



Early Design Decisions for Mass Timber Success

September 29, 2026

Presented by:

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WoodWorks



WoodWorks | The Wood Products Council

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



Course Description

Demonstrating how early design decisions influence the successful delivery of a large-scale mass timber project, this session combines a technical presentation with an exclusive tour of the Saddleback College @ ATEP's new mass timber-forward higher education campus in Tustin, CA. The presentation explores critical decisions made during the earliest stages of design, including construction type, fire-resistance strategy, structural grids, beam and panel spans, acoustics, connection detailing, and MEP integration, and how these choices affect code compliance, constructability, and project outcomes. Participants will then tour the two-story, 50,000-square-foot building with members of the project team, gaining firsthand insight into how these strategies were implemented during design and construction. By connecting fundamental design principles with real-world applications, attendees will gain practical lessons they can apply to future mass timber projects.

Learning Objectives

1. Identify the International Building Code construction types that permit mass timber and evaluate how early decisions regarding construction type, fire-resistance ratings, structural grids, and member spans influence code compliance, project cost, and constructability.
2. Explain strategies for integrating structural systems, MEP services, acoustics, and connection detailing in mass timber buildings to satisfy performance, fire-resistance, and occupant comfort requirements while supporting future building flexibility.
3. Describe construction sequencing, installation practices, and multidisciplinary coordination techniques that contribute to the safe, efficient, and successful execution of mass timber projects.
4. Evaluate how the design and construction strategies implemented in Saddleback College's mass timber campus addition addressed structural, fire, architectural, and constructability challenges.

Outline

- » Key Early Design Decisions
- » Construction Types
- » Fire Design
- » Structural Grid
- » Connections
- » Penetrations & Firestopping
- » MEP Layout and Integration
- » Lateral Systems
- » Acoustics

Outline

- Key Early Design Decisions
 - » Construction Types
 - » Fire Design
 - » Structural Grid
 - » Connections
 - » Penetrations & Firestopping
 - » MEP Layout and Integration
 - » Lateral Systems
 - » Acoustics

Key Early Design Decisions

What is the Single Most Important Early Design Decision on a Mass Timber Project? Is it:

Construction Type

Fire-Resistance Ratings

Member Sizes

Grids & Spans

Exposed Timber (where & how much)

MEP Layout

Acoustics

Concealed Spaces

Connections

Penetrations

The Answer is...They All Need to Be Weighed (Plus Others)

Key Early Design Decisions

Significant Emphasis Placed on the Word **Early**

Early Because:

- » Avoids placing limitations due to construction norms or traditions that may not be efficient with mass timber
- » Allows greater integration of all building elements in 3D models, ultimately used throughout design, manufacturing and install



Key Early Design Decisions

Early = Efficient

Realize Efficiency in:

- » Cost reduction
- » Material use (optimize fiber use, minimize waste)
- » Construction speed
- » Trade coordination
- » Minimize RFIs

