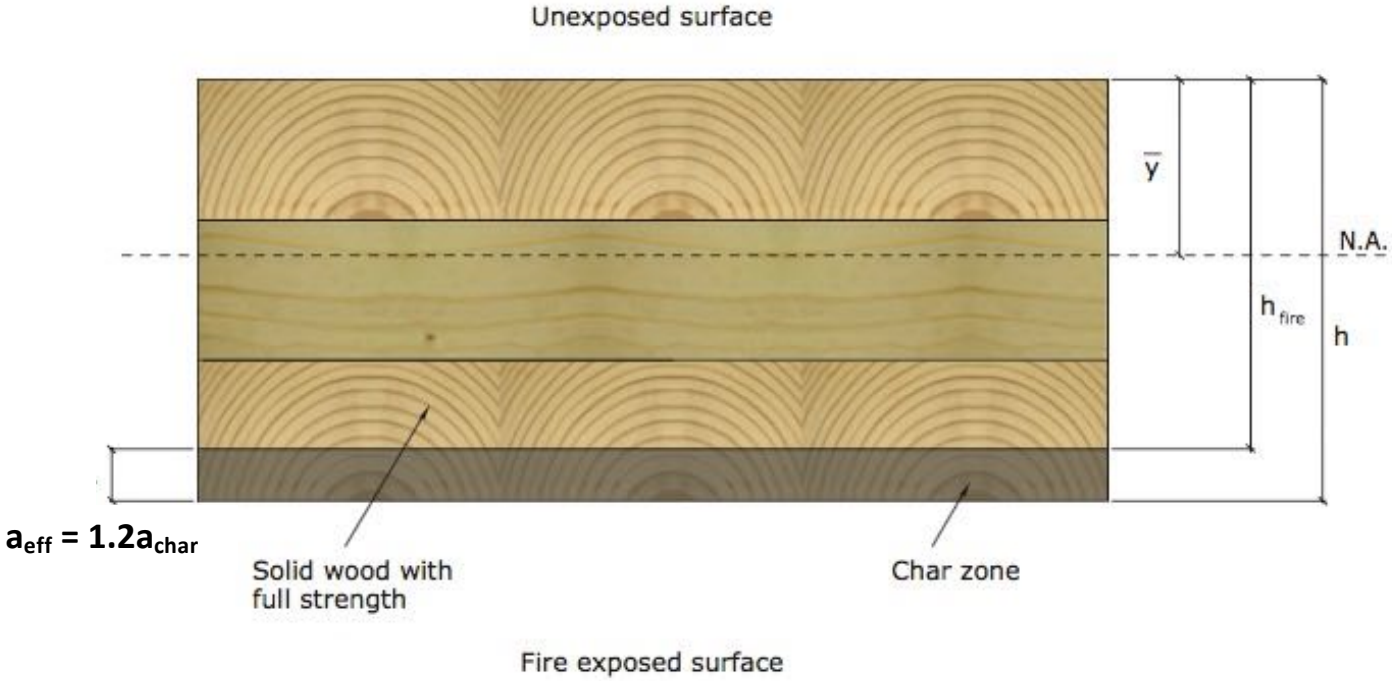
MT Fire Resistance Ratings (FRR)

How do you determine FRR of MT?

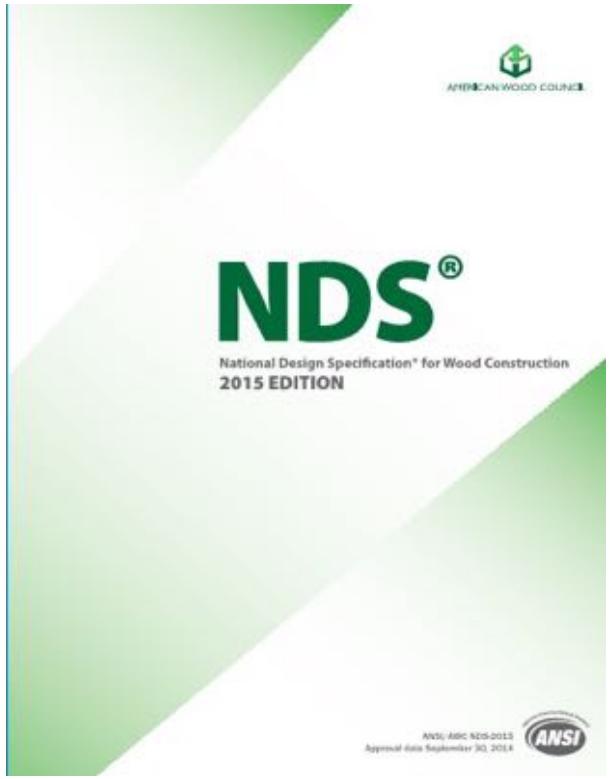
2 Options:

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


Credit: Urban One



MT Fire Resistance Ratings (FRR)



NDS Chapter 16 includes calculation of fire resistance of NLT, CLT, Glulam, Solid Sawn and SCL wood products

Table 16.2.1B Effective Char Depths (for CLT with β_n=1.5in./hr.)

Required Fire Endurance (hr.)	Effective Char Depths, a_{char} (in.) lamination thicknesses, h_{lam} (in.)								
	5/8	3/4	7/8	1	1-1/4	1-3/8	1-1/2	1-3/4	2
1-Hour	2.2	2.2	2.1	2.0	2.0	1.9	1.8	1.8	1.8
1½-Hour	3.4	3.2	3.1	3.0	2.9	2.8	2.8	2.8	2.6
2-Hour	4.4	4.3	4.1	4.0	3.9	3.8	3.6	3.6	3.6

MT Fire Resistance Ratings (FRR)

Inventory of Fire Tested MT Assemblies

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

WoodWorks™ WOOD PRODUCTS COUNCIL

CLT Panel	Manufacturer	CLT Grade or Major x Minor Grade	Ceiling Protection	Panel Connection in Test	Floor Topping	Load Rating	Fire Resistance Achieved (Hours)	Source	Testing Lab
3-ply CLT (114mm 4.488 in)	Nordic	SPF 1650 Fb 1.5E MSR x SPF #3	2 layers 1/2" Type X gypsum	Half-Lap	None	Reduced 36% Moment Capacity	1	1 (Test 1)	NRC Fire Laboratory
3-ply CLT (105mm 4.133 in)	Structurlam	SPF #1/#2 x SPF #1/#2	1 layer 5/8" Type X gypsum	Half-Lap	None	Reduced 75% Moment Capacity	1	1 (Test 5)	NRC Fire Laboratory
5-ply CLT (175mm 6.875")	Nordic	E1	None	Topside Spline	2 staggered layers of 1/2" cement boards	Loaded, See Manufacturer	2	2	NRC Fire Laboratory March 2016
5-ply CLT (175mm 6.875")	Nordic	E1	1 layer of 5/8" Type X gypsum under Z-channels and furring strips with 3 5/8" fiberglass batts	Topside Spline	2 staggered layers of 1/2" cement boards	Loaded, See Manufacturer	2	5	NRC Fire Laboratory Nov 2014
5-ply CLT (175mm 6.875")	Nordic	E1	None	Topside Spline	3/4 in. proprietary gypcrete over Maxxon acoustical mat	Reduced 50% Moment Capactiy	1.5	3	UL
5-ply CLT (175mm 6.875")	Nordic	E1	1 layer 5/8" normal gypsum	Topside Spline	3/4 in. proprietary gypcrete over Maxxon acoustical mat or proprietary sound board	Reduced 50% Moment Capactiy	2	4	UL
5-ply CLT (175mm 6.875")	Nordic	E1	1 layer 5/8" Type X Gyp under Resilient Channel under 7 7/8" I-Joists with 3 1/2" Mineral Wool beween Joists	Half-Lap	None	Loaded, See Manufacturer	2	21	Intertek 8/24/2012
5-ply CLT (175mm 6.875")	Structurlam	E1 M5 MSR 2100 x SPF #2	None	Topside Spline	1-1/2" Maxxon Cyp-Grete 2000 over Maxxon Reinforcing Mesh	Loaded, See Manufacturer	2.5	6	Intertek, 2/22/2016
5-ply CLT (175mm 6.875")	DR Johnson	V1	None	Half-Lap & Topside Spline	2" gypsum topping	Loaded, See Manufacturer	2	7	SwRI (May 2016)
5-ply CLT (175mm 6.875")	Nordic	SPF 1950 Fb MSR x SPF #3	None	Half-Lap	None	Reduced 59% Moment Capacity	1.5	1 (Test 3)	NRC Fire Laboratory
5-ply CLT (175mm 6.875")	Structurlam	SPF #1/#2 x SPF #1/#2	1 layer 5/8" Type X gypsum	Half-Lap	None	Unreduced 101% Moment Capacity	2	1 (Test 6)	NRC Fire Laboratory
7-ply CLT (245mm 9.65")	Structurlam	SPF #1/#2 x SPF #1/#2	None	Half-Lap	None	Unreduced 101% Moment Capacity	2.5	1 (Test 7)	NRC Fire Laboratory
5-ply CLT (175mm 6.875")	SmartLam	SL-V4	None	Half-Lap	nominal 1/2" plywood with 8d nails.	Loaded, See Manufacturer	2	12 (Test 4)	Western Fire Center 10/26/2016
5-ply CLT (175mm 6.875")	SmartLam	V1	None	Half-Lap	nominal 1/2" plywood with 8d nails.	Loaded, See Manufacturer	2	12 (Test 5)	Western Fire Center 10/28/2016
5-ply CLT (175mm 6.875")	DR Johnson	V1	None	Half-Lap	nominal 1/2" plywood with 8d nails.	Loaded, See Manufacturer	2	12 (Test 6)	Western Fire Center 11/01/2016
5-ply CLT (160mm 6.3")	KLH	CV3M1	None	Half-Lap & Topside spline	None	Loaded, See Manufacturer	1	18	SwRI

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

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

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

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

FRRs for the new construction types are similar to those required for Type I construction, which is primarily steel and concrete.[1] (See Table 1.) They are found in IBC Table 601, which includes FRR requirements for all construction types and building elements; however, other code

Image: Korb + Associates Architects

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

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

Building Element	I-A *Unlimited stories, heights and areas**	IV-A *Max. 18 stories, 270 ft, 324,000 sf***	I-B *Max. 12 stories, 180 ft, unlimited areas**	IV-B *Max. 12 stories, 180 ft, 216,000 sf***	IV-C *Max. 9 stories, 85 ft, 135,000 sf***
Primary Frame	3	3	2	2	2
Exterior Bearing Walls	3	3	2	2	2

Assumes an NFPA 13 automatic sprinkler system throughout building

Source: 2021 IBC Tables 504.3, 504.4, 506.2 and 601

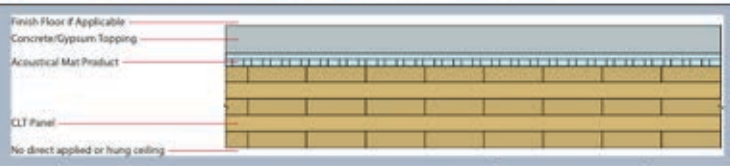
Tall Timber Fire-Resistance Design

ACOUSTICS

Railyard Flats, Sioux Falls, SD Credit: WoodWorks

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

WoodWorks
WOOD PRODUCTS COUNCIL



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

Questions?

Ricky McLain, PE, SE

Senior Technical Director – Tall Mass Timber

WoodWorks – Wood Products Council

802.498.3310

Ricky.mclain@woodworks.org

901 East Sixth, Thoughtbarn-Delineate Studio, Leap!Structures, photo Casey Dunn

Copyright Materials

Funding provided in part by the Softwood Lumber Board

PART 2 - HIGH RISE MASS TIMBER CASE STUDIES

JOHN MITCHELL
ASSOCIATE PARTNER
HARTSHORNE PLUNKARD ARCHITECTURE
CHICAGO, IL

WOOD CONSTRUCTION IN CHICAGO

1871 CHICAGO FIRE

HPA - TALL TIMBER PROJECTS IN CHICAGO

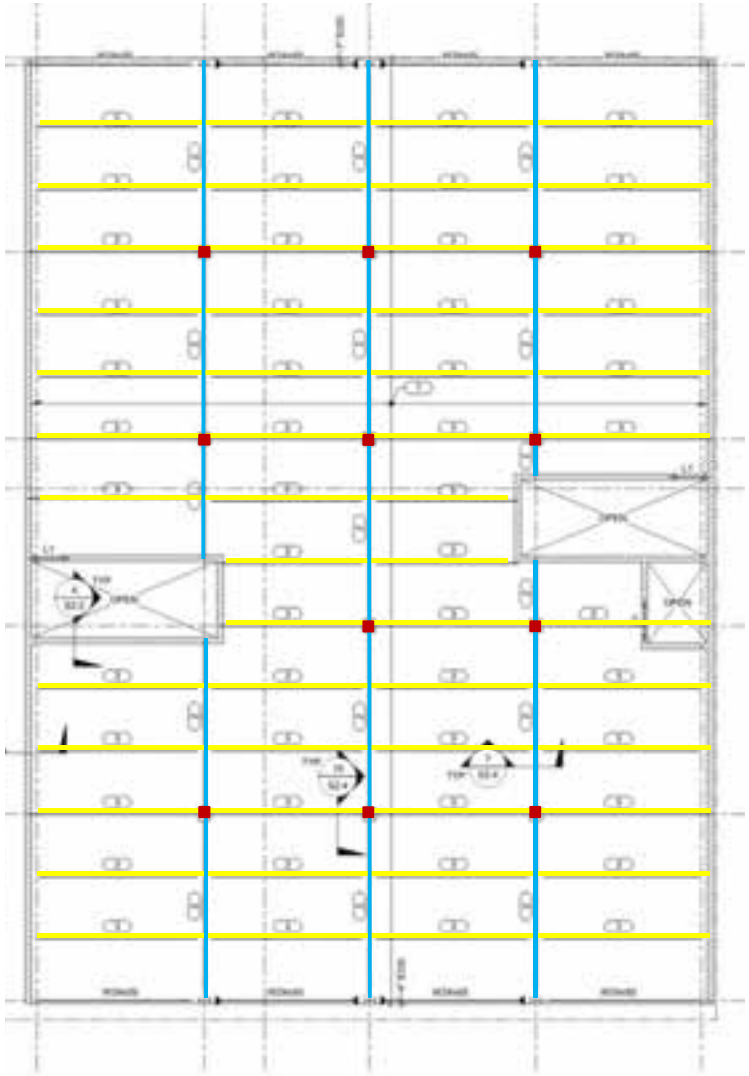
1040 W. ADAMS

CHINA CLUB LOFTS

CASE STUDY #1 - 1038 W. FULTON, CHICAGO, IL

SIZE:	43,000SF/ 5 STORIES
USE:	URBAN INFILL OFFICE/ RETAIL
FRAMING SYSTEM:	GLULAM COLUMNS AND BEAMS
FLOORS:	2X3 TONGUE AND GROOVE WOOD PLANKS WITH ACOUSTIC MAT AND CONCRETE TOPPING
GARAGE:	CONCRETE AND STEEL
CODE:	2018 CHICAGO BUILDING CODE HEAVY TIMBER - 5 STORIES, 80’

OPTIMIZING THE TIMBER GRID



SOURCE: IMEG

TYPICAL FLOOR ASSEMBLY

13-60-050 Type III-A, heavy timber construction.