Commit to a mass timber design from the start

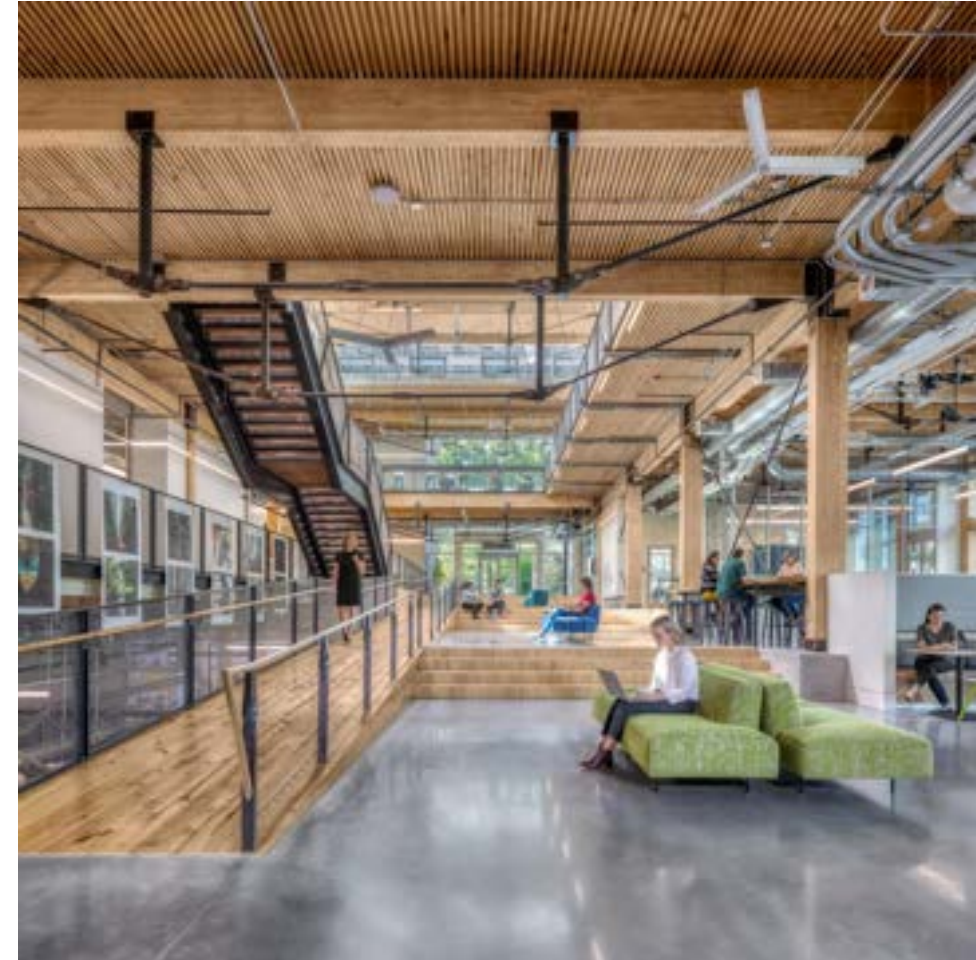


Key Early Design Decisions

One *potential* design route:

1. Building size & occupancy informs construction type & grid
2. Construction type informs fire resistance ratings
3. Grid & fire resistance ratings inform timber member sizes & MEP layout

But that's not all...



Architects: The Miller Hull Partnership with Lord Aeck Sargent
Engineer: Uzun + Case
Contractor: Skanska USA
Photo: Jonathan Hillyer

Key Early Design Decisions

Other impactful decisions:

- » **Acoustics** informs member sizes (and vice versa)
- » Fire-resistance ratings inform **connections & penetrations**
- » **MEP layout** informs use of concealed spaces



Key Early Design Decisions

Other impactful decisions:

- » **Grid** informs efficient spans, MEP layout
- » **Manufacturer capabilities** inform member sizes, grids & connections
- » **Lateral system** informs connections, construction sequencing

And more...



Key Early Design Decisions

Where do we start?



1 De Haro, Perkins & Will, photo Alex Nye



Key Early Design Decisions

Construction Type – Primarily based on building size & occupancy

	Construction Type (All Sprinklered Values)							
	IV-A	IV-B	IV-C	IV-HT	III-A	III-B	V-A	V-B
Occupancies	Allowable Building Height above Grade Plane, Feet (IBC Table 504.3)							
A, B, R	270	180	85	85	85	75	70	60
	Allowable Number of Stories above Grade Plane (IBC Table 505.4)							
A-2, A-3, A-4	18	12	6	4	4	3	3	2
B	18	12	9	6	6	4	4	3
R-2	18	12	8	5	5	5	4	3
	Allowable Area Factor (At) for SM, Feet ² (IBC Table 506.2)							
A-2, A-3, A-4	135,000	90,000	56,250	45,000	42,000	28,500	34,500	18,000
B	324,000	216,000	135,000	108,000	85,500	57,000	54,000	27,000
R-2	184,500	123,000	76,875	61,500	72,000	48,000	36,000	21,000

Key Early Design Decisions

Construction Type – Primarily based on building size & occupancy

	Construction Type (All Sprinklered Values)							
	IV-A	IV-B	IV-C	IV-HT	III-A	III-B	V-A	V-B
Occupancies	Allowable Building Height above Grade Plane, Feet (IBC Table 504.3)							
A, B, R	270	180	85	85	85	75	70	60
For low- to mid-rise mass timber buildings, there may be multiple options for construction type. There are pros and cons of each, don't assume that one type is always best.								
A-2, A-3, A-4	135,000	90,000	56,250	45,000	42,000	28,500	34,500	18,000
B	324,000	216,000	135,000	108,000	85,500	57,000	54,000	27,000
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R-2	184,500	123,000	76,875	61,500	72,000	48,000	36,000	21,000

Key Early Design Decisions

Fire-Resistance Ratings

- » Driven primarily by construction type
- » Rating achieved through timber alone or non-com protection required?