Type III-A, heavy timber construction, shall have interior structural elements of heavy timber material as required in this section.

(a) Wood members of heavy timber construction shall be arranged so that there will be no concealed spaces within the construction.

(b) Columns shall have a minimum dimension of eight inches.

(c) Floor framing members shall have minimum nominal dimensions of six by ten inches.

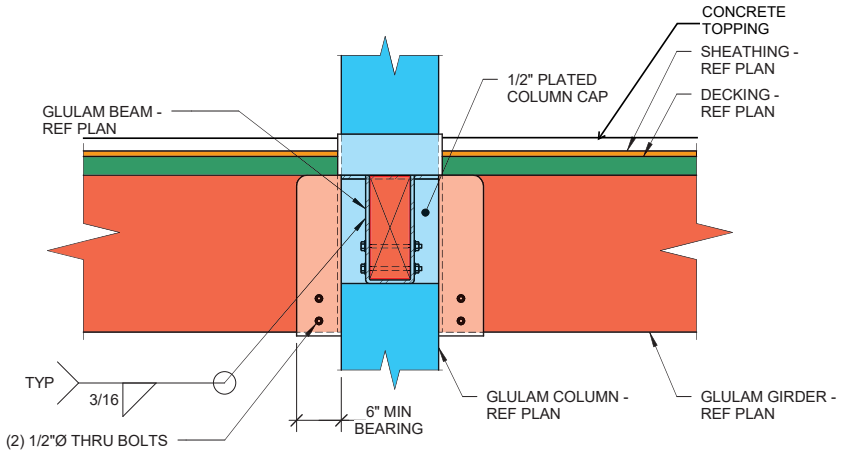
(d) Roof framing members, except trusses, shall have a minimum nominal dimension of six inches.

(e) The members of roof trusses shall have minimum nominal dimensions of four inches by six inches with the following exceptions:

(1) Members may consist of two or more pieces of three-inch nominal thickness with intervening spaces blocked solidly or tightly closed by a continuous wood cover plate of not less than two-inch nominal thickness.

(2) Any member may be reduced to three- inch nominal thickness when protected by an approved automatic sprinkler system under the roof deck.

(f) Wood floors shall be splined or tongue and grooved planks of not less than three-inch nominal thickness or of laminated planking laid on edge of not less than four-inch nominal thickness. A top flooring of not less than one inch nominal thickness shall be added to the structural floor.



SOURCE: GOOGLE MAPS

BUILDING IMAGES

CASE STUDY #2 - INTRO - 25TH AND LORAIN, CLEVELAND, OH

SIZE:	515,000SF/ 9 STORIES
USE:	RESIDENTIAL MIXED USE
FRAMING SYSTEM:	POST AND BEAM WITH CONCRETE CORES
FLOORS:	CLT WITH ACOUSTIC MAT AND CONCRETE TOPPING
GARAGE:	(2) UNDERGROUND LEVELS - 330 SPACES
CODE:	2018 OHIO BUILDING CODE (IBC) WITH ALTERNATIVELY ENGINEERED DESIGN FOR MASS TIMBER (USING 2021 IBC TYPE IV-B RULES AS A GUIDE)

SOURCE: IMAGE FICTION

PART 1 - AHJ DIALOGUE

OVERCOMING OBSTACLES WITH THE AHJ

COMMON CONCERNS THE LOCAL CODE OFFICIAL MAY HAVE REGARDING MASS TIMBER, TO WHICH THE DESIGN TEAM NEEDS TO RESPOND:

1. UNFAMILIARITY WITH THE TECHNOLOGY, TESTING, AND/OR FIRE RESISTANCE CHARACTERISTICS.
2. FIREFIGHTER ACCESS AND SAFETY.
3. REVIEWING THE DESIGN/ INSPECTING THE CONSTRUCTION.

ENGAGE THE CODE OFFICIAL EARLY!

SOURCE: BONDY STUDIO

CODE APPROVAL PATH - ALTERNATIVELY ENGINEERED DESIGN

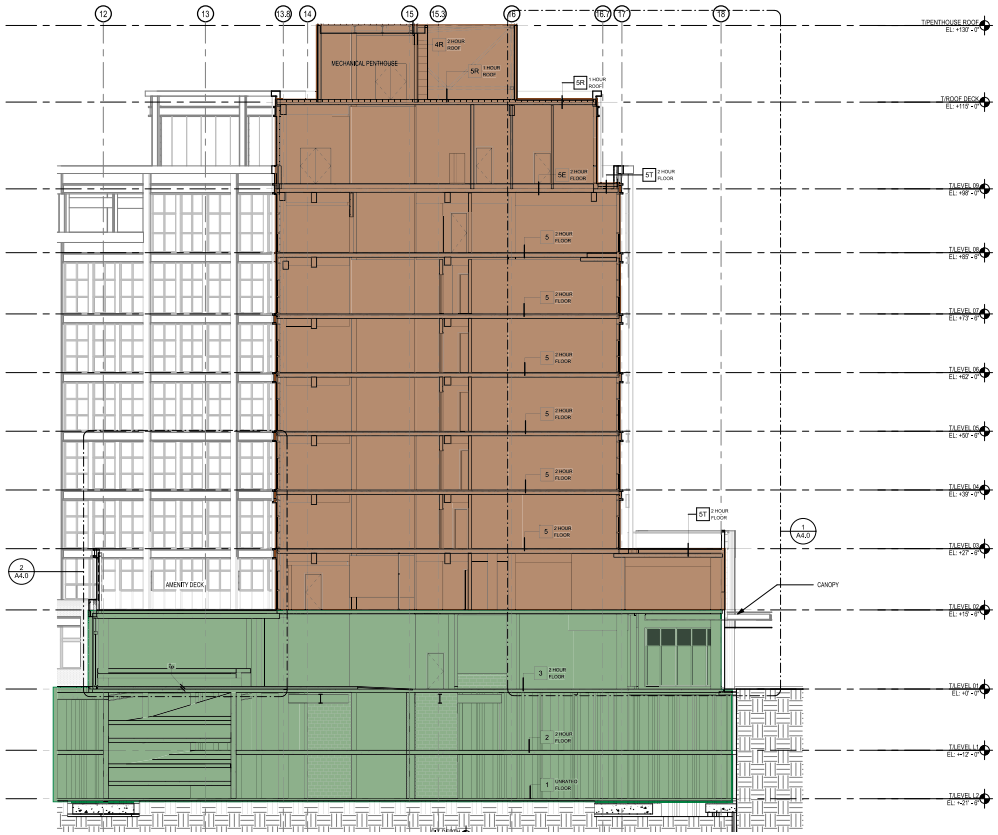
CONSTRUCTION TYPE = IV-B (I-A GARAGE AND 1ST FLOOR)

TOPIC	ALLOWED	PROPOSED
HEIGHT =	180’	115’
STORIES =	12	9
AREA (MIXED USE) =	~653,000 SF	~512,000 SF*
TIMBER COVERAGE =	80% CEILINGS OR 60% WALLS	50% CEILINGS NO TIMBER WALLS

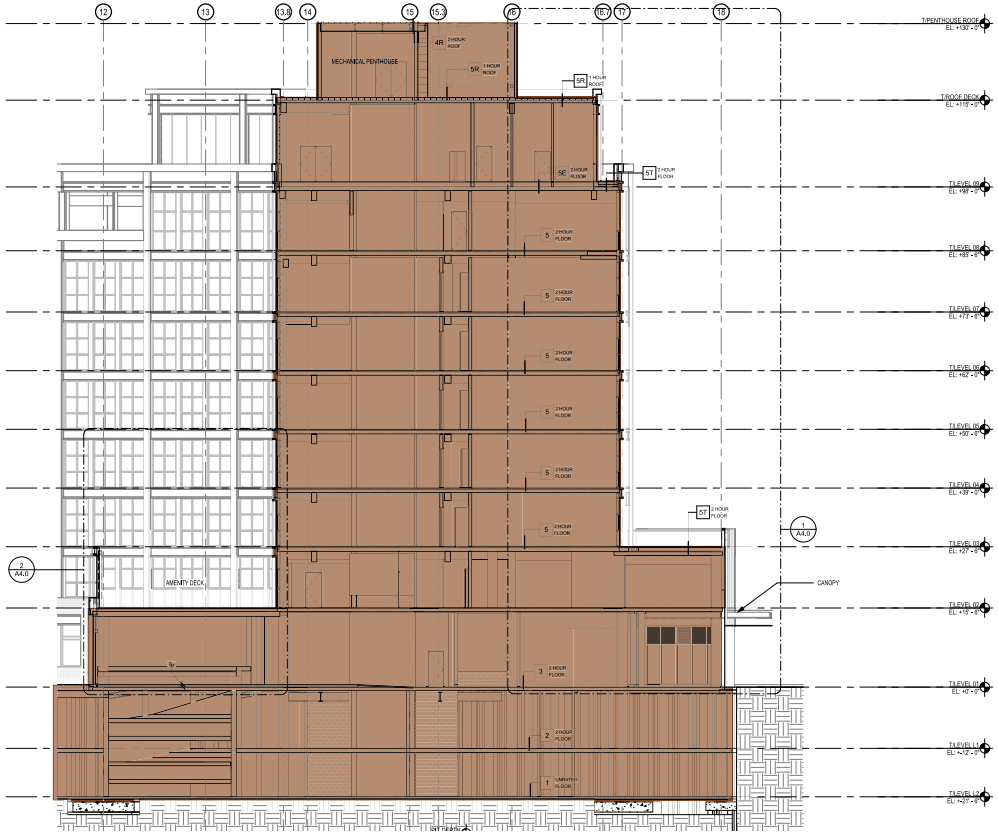
*ONLY 304,000 SF OF THE BUILDING IS TYPE IV-B TIMBER (LL2 THRU 2ND FLOOR ARE CONCRETE), SO THE BUILDING COULD BE SUBSTANTIALLY LARGER AS-OF-RIGHT.

CODE APPROVAL PATH - ALTERNATIVELY ENGINEERED DESIGN

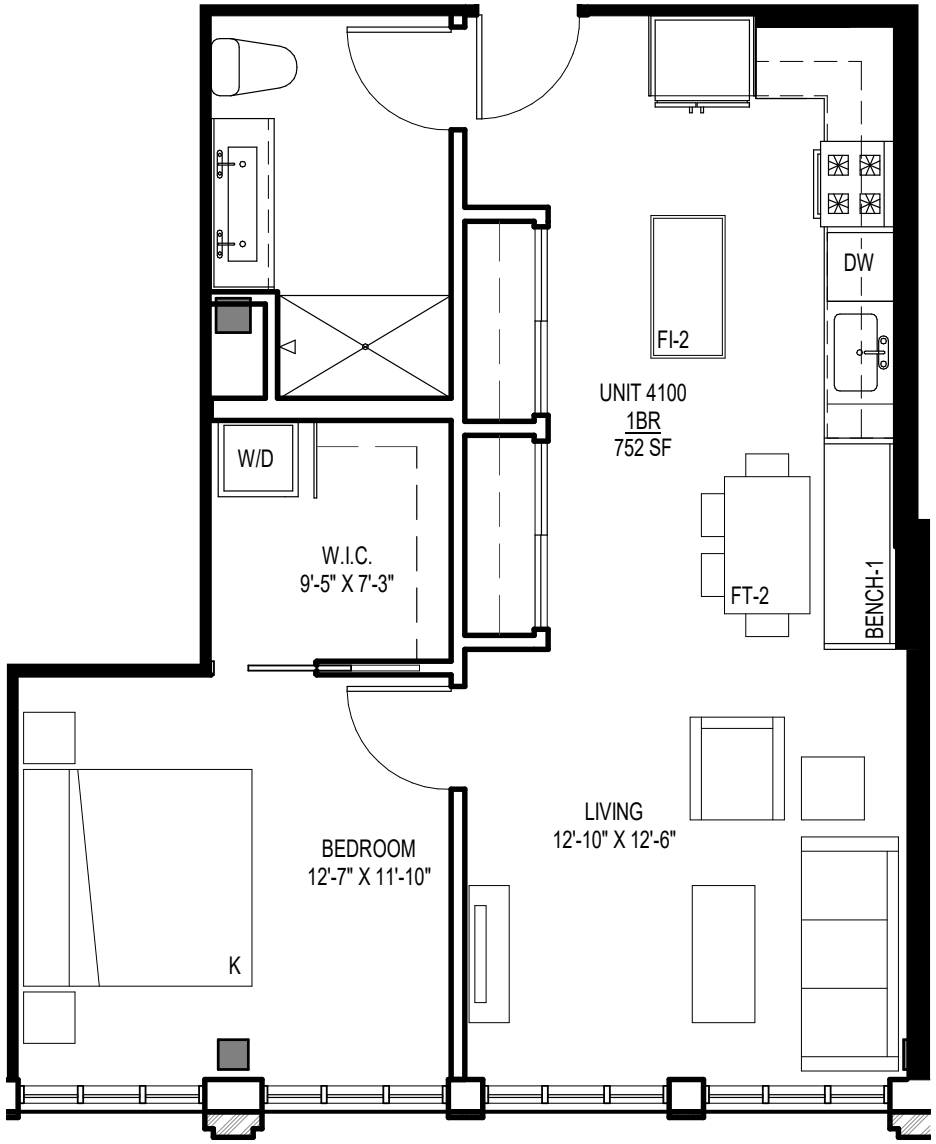
PROPOSED BUILDING:
-LL2-2ND FLOOR SLAB: TYPE I-A (CONCRETE)
-2ND FLOOR-ROOF: TYPE IV-B (TIMBER)
-FLOOR AREA: AS PROPOSED



THEORETICAL MAXIMUM AREA BUILDING:
-LL2-ROOF: TYPE IV-B (TIMBER)
-FLOOR AREA: MAXIMUM ALLOWABLE BASED ON PROPOSED BUILDING FOOTPRINT, USES, AND # FLOORS

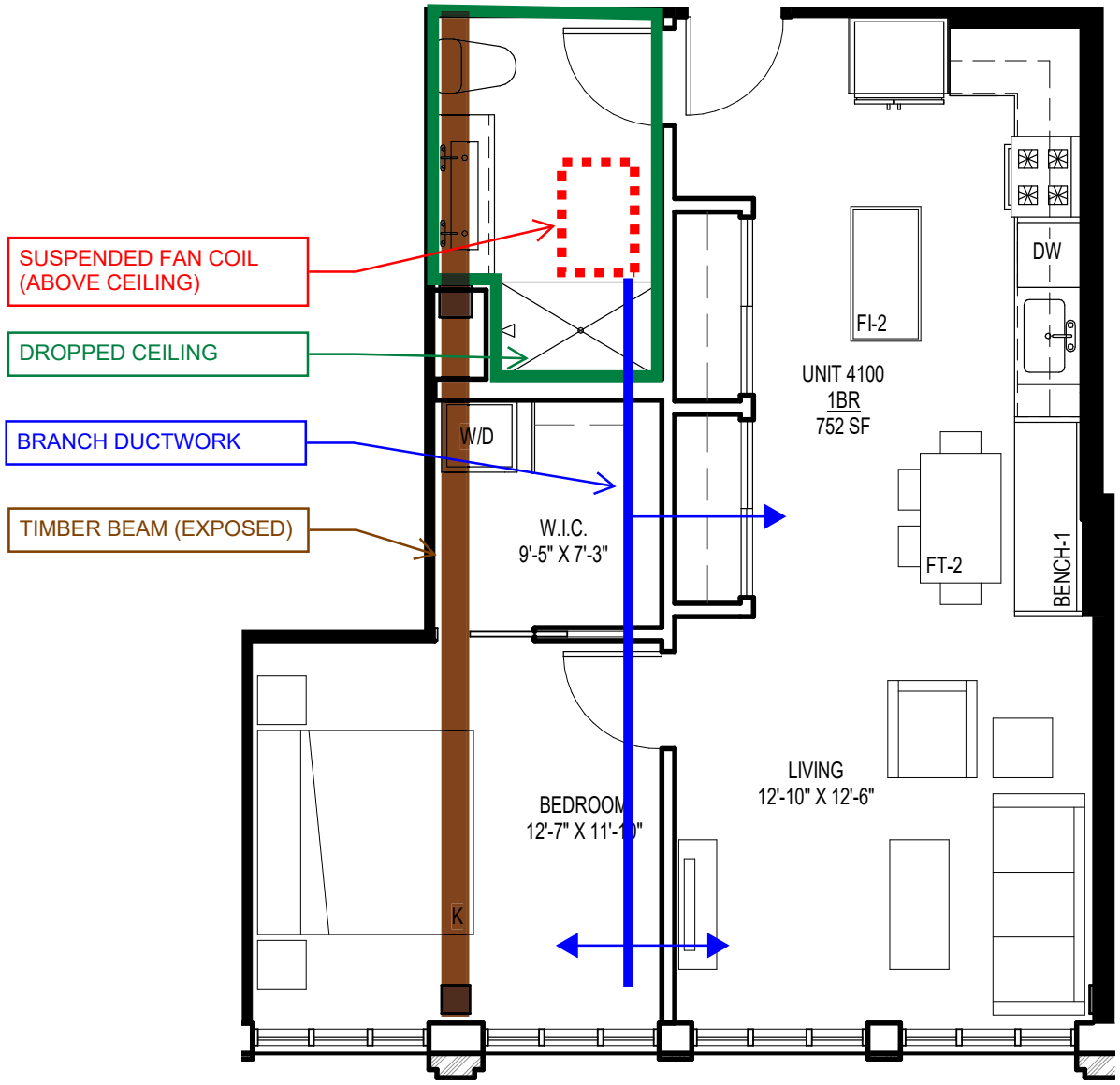


TYPICAL 1-BEDROOM UNIT



SOURCE: INTRO

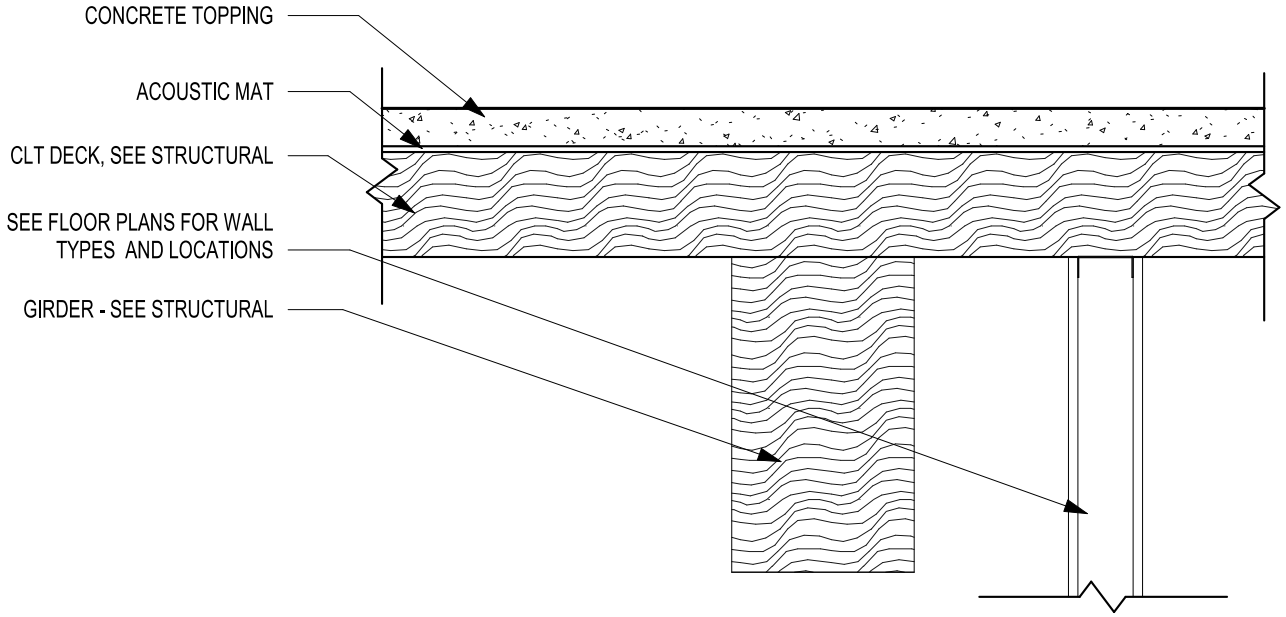
TYPICAL 1-BEDROOM UNIT - CEILING OVERLAY