**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	A	B	C	HT	A	B
Primary structural frame ^f (see Section 202)	3 ^{a, b}	2 ^{a, b, c}	1 ^{b, c}	0 ^c	1 ^{b, c}	0	3 ^a	2 ^a	2 ^a	HT	1 ^{b, c}	0
Bearing walls												
Exterior ^{a, f}	3	2	1	0	2	2	3	2	2	2	1	0
Interior	3 ^a	2 ^a	1	0	1	0	3	2	2	1/HT ^g	1	0
Nonbearing walls and partitions Exterior					See Table 705.5							
Nonbearing walls and partitions Interior ^d	0	0	0	0	0	0	0	0	0	See Section 2304.11.2	0	0
Floor construction and associated secondary structural members (see Section 202)	2	2	1	0	1	0	2	2	2	HT	1	0
Roof construction and associated secondary structural members (see Section 202)	1½ ^b	1 ^{b, c}	1 ^{b, c}	0 ^c	1 ^{b, c}	0	1½	1	1	HT	1 ^{b, c}	0

Outline

- » Key Early Design Decisions

- **Construction Types**

- » Fire Design

- » Structural Grid

- » Connections

- » Penetrations & Firestopping

- » MEP Layout and Integration

- » Lateral Systems

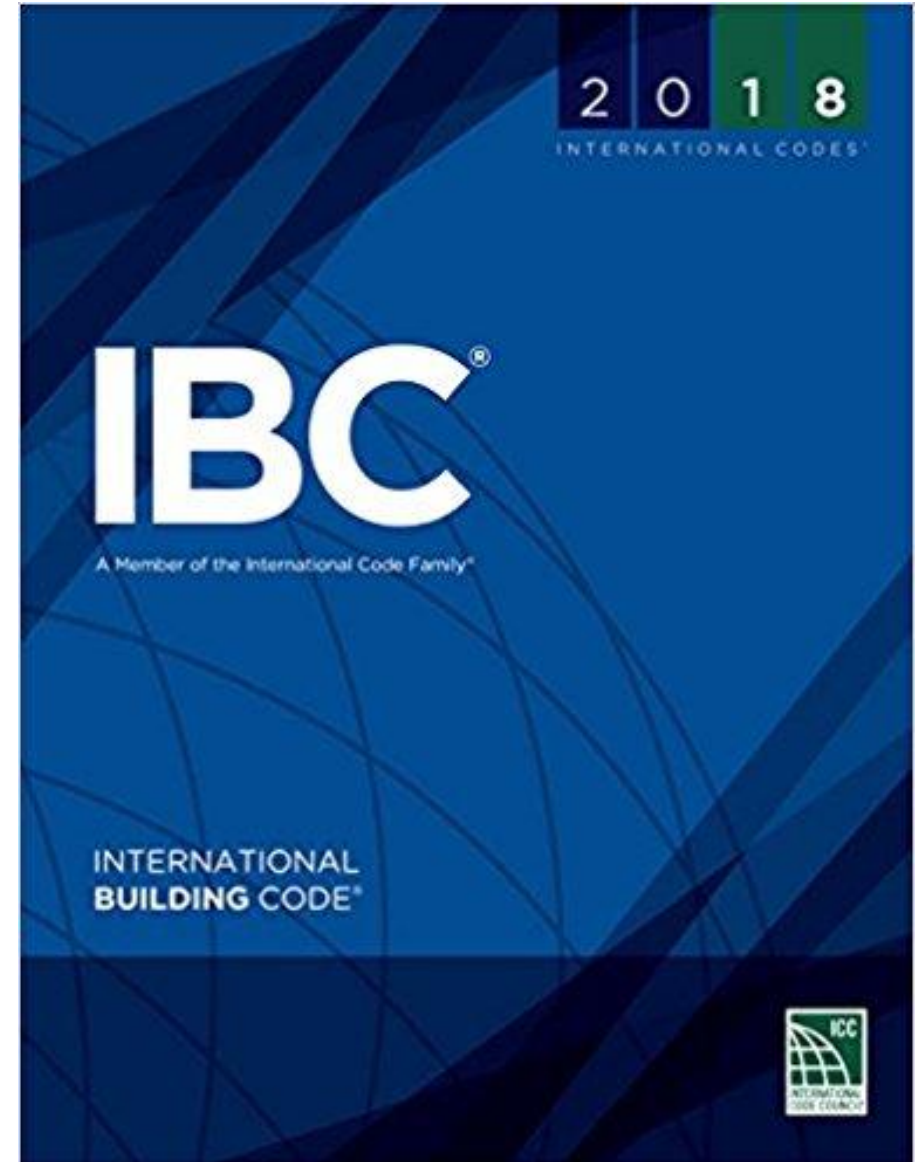
- » Acoustics

Construction Types

When does the code allow mass timber to be used?

IBC defines mass timber systems in IBC Chapter 2 and notes their acceptance and manufacturing standards in IBC Chapter 23

Permitted anywhere that combustible materials and heavy timber are allowed, plus more



Construction Types

IBC defines 5 construction types: I, II, III, IV, V

A building must be classified as one of these

Construction Types I & II:

All elements required to be non-combustible materials

However, there are exceptions including several for mass timber