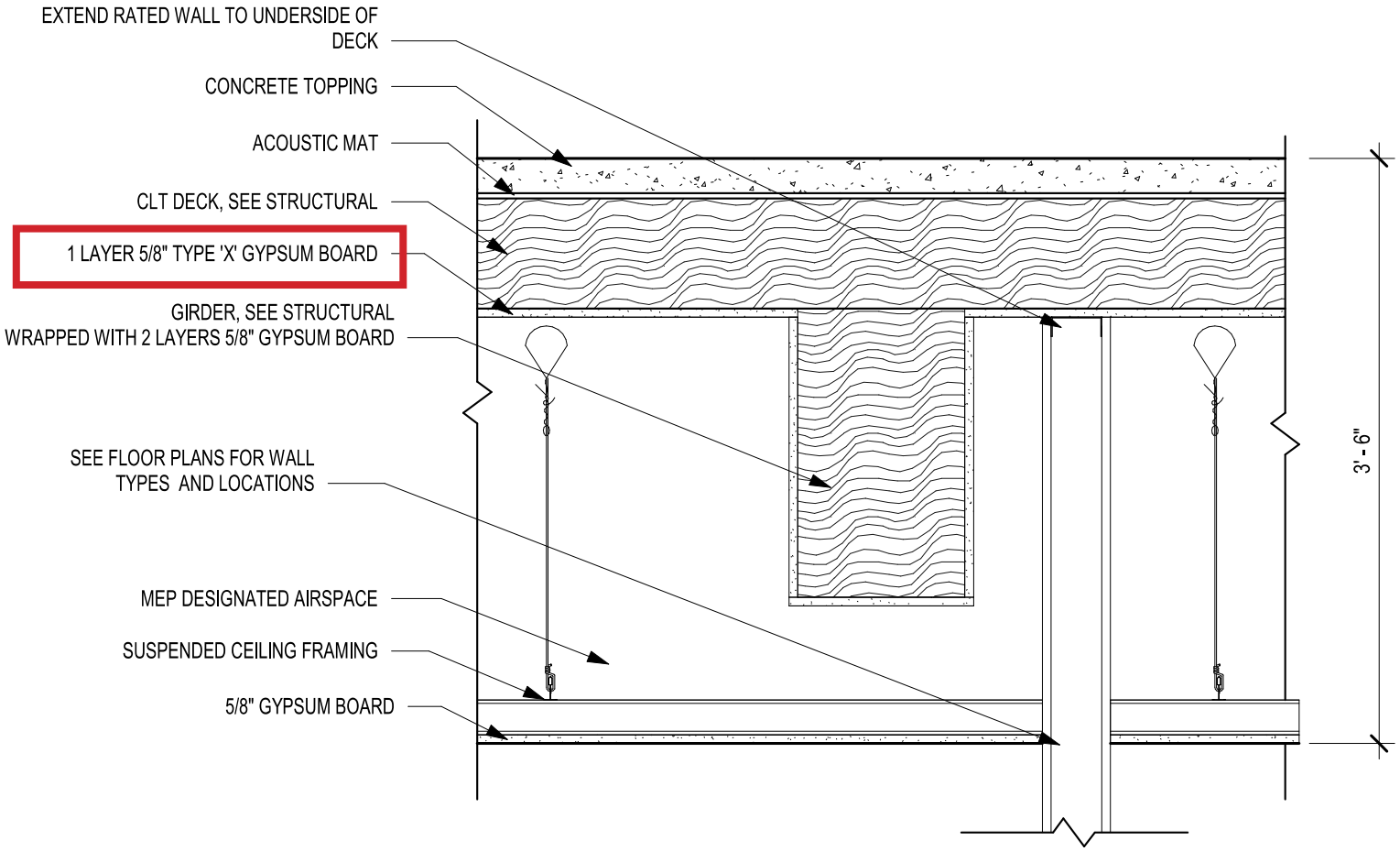
SOURCE: INTRO

TYPICAL FLOOR ASSEMBLY - EXPOSED TIMBER

*SEE BUILDING SECTION SHEETS
FOR FLOOR ASSEMBLIES



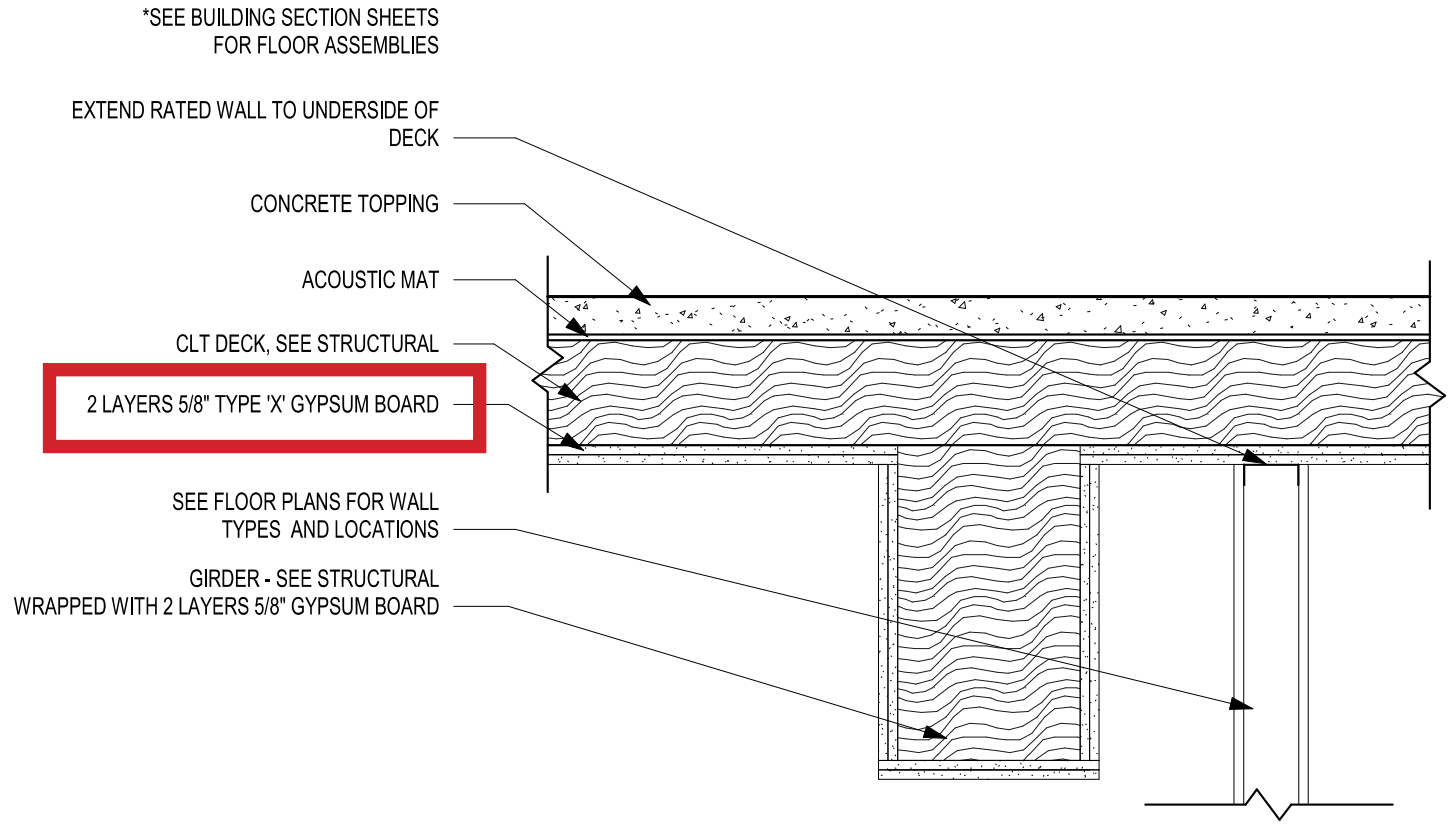
TYPICAL FLOOR ASSEMBLY - UNPROTECTED TIMBER WITH CONCEALED SPACE



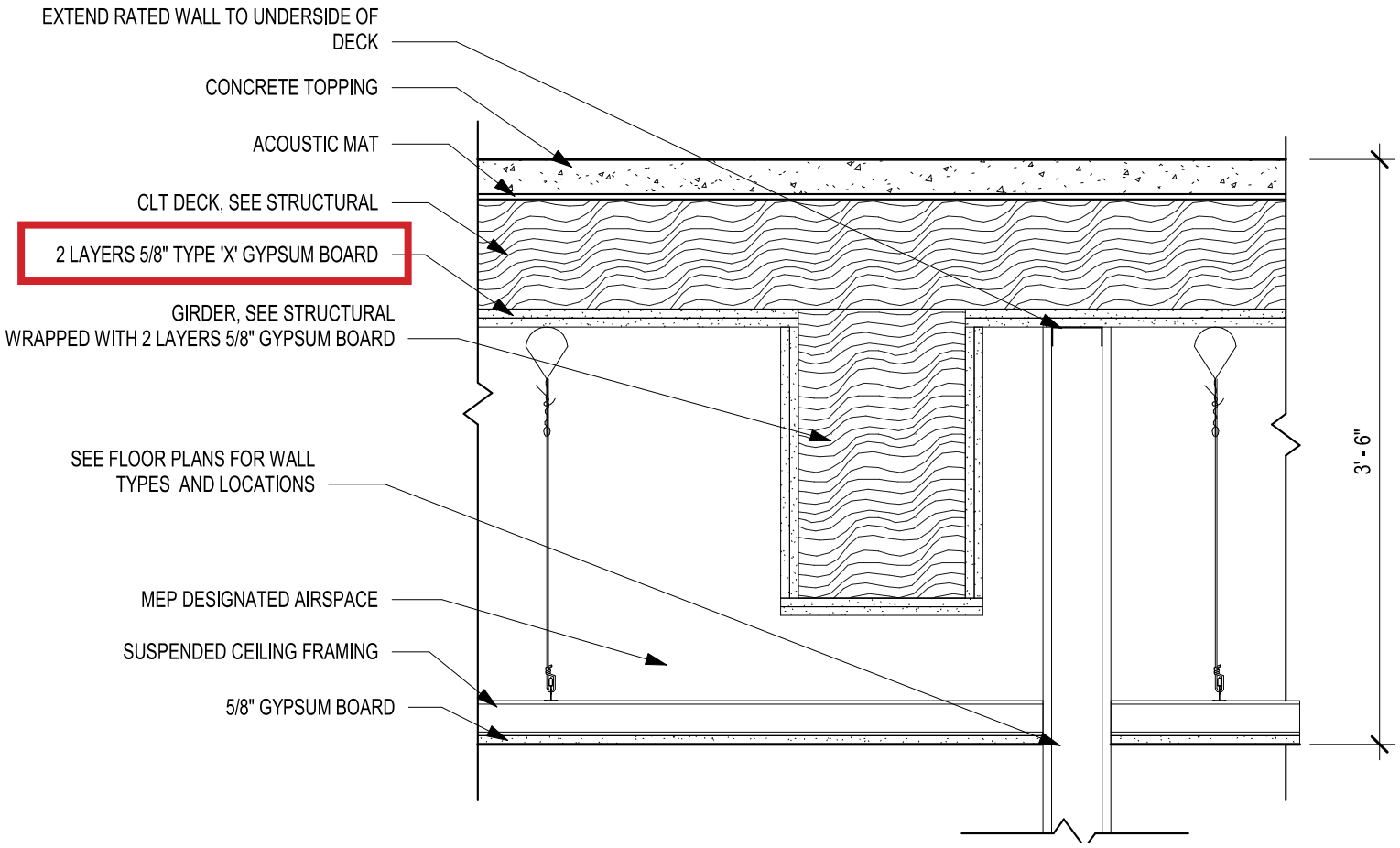
TYPICAL FLOOR ASSEMBLY - PROTECTED TIMBER

PER IBC SEC. 602.4.2.2.1, 2/3 OF THE HOURLY RATING NEEDS TO BE FROM NONCOMBUSTIBLE PROTECTION (GYP BOARD OR SFRM).

HOWEVER, EACH TIMBER MEMBER WILL BE SIZED FOR THE WORST-CASE SCENARIO; SO IF ANY PART OF THE PLANK OR BEAM IS EXPOSED, THE ENTIRE MEMBER NEEDS TO BE 2HR.



TYPICAL FLOOR ASSEMBLY - PROTECTED TIMBER WITH CONCEALED SPACE



DESIGN ENHANCEMENTS

ADDITIONAL LIFE SAFETY FEATURES:

-ALL VERTICAL EGRESS COMPONENTS (STAIRS, ELEVATORS) ARE TYPE 1-A CONSTRUCTION.

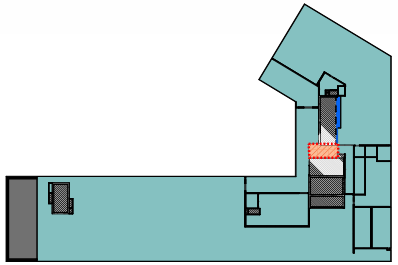
-ADDITIONAL LAYER OF DRYWALL ENCAPSULATION AT HORIZONTAL EGRESS COMPONENTS (CORRIDORS).

-STAIRS POSITIONED TO LIMIT DEAD END CORRIDORS.

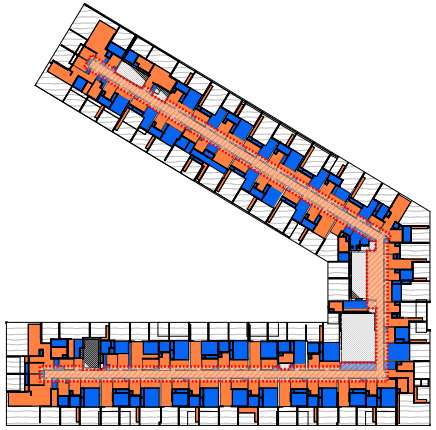
-ALL TIMBER MEMBERS SIZED FOR 2HR RATING, REGARDLESS OF ENCAPSULATION.

-FIRE DEPARTMENT ACCESS TO 100% OF SITE PERIMETER.

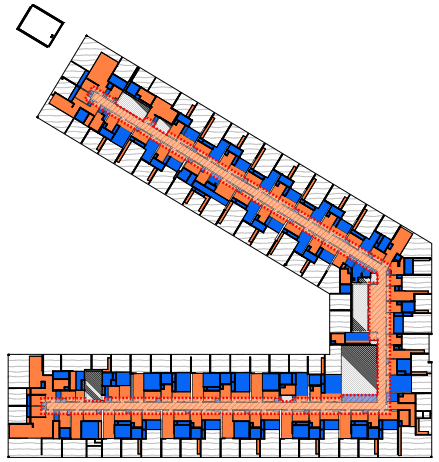
-PARKING GARAGE AND 1ST FLOOR ARE TYPE 1-A CONSTRUCTION.



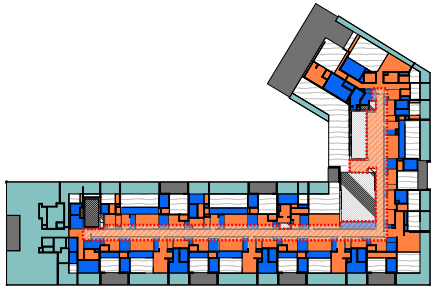
6 LEVEL 09 - TIMBER COVERAGE PLAN
SCALE: 1" = 30'-0"



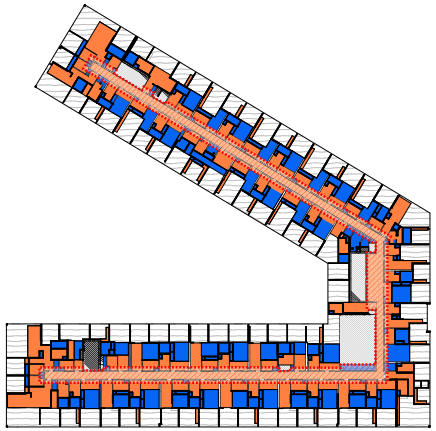
4 LEVEL 07 - TIMBER COVERAGE PLAN
SCALE: 1" = 30'-0"



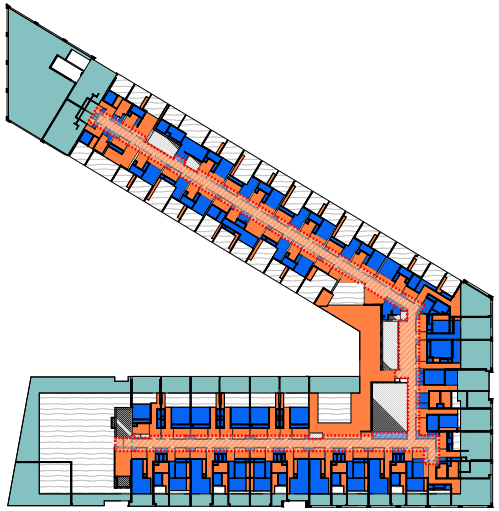
2 LEVEL 03 - TIMBER COVERAGE PLAN
SCALE: 1" = 30'-0"



5 LEVEL 08 - TIMBER COVERAGE PLAN
SCALE: 1" = 30'-0"



3 LEVELS 04, 05 & 6 - TIMBER COVERAGE PLAN
SCALE: 1" = 30'-0"



1 LEVEL 02 - TIMBER COVERAGE PLAN
SCALE: 1" = 30'-0"

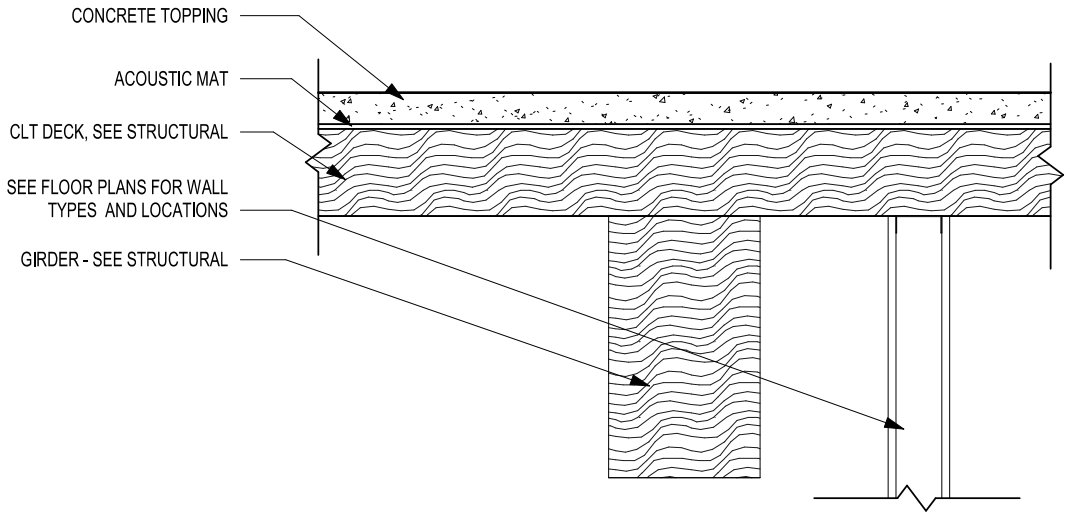
TYPICAL DWELLING UNIT

SOURCE: INTRO

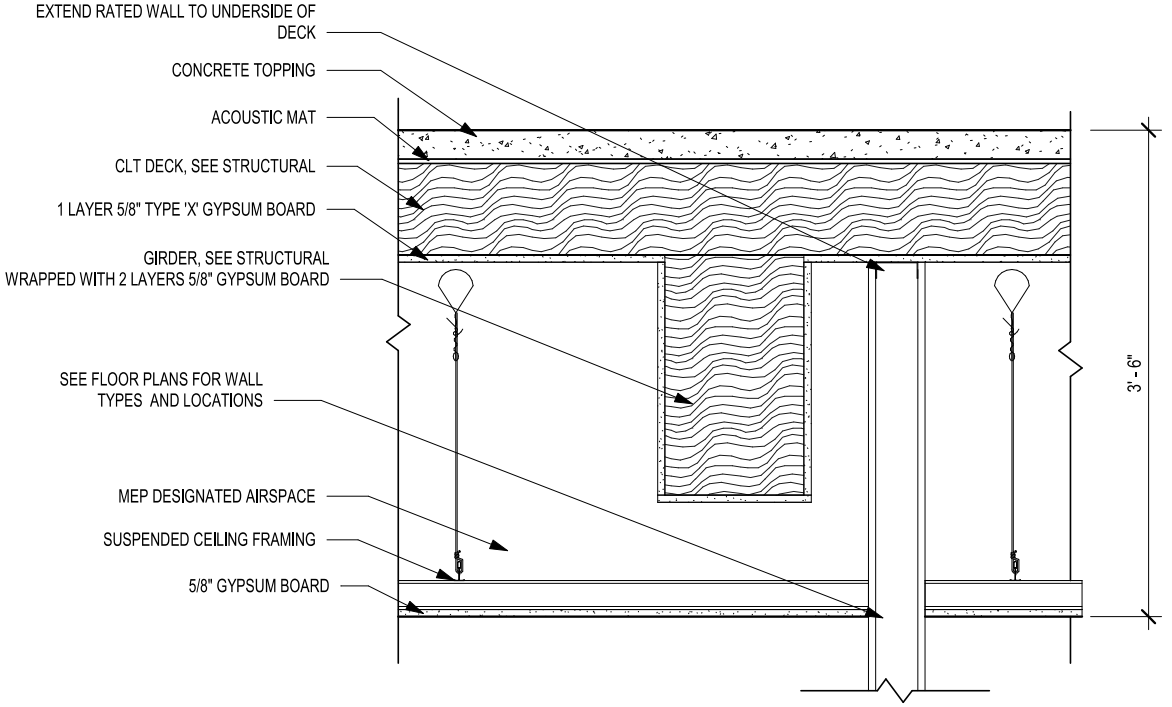
SOURCE: INTRO

PART 2 - LESSONS LEARNED

TIMBER FRAMING AND ACOUSTICS

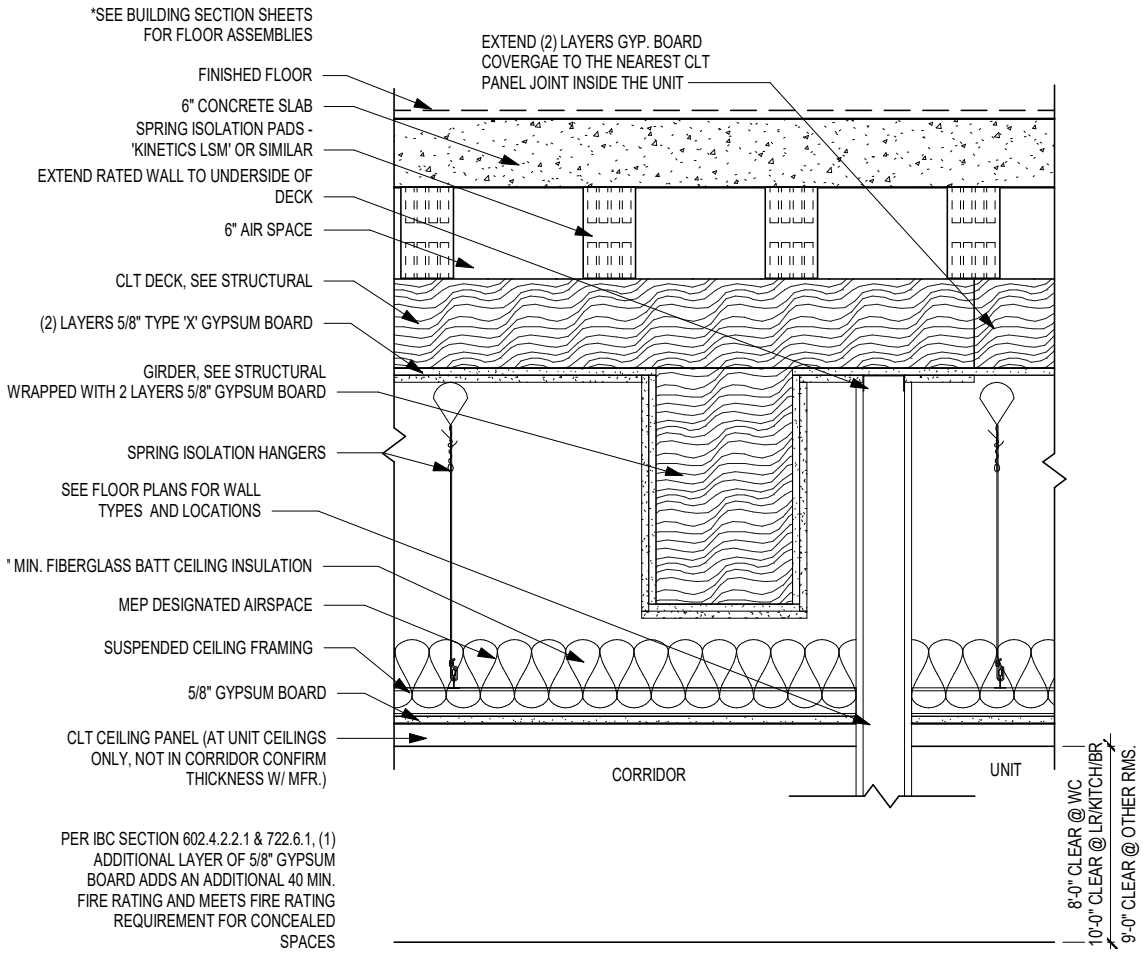


TYPICAL FLOOR ASSEMBLY



TYPICAL FLOOR ASSEMBLY W/ DROPPED CEILING

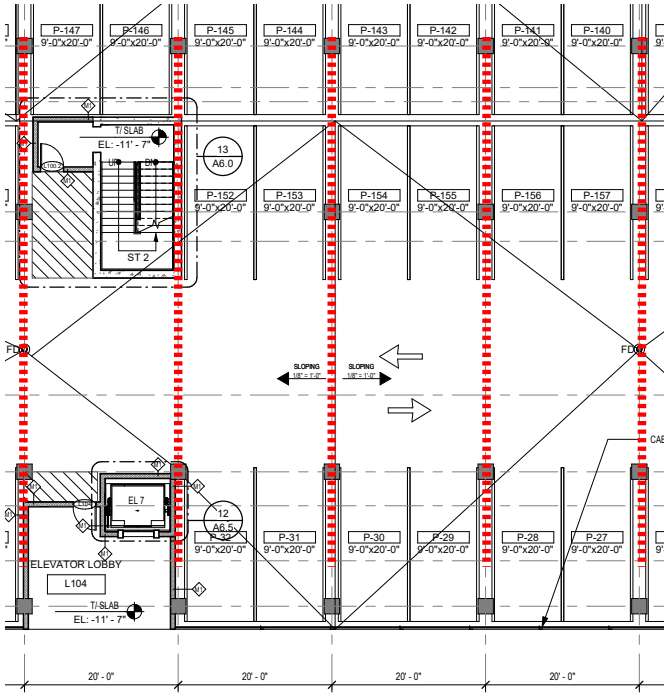
TIMBER FRAMING AND ACOUSTICS



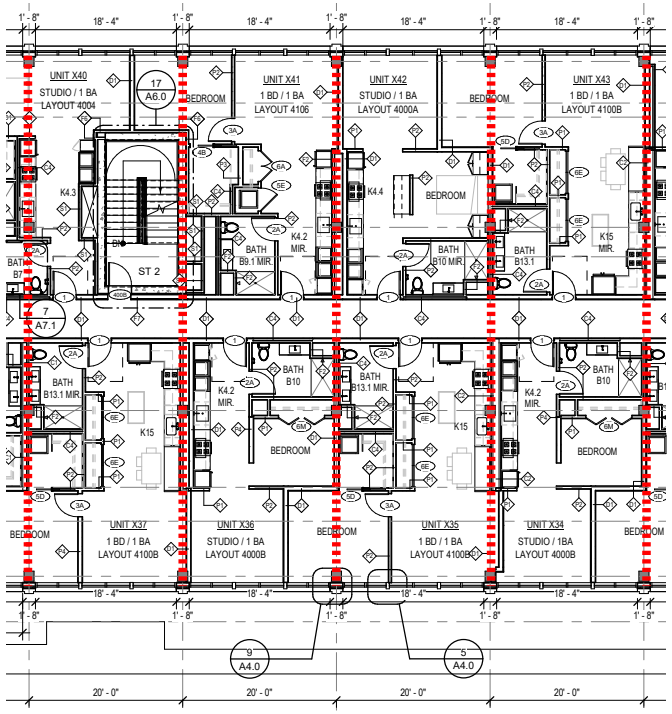
SOURCE: INTRO

OPTIMIZING THE TIMBER GRID

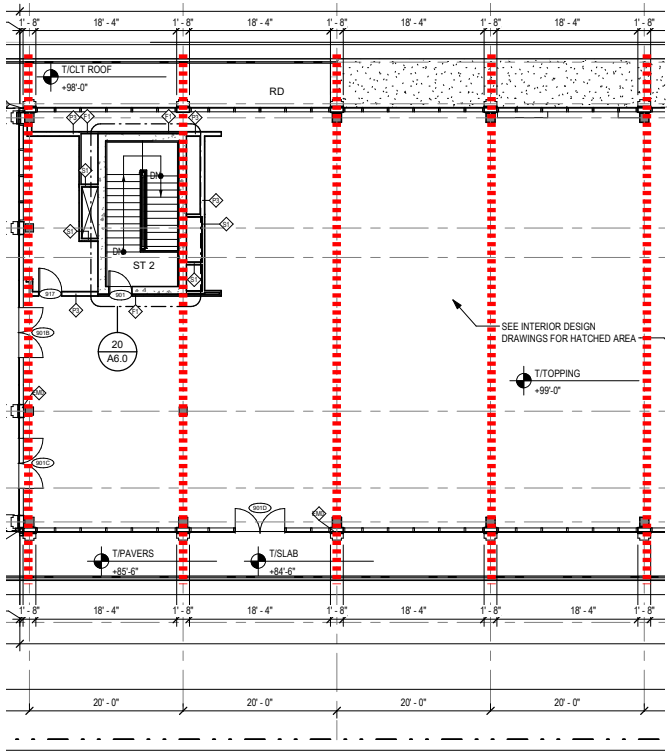
FACTORS TO CONSIDER:
-MANUFACTURER - TYPICAL PANEL LENGTH, WIDTH
-SHIPPING CONSTRAINTS
-MEP PENETRATIONS
-EXTERIOR CLADDING



PARKING



RESIDENTIAL FLOOR



EVENT SPACE

BUILDING IMAGES

BUILDING IMAGES

SOURCE: IMAGE FICTION

BUILDING IMAGES - EXTERIOR

BUILDING IMAGES - EVENT SPACE

WHAT'S NEXT, AND WHY PUSH FOR MORE TALL MASS TIMBER BUILDINGS?

-TALLER AND LARGER TIMBER BUILDINGS
-STRUCTURAL INNOVATIONS - HYBRID, PANEL OPTIMIZATION
-NEW WAVE OF AMERICAN MASS TIMBER - NEW LOCATIONS FOR TALL TIMBER PROJECTS (OR TALLER PROJECTS IN OLD LOCATIONS)
-BIOPHILIC DESIGN
-TESTED FIRE-RESISTIVE CHARACTERISTICS
-MASS TIMBER = CARBON SINK
-MARKET DEMAND

THANK YOU

PART 2 - HIGH RISE MASS TIMBER CASE STUDIES

JOHN MITCHELL
ASSOCIATE PARTNER
HARTSHORNE PLUNKARD ARCHITECTURE
CHICAGO, IL

Disclaimer: This presentation was developed by a third party and is not funded by WoodWorks or the Softwood Lumber Board.

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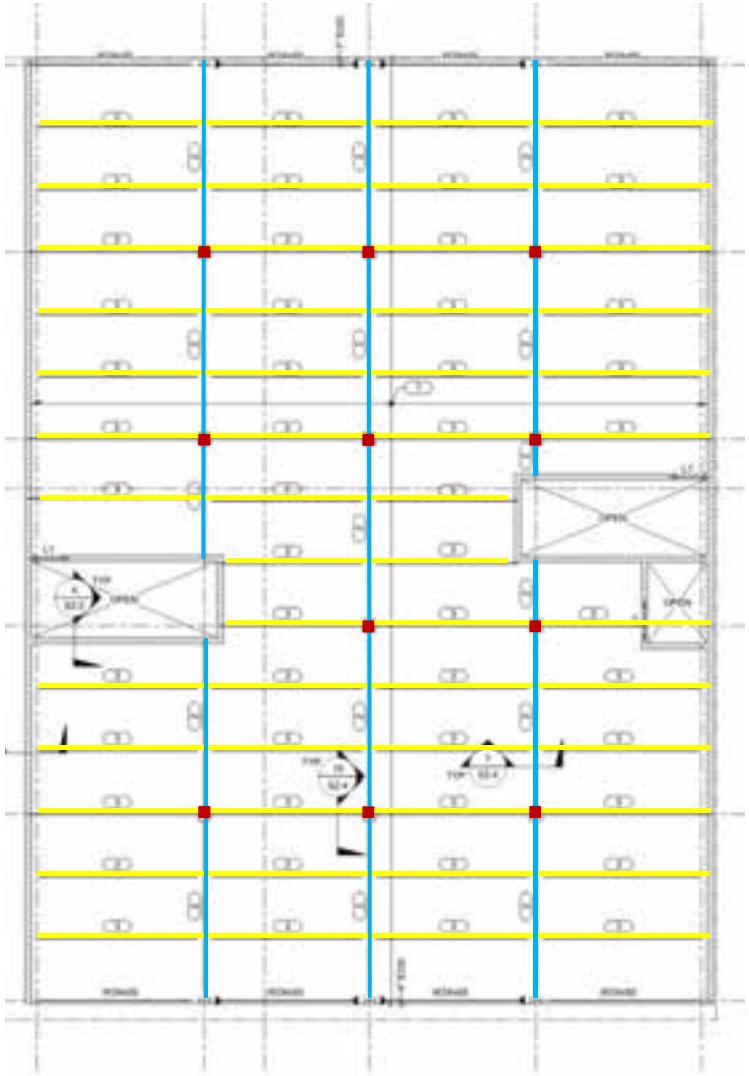

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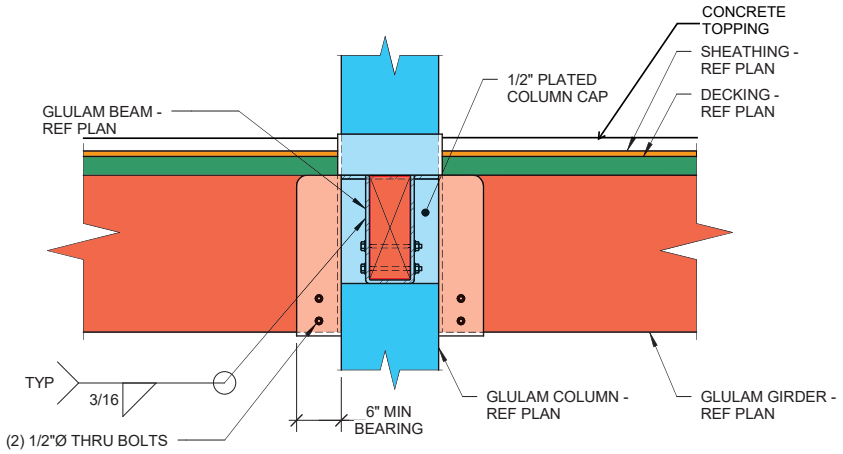

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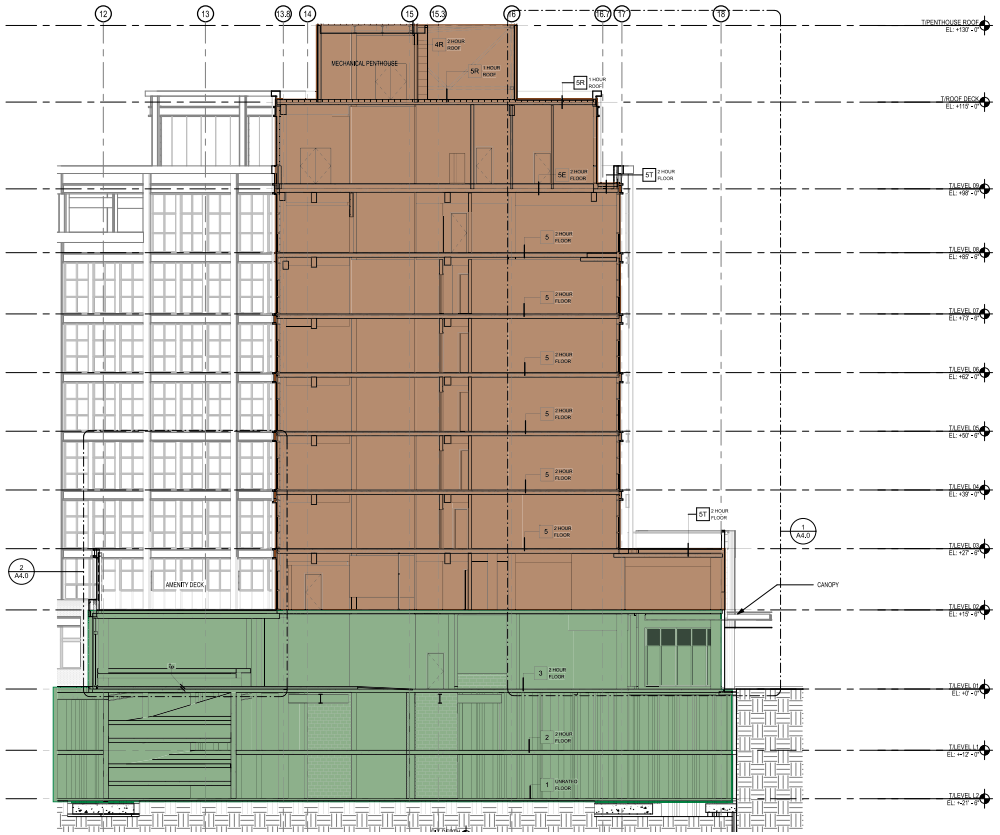