Construction Types

Where does the code allow MT to be used?

Type IB & II: Roof Decking



Image: DeStafano & Chamberlain, Inc, Robert Benson Photography



Image: StructureCraft Builders

Construction Types

All wood-framed building options:

Type III

Exterior walls non-combustible (may be FRTW)

Interior elements any allowed by code, including mass timber

Type V

All building elements are any allowed by code, including mass timber

Types III and V are subdivided to A (protected) and B (unprotected)

Type IV (Heavy Timber)

Exterior walls non-combustible (may be FRTW OR CLT)

Interior elements qualify as Heavy Timber (min. sizes, no concealed spaces except in 2021 IBC)

Construction Types

Where does the code allow MT to be used?

Type III: Interior elements (floors, roofs, partitions/shafts) and exterior walls if FRT



Construction Types

Where does the code allow MT to be used?

Type IV: Any exposed interior elements & roofs, must meet min. sizes; exterior walls if CLT or FRT. Concealed space limitations (varies by code version)



Construction Types

Type IV construction permits exposed heavy/mass timber elements of min. sizes.

Minimum Width by Depth in Inches

Framing		Solid Sawn (nominal)	Glulam (actual)	SCL (actual)
Floor	Columns	8 x 8	6 ³ / ₄ x 8 ¹ / ₄	7 x 7 ¹ / ₂
	Beams	6 x 10	5 x 10 ¹ / ₂	5 ¹ / ₄ x 9 ¹ / ₂
Roof	Columns	6 x 8	5 x 8 ¹ / ₄	5 ¹ / ₄ x 7 ¹ / ₂
	Beams*	4 x 6	3 X 6 ⁷ / ₈	3 ¹ / ₂ X 5 ¹ / ₂

*3” nominal width allowed where sprinklered
See IBC 2018 2304.11 or IBC 2015 602.4 for Details

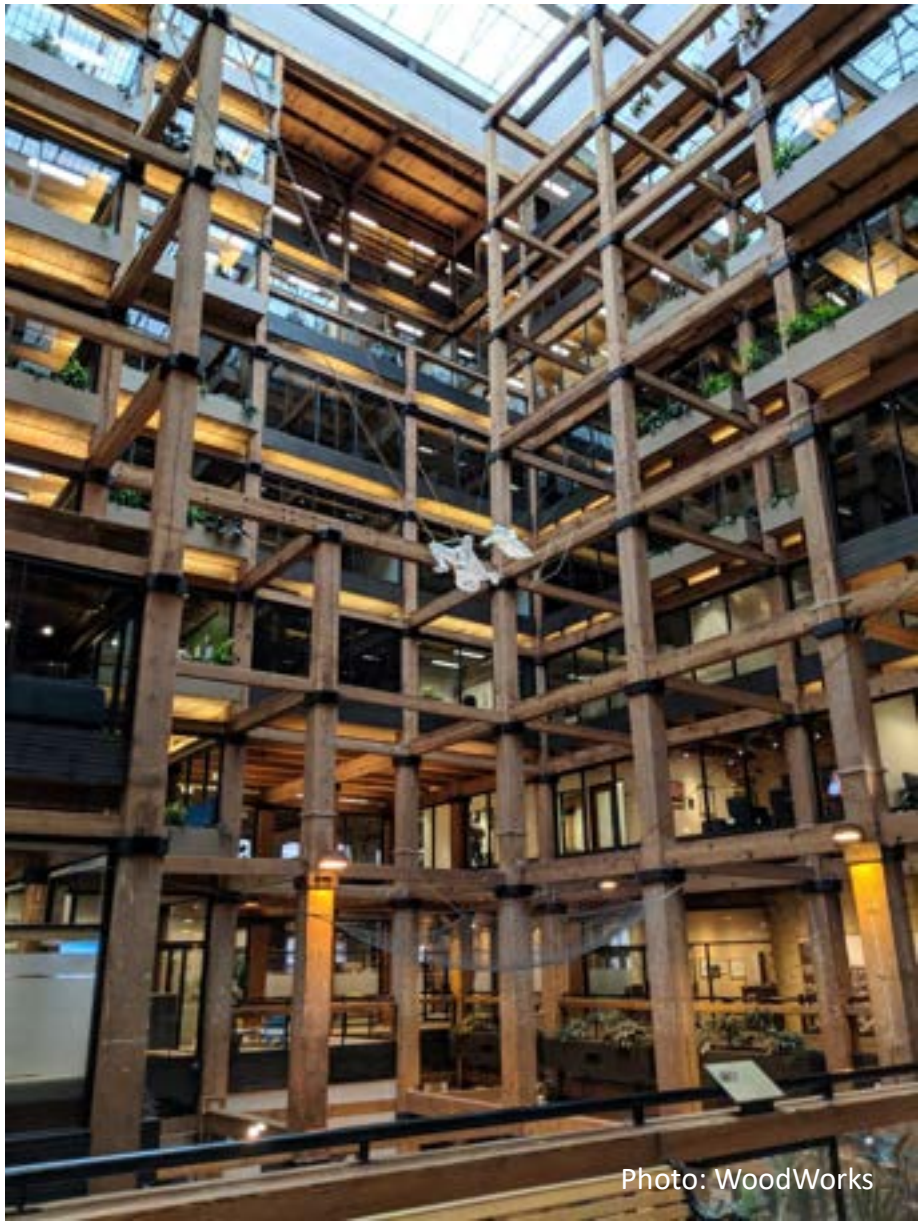


Photo: WoodWorks

Construction Types

Type IV min. sizes:

Floor Panels/Decking:

- » 4" thick CLT (actual thickness)
- » 4" NLT/DLT/GLT (nominal thickness)
- » 3" thick (nominal) decking covered with: 1" decking or 15/32" WSP or ½" particleboard



Photo: StructureCraft



Photo: Aitor Sanchez/ Ewing Cole



Photo: WoodWorks

Construction Types

Type IV min. sizes:

Interior Walls:

- » Laminated construction 4" thick
- » Solid wood construction min. 2 layers of 1" matched boards
- » Wood stud wall (1 hr min)
- » Non-combustible (1 hr min)