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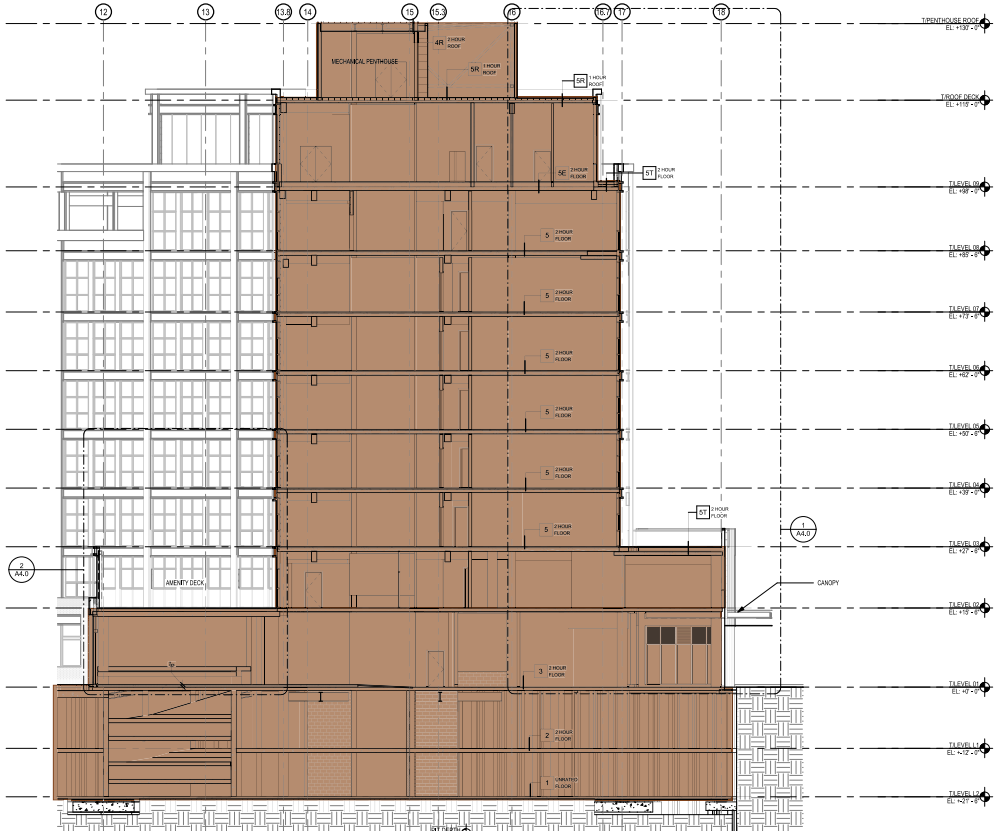
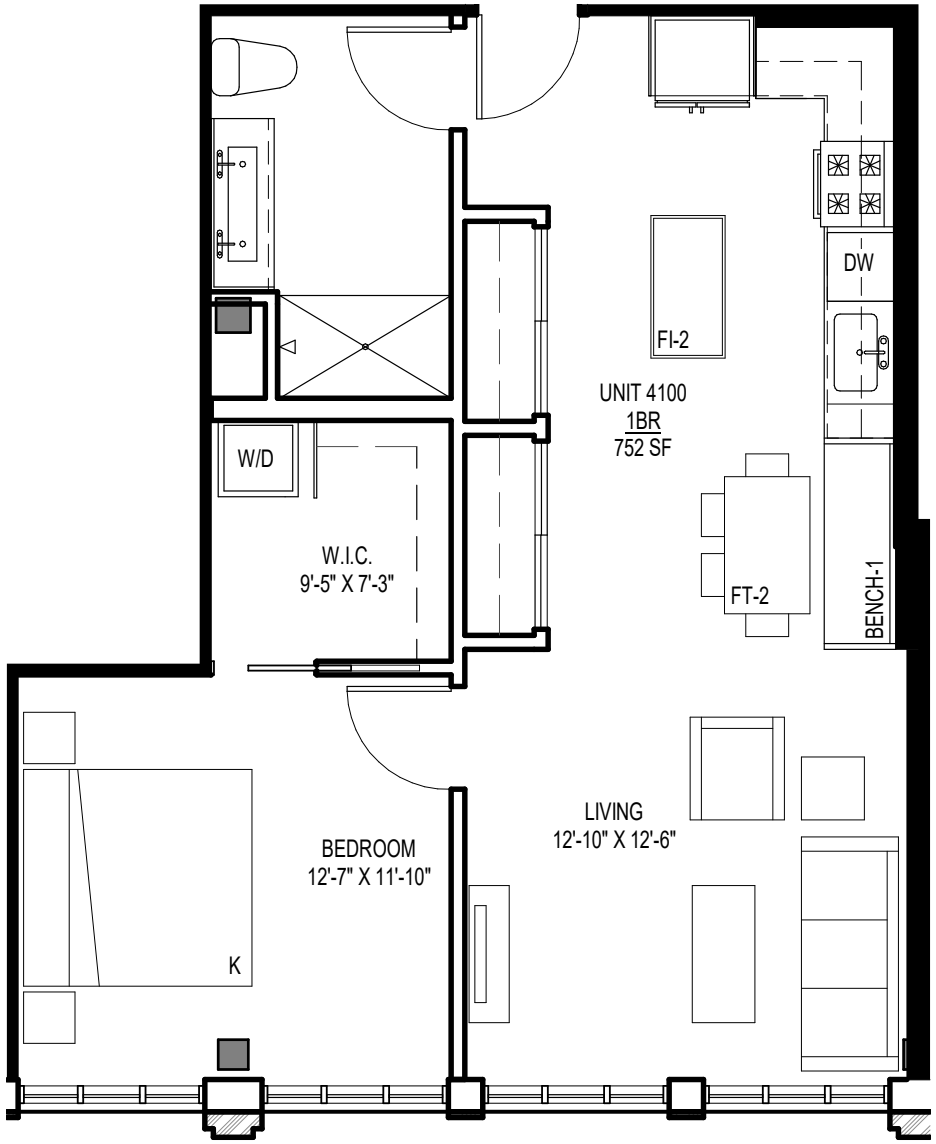


TYPICAL 1-BEDROOM UNIT



SOURCE: INTRO

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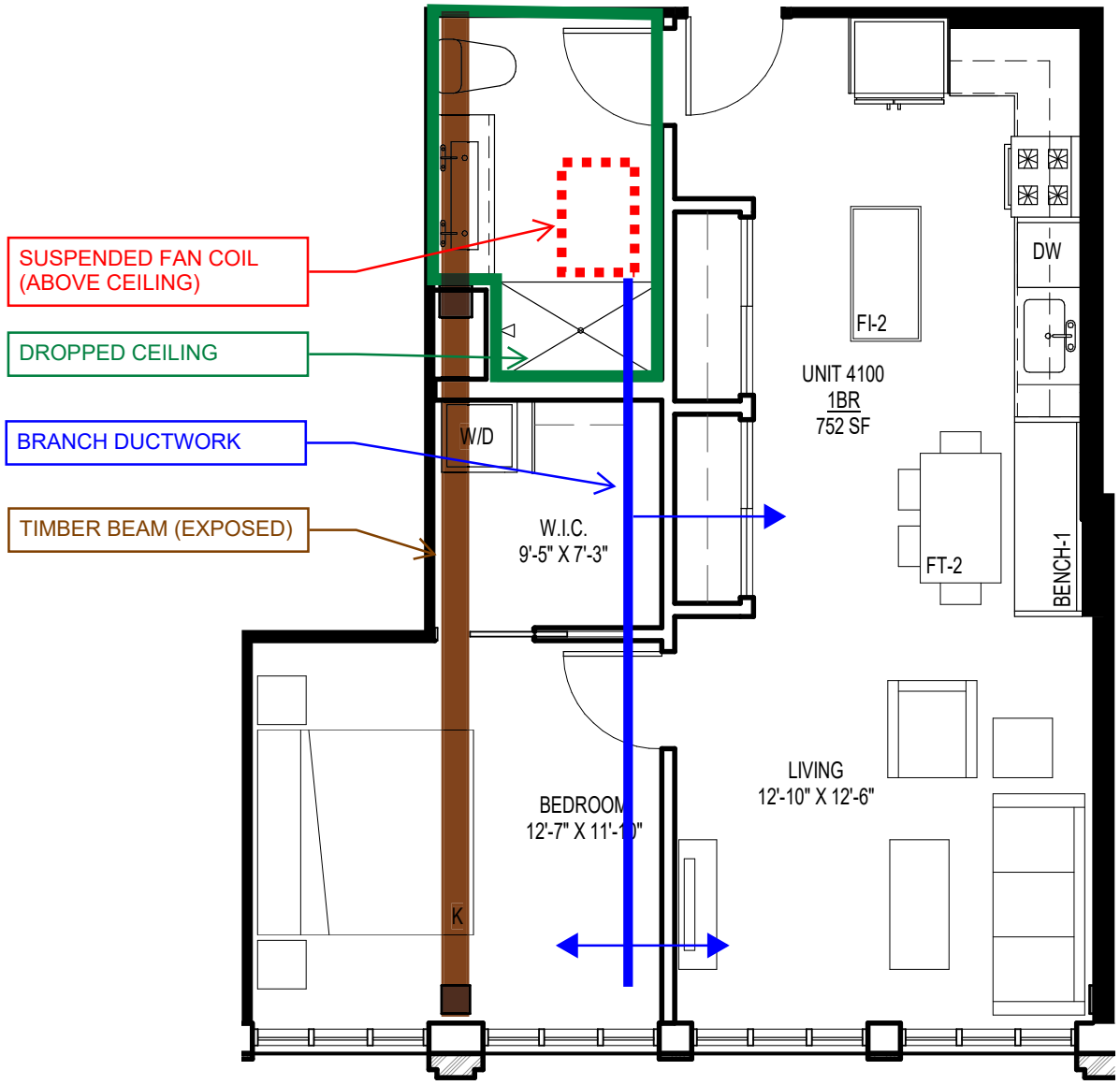

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*SEE BUILDING SECTION SHEETS
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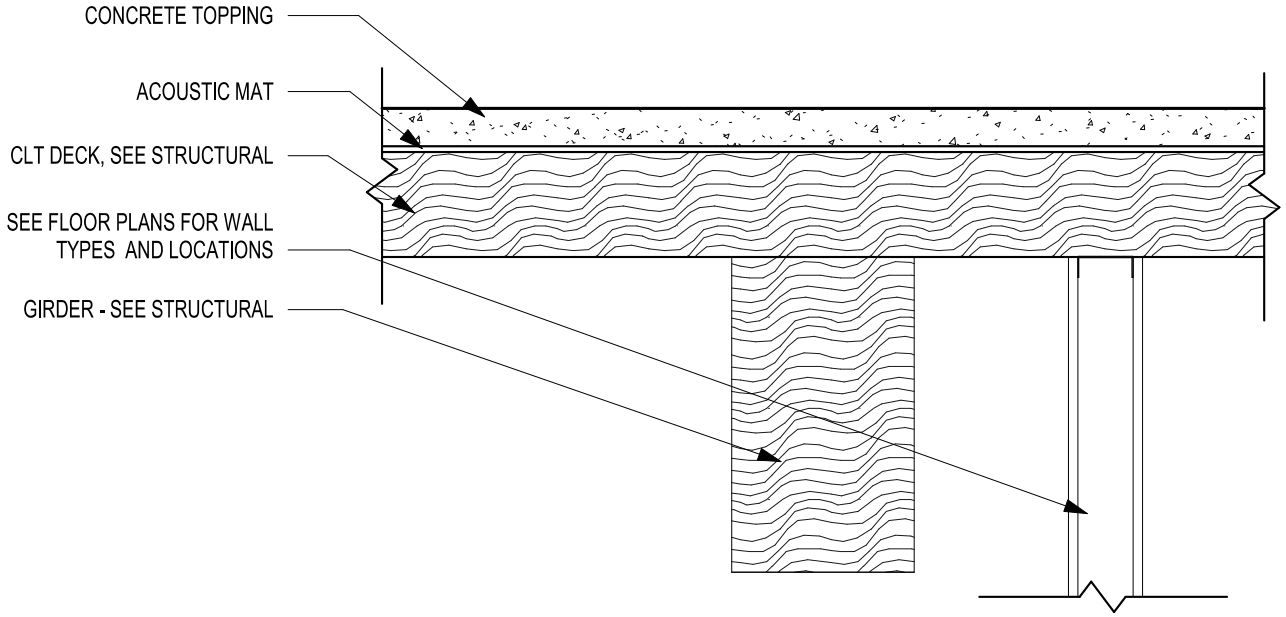