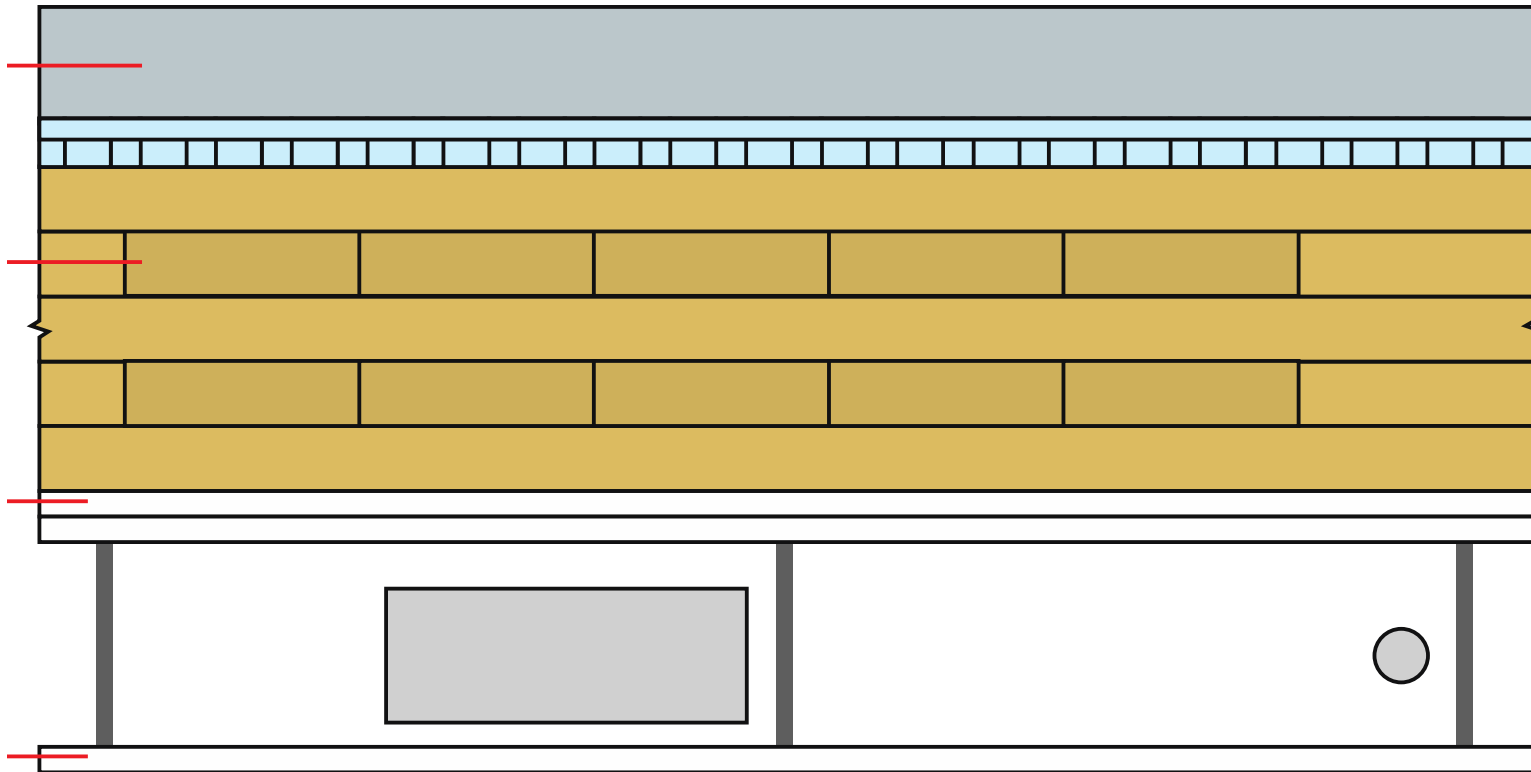
Verify other code requirements for FRR (eg. interior bearing wall; occupancy separation)



Construction Types

Type IV concealed spaces

Can I have a dropped ceiling? Raised access floor?