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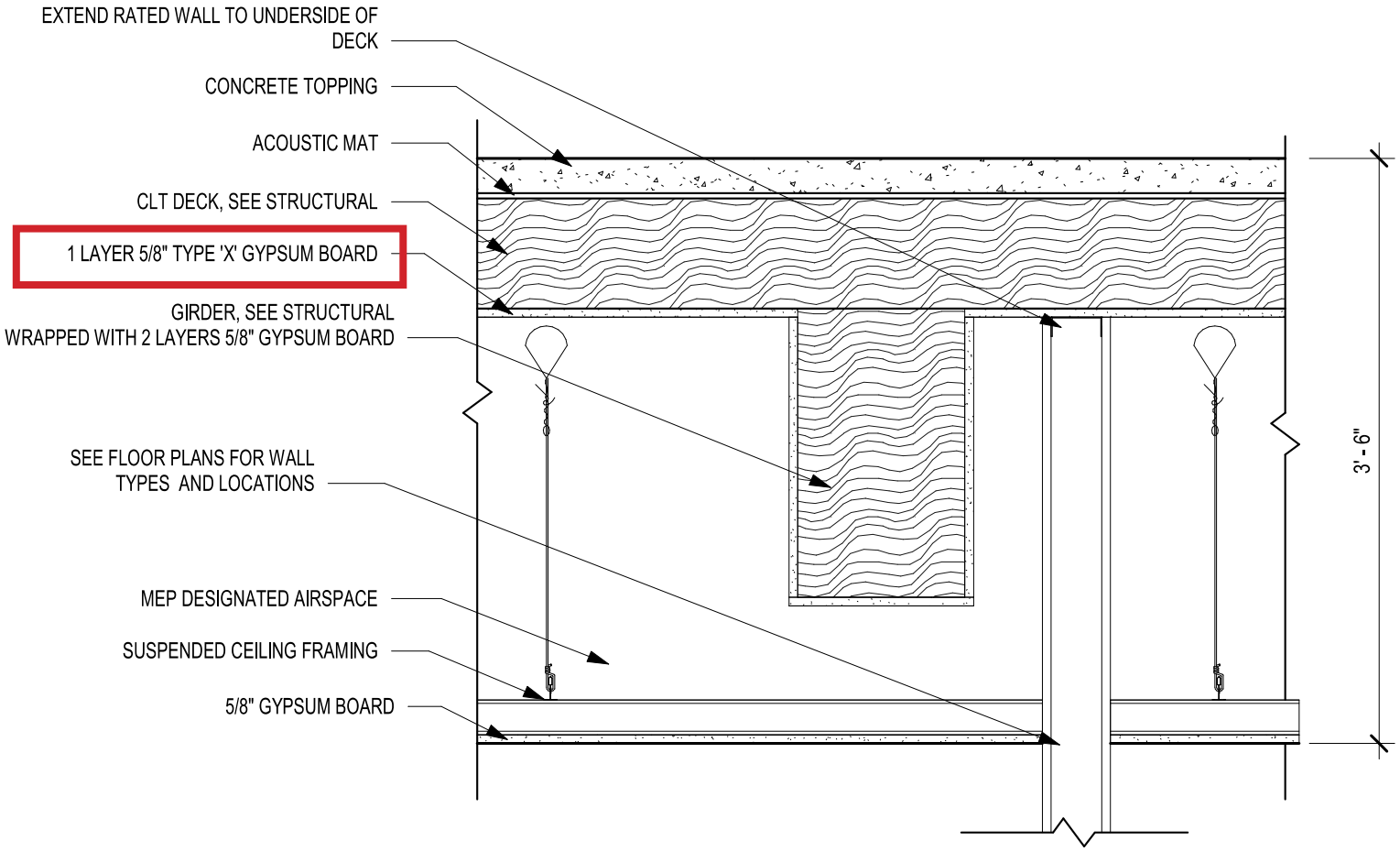

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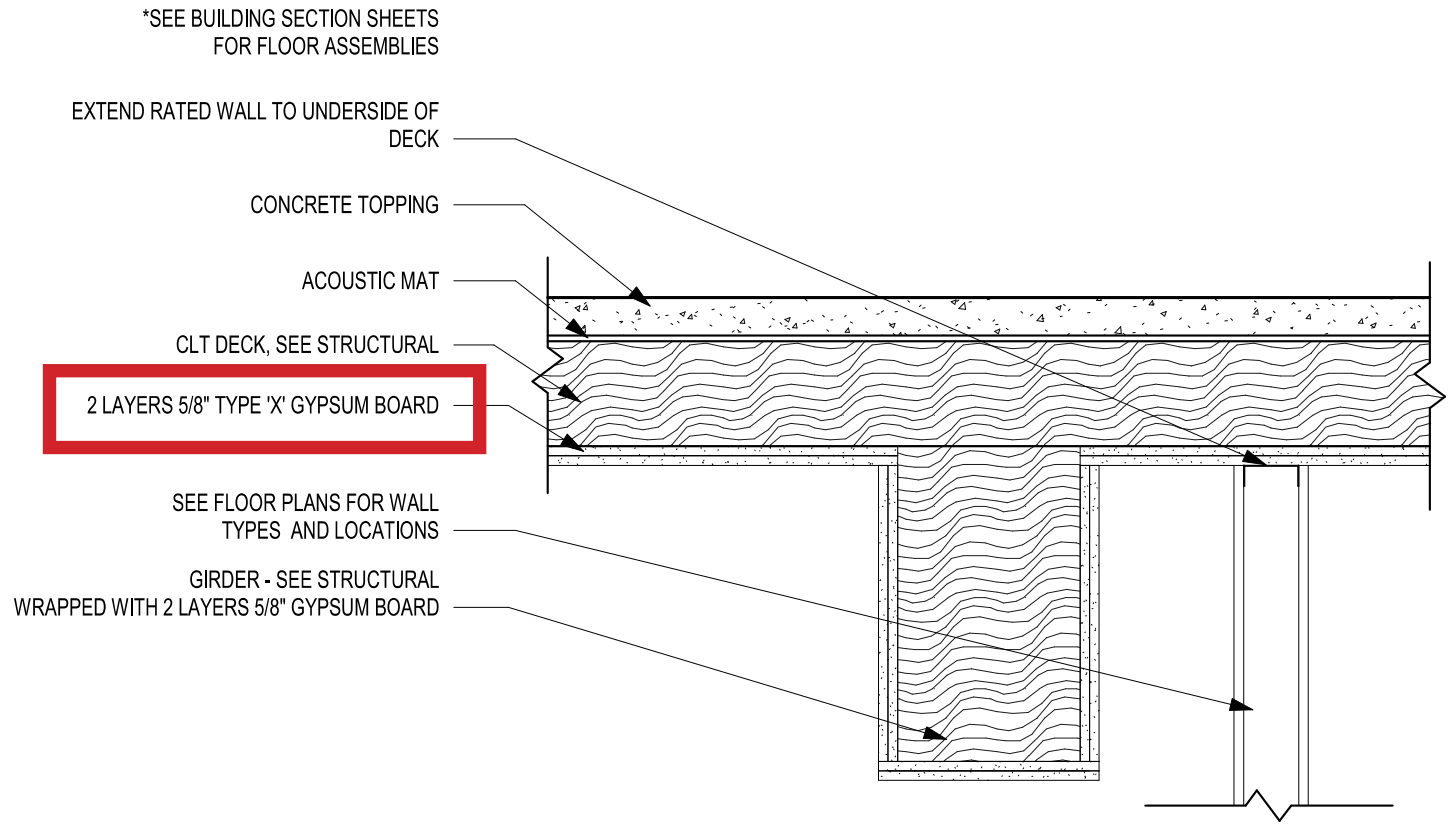

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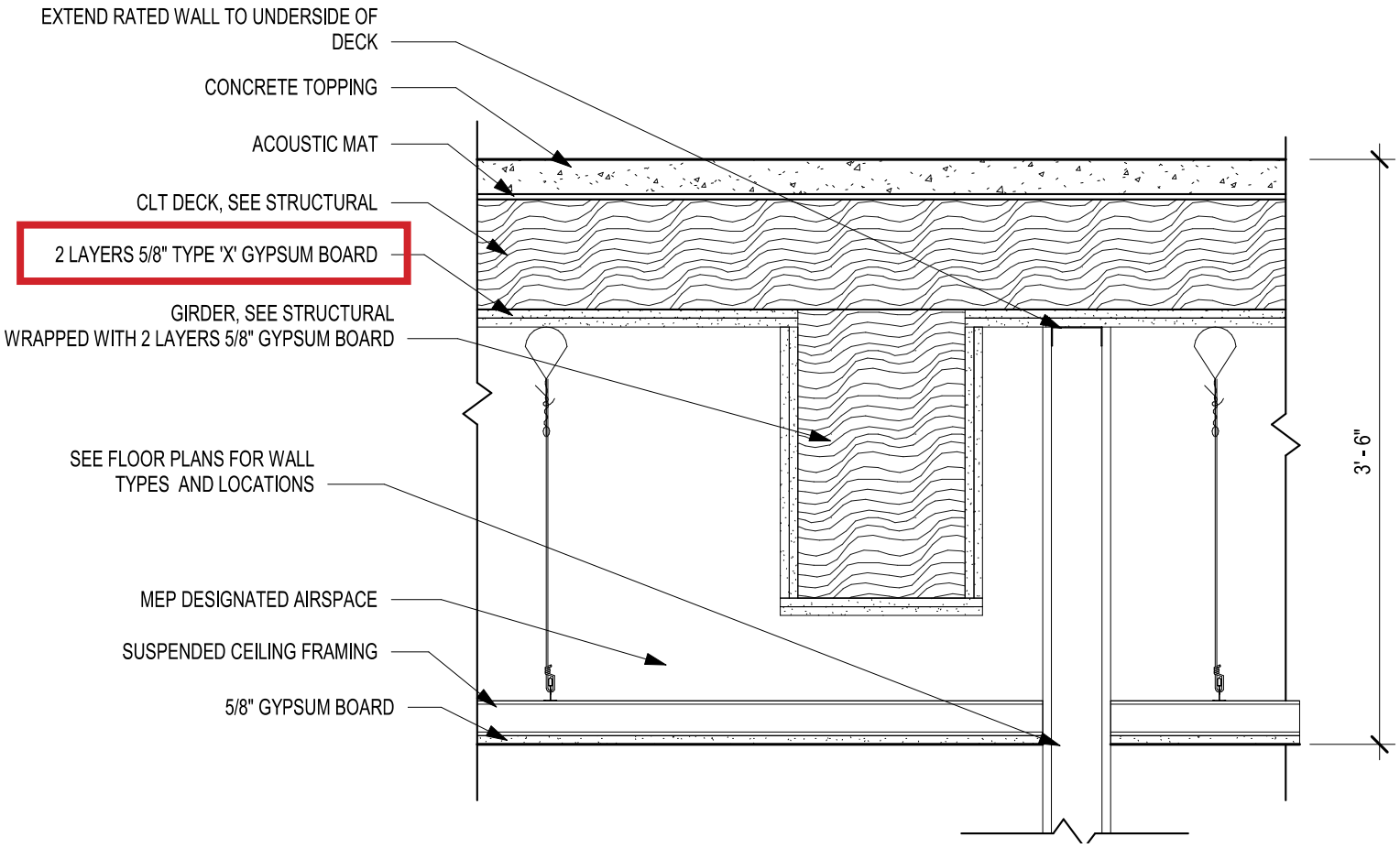

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-ALL VERTICAL EGRESS COMPONENTS (STAIRS, ELEVATORS) ARE TYPE 1-A CONSTRUCTION.

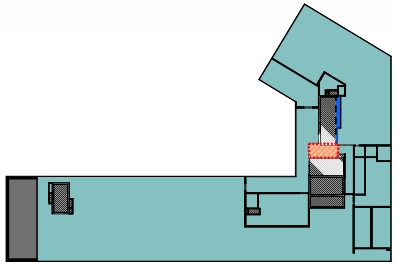
-ADDITIONAL LAYER OF DRYWALL ENCAPSULATION AT HORIZONTAL EGRESS COMPONENTS (CORRIDORS).

-STAIRS POSITIONED TO LIMIT DEAD END CORRIDORS.

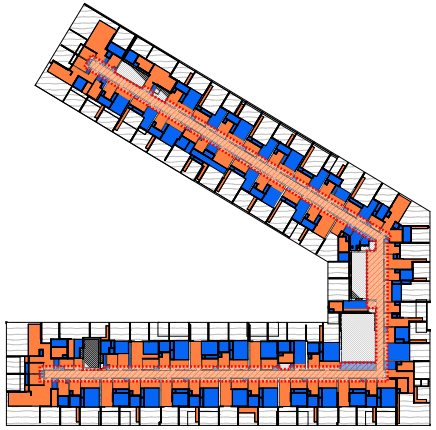
-ALL TIMBER MEMBERS SIZED FOR 2HR RATING, REGARDLESS OF ENCAPSULATION.

-FIRE DEPARTMENT ACCESS TO 100% OF SITE PERIMETER.

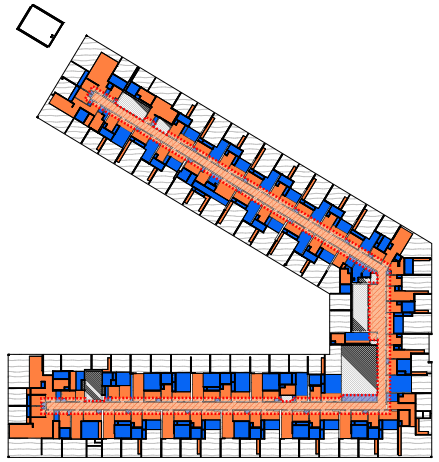
-PARKING GARAGE AND 1ST FLOOR ARE TYPE 1-A CONSTRUCTION.



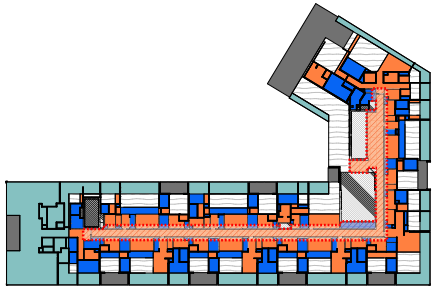
6 LEVEL 09 - TIMBER COVERAGE PLAN
SCALE: 1" = 30'-0"



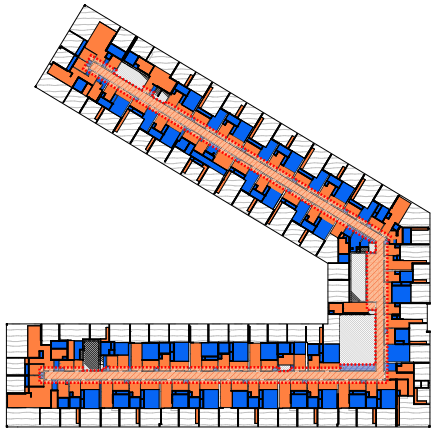
4 LEVEL 07 - TIMBER COVERAGE PLAN
SCALE: 1" = 30'-0"



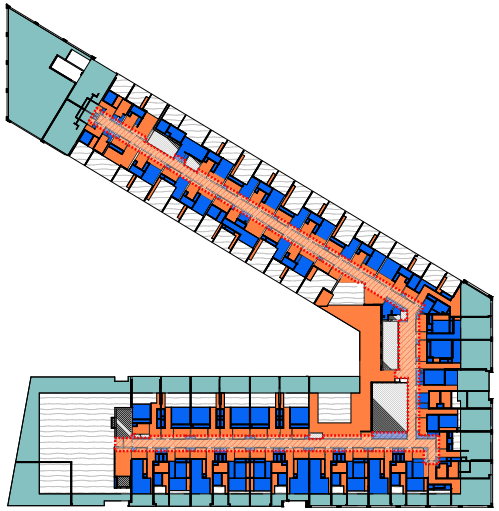
2 LEVEL 03 - TIMBER COVERAGE PLAN
SCALE: 1" = 30'-0"



5 LEVEL 08 - TIMBER COVERAGE PLAN
SCALE: 1" = 30'-0"



3 LEVELS 04, 05 & 6 - TIMBER COVERAGE PLAN
SCALE: 1" = 30'-0"



1 LEVEL 02 - TIMBER COVERAGE PLAN
SCALE: 1" = 30'-0"

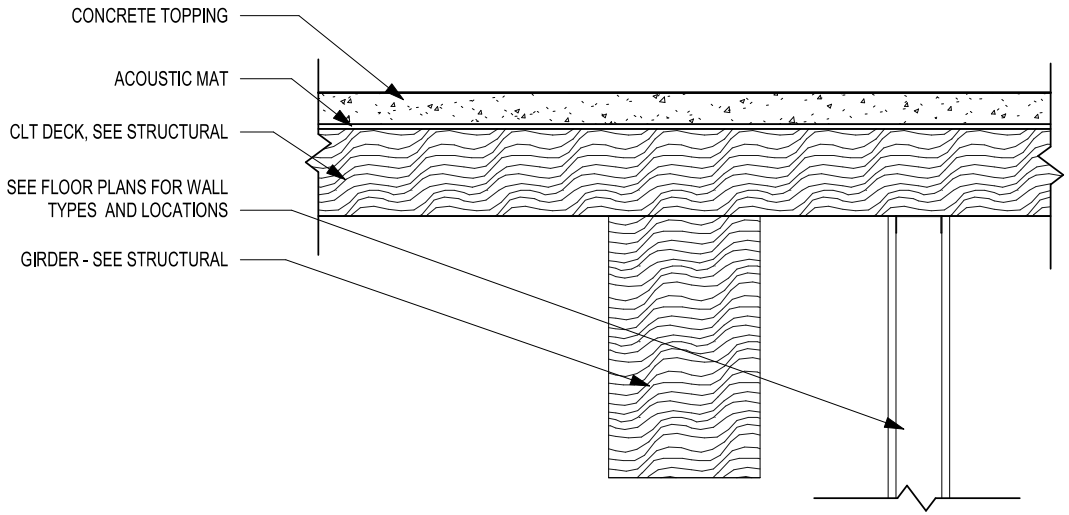
TYPICAL DWELLING UNIT

SOURCE: INTRO

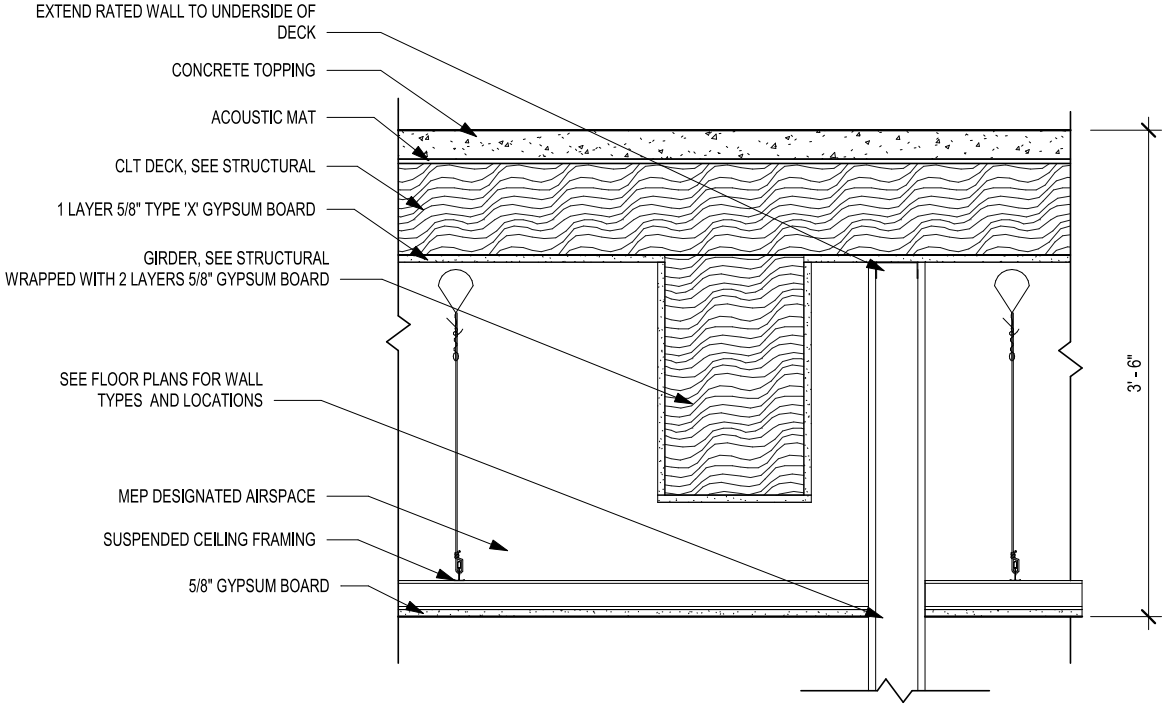
SOURCE: INTRO

PART 2 - LESSONS LEARNED

TIMBER FRAMING AND ACOUSTICS

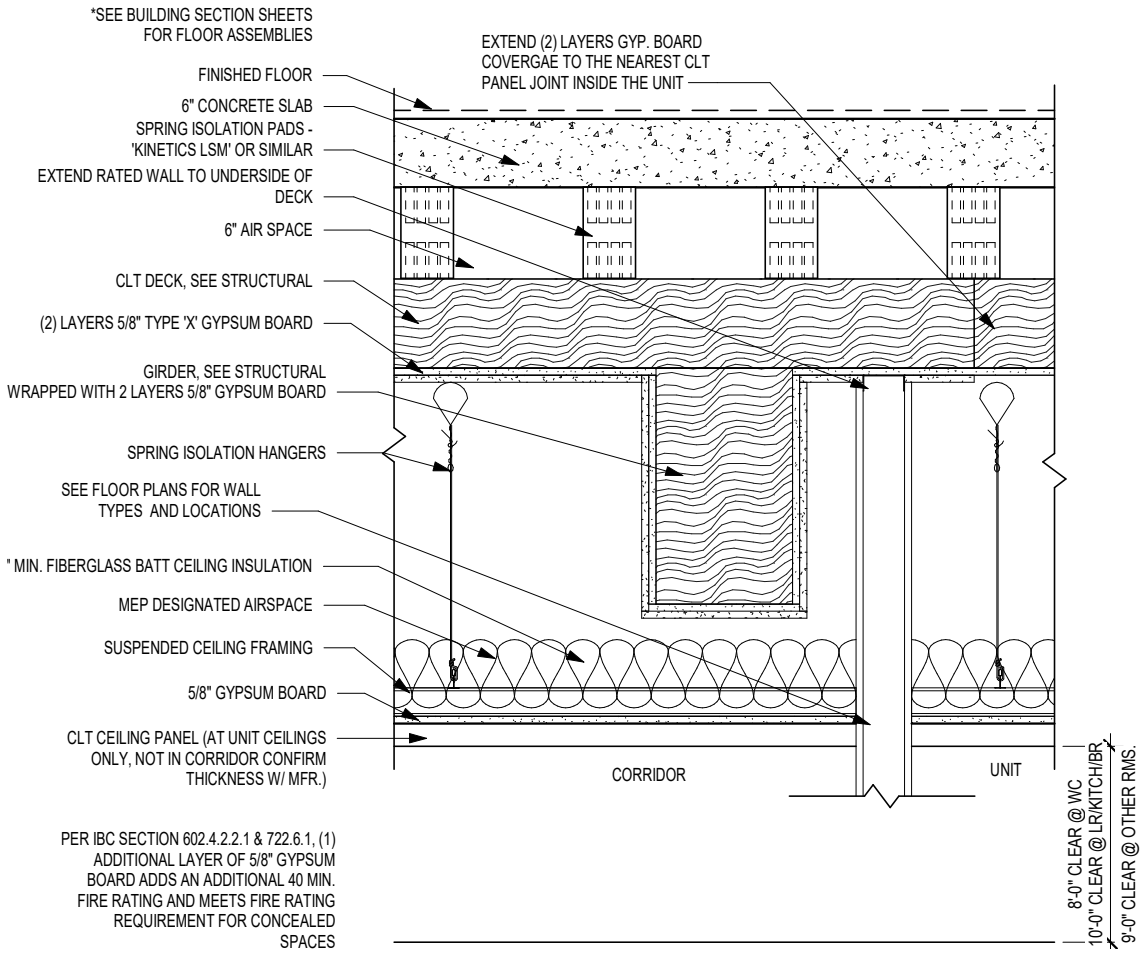


TYPICAL FLOOR ASSEMBLY



TYPICAL FLOOR ASSEMBLY W/ DROPPED CEILING

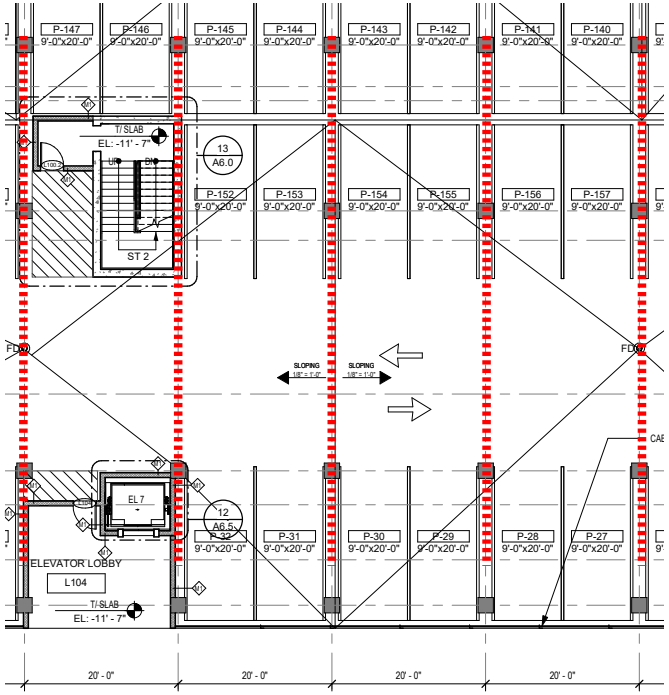
TIMBER FRAMING AND ACOUSTICS



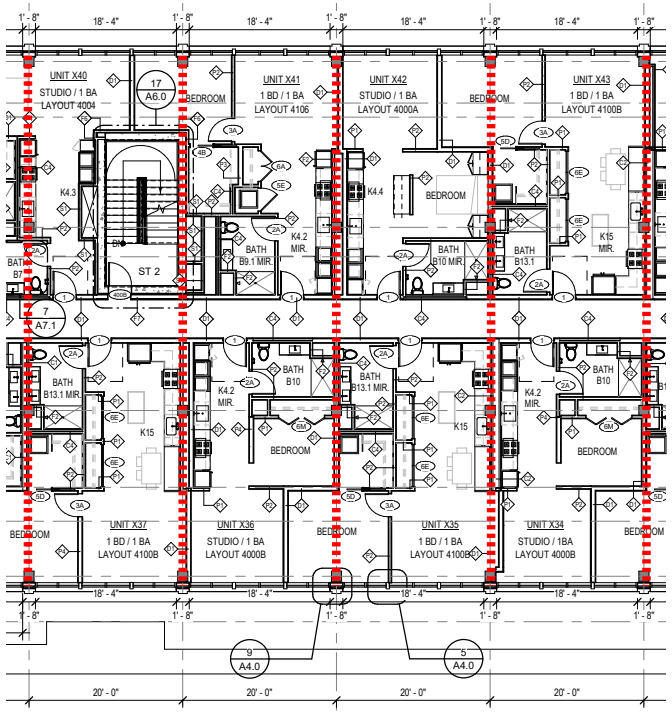
SOURCE: INTRO

OPTIMIZING THE TIMBER GRID

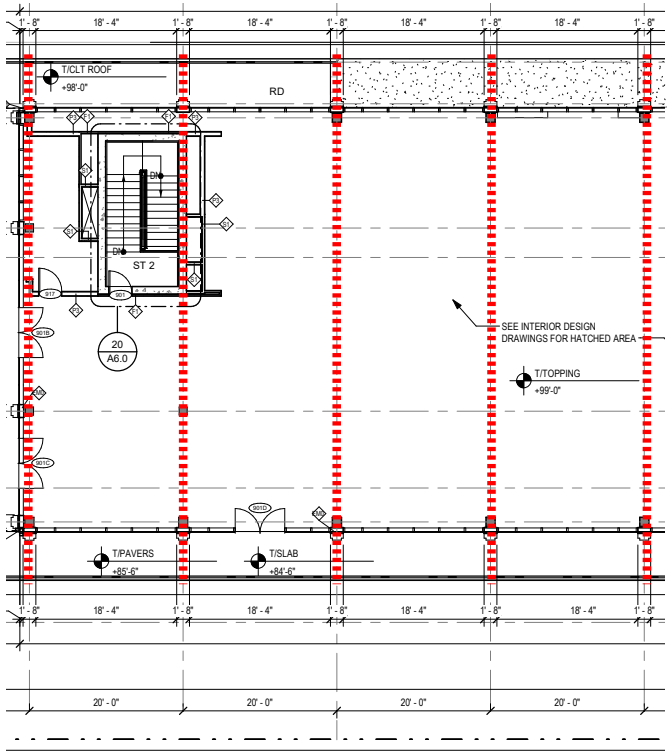
FACTORS TO CONSIDER:
-MANUFACTURER - TYPICAL PANEL LENGTH, WIDTH
-SHIPPING CONSTRAINTS
-MEP PENETRATIONS
-EXTERIOR CLADDING



PARKING



RESIDENTIAL FLOOR



EVENT SPACE

BUILDING IMAGES

BUILDING IMAGES

SOURCE: IMAGE FICTION

BUILDING IMAGES - EXTERIOR

BUILDING IMAGES - EVENT SPACE

WHAT'S NEXT, AND WHY PUSH FOR MORE TALL MASS TIMBER BUILDINGS?

-TALLER AND LARGER TIMBER BUILDINGS
-STRUCTURAL INNOVATIONS - HYBRID, PANEL OPTIMIZATION
-NEW WAVE OF AMERICAN MASS TIMBER - NEW LOCATIONS FOR TALL TIMBER PROJECTS (OR TALLER PROJECTS IN OLD LOCATIONS)
-BIOPHILIC DESIGN
-TESTED FIRE-RESISTIVE CHARACTERISTICS
-MASS TIMBER = CARBON SINK
-MARKET DEMAND

THANK YOU

QUESTIONS? CONTACT:

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