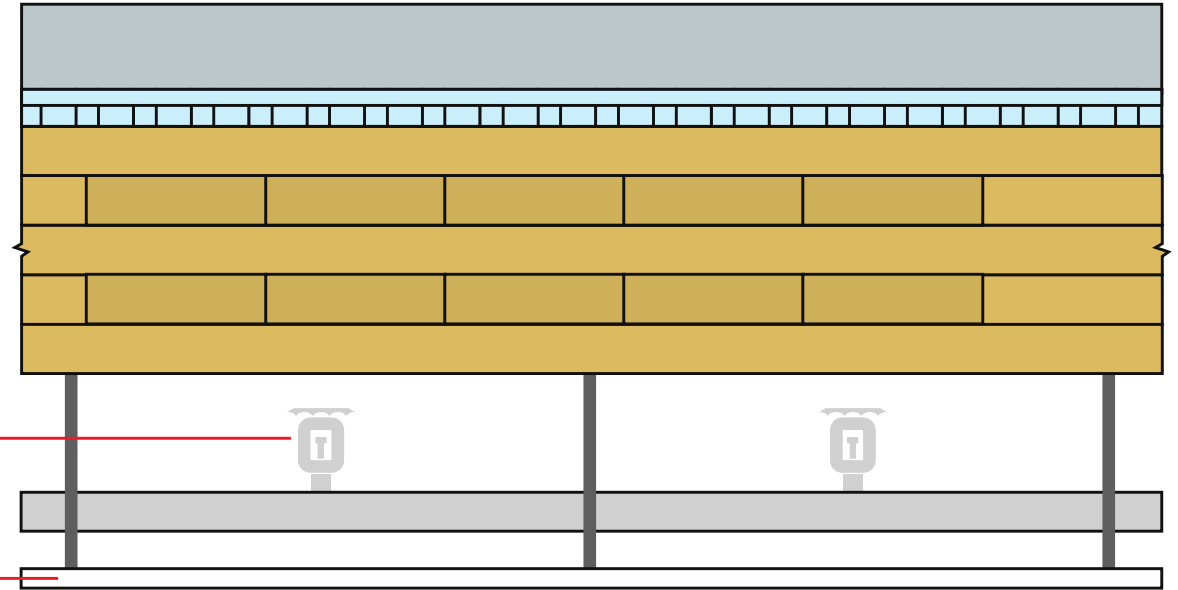
Construction Types

Type IV concealed space options within 2021 IBC

Option 1:

Sprinklers in concealed spaces

Dropped ceiling



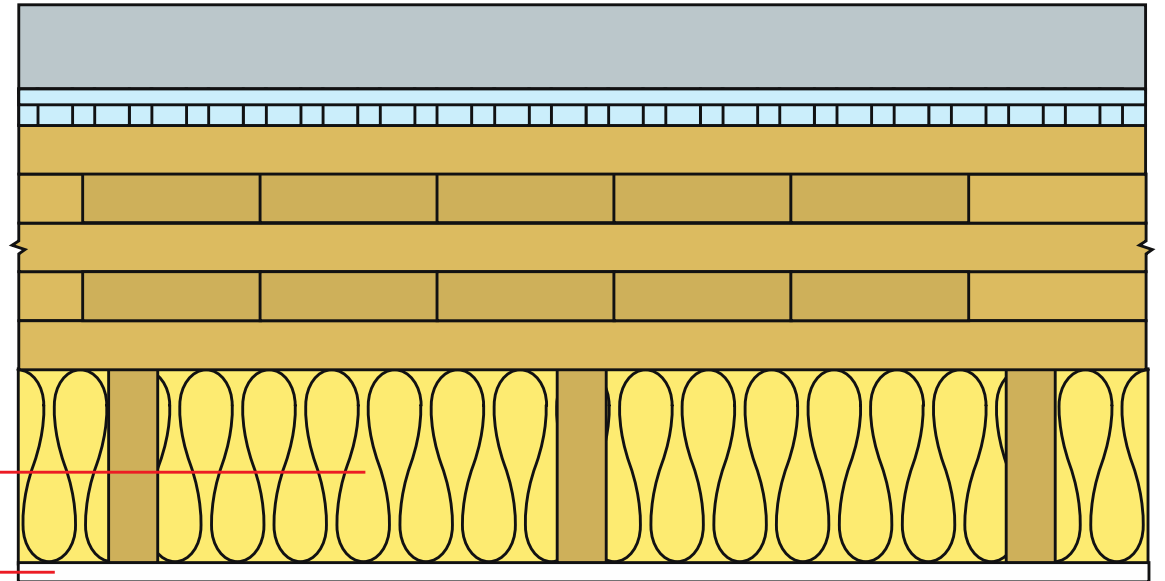
Construction Types

Type IV concealed space options within 2021 IBC

Option 2:

Noncombustible insulation

Dropped ceiling



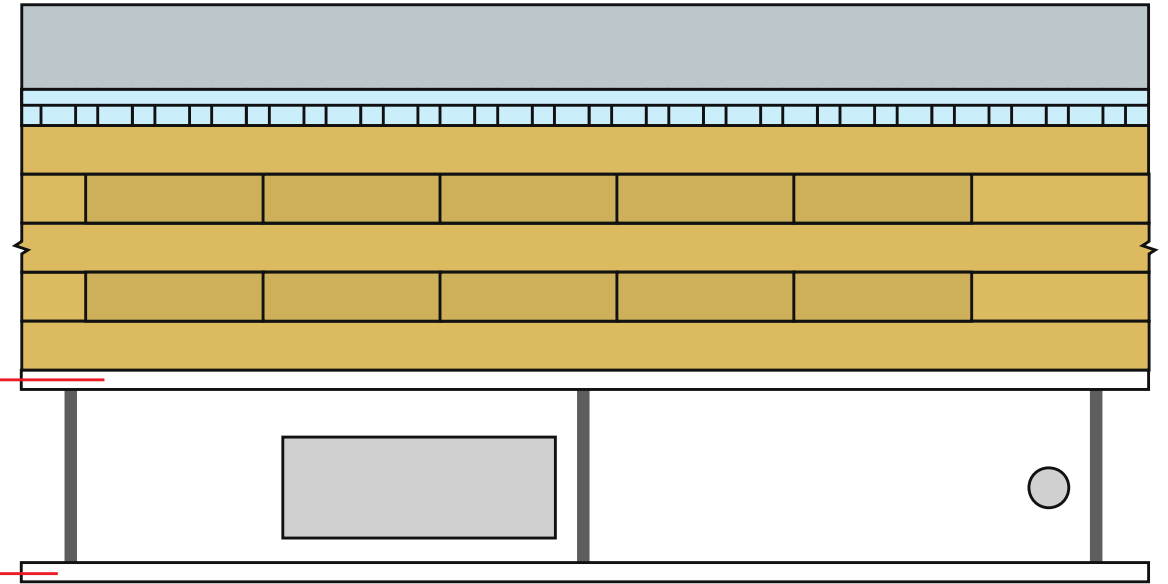
Construction Types

Type IV concealed space options within 2021 IBC

Option 3:

5/8" Type X gypsum on all mass timber surfaces within concealed space

Dropped ceiling



Construction Types

Concealed spaces solutions paper



Concealed Spaces in Mass Timber and Heavy Timber Structures

Concealed spaces, such as those created by a dropped ceiling in a floor/ceiling assembly or by a stud wall assembly, have unique requirements in the International Building Code (IBC) to address the potential of fire spread in non-visible areas of a building. Section 718 of the 2018 IBC includes prescriptive requirements for protection and/or compartmentalization of concealed spaces through the use of draft stopping, fire blocking, sprinklers and other means. For information on these requirements, see the WoodWorks Q&A, *Are sprinklers required in concealed spaces such as floor and roof cavities in multi-family wood-frame buildings?*¹

For mass timber building elements, the choice of construction type can have a significant impact on concealed space requirements. Because mass timber products such as cross-laminated timber (CLT) are prescriptively recognized for Type IV construction, there is a common misperception that exposed mass timber building elements cannot be used or exposed in other construction types. This is not the case.

In addition to Type IV buildings, structural mass timber elements—including CLT, glue-laminated timber (glulam), nail-laminated timber (NLT), structural composite lumber (SCL), and tongue-and-groove (T&G) decking—can be utilized and exposed in the following construction types, whether or not a fire-resistance rating is required:

- **Type III** – Floors, roofs and interior walls may be any material permitted by code, including mass timber; exterior walls are required to be noncombustible or fire retardant-treated wood.
- **Type V** – Floors, roofs, interior walls and exterior walls (i.e., the entire structure) may be constructed of mass timber.
- **Types I and II** – Mass timber may be used in select circumstances such as roof construction—including the primary frame in the 2021 IBC—in Types I-B, II-A or II-B; exterior columns and arches when 20 feet or more of horizontal separation is provided; and balconies, canopies and similar projections.



https://www.woodworks.org/wp-content/uploads/wood_solution_paper-Concealed_Spaces_Timber_Structures.pdf

Construction Types

Where does the code allow MT to be used?

Type V: All interior elements, roofs & exterior walls



Image: Christian Columbres Photography

Construction Types



Type III: 6 stories

Allowable mass timber
building size for group B
occupancy with NFPA 13
Sprinkler



Type IV: 6 stories

Credit: Ema Peter



Credit: Christian Columbres Photography

Type V: 4 stories

Construction Types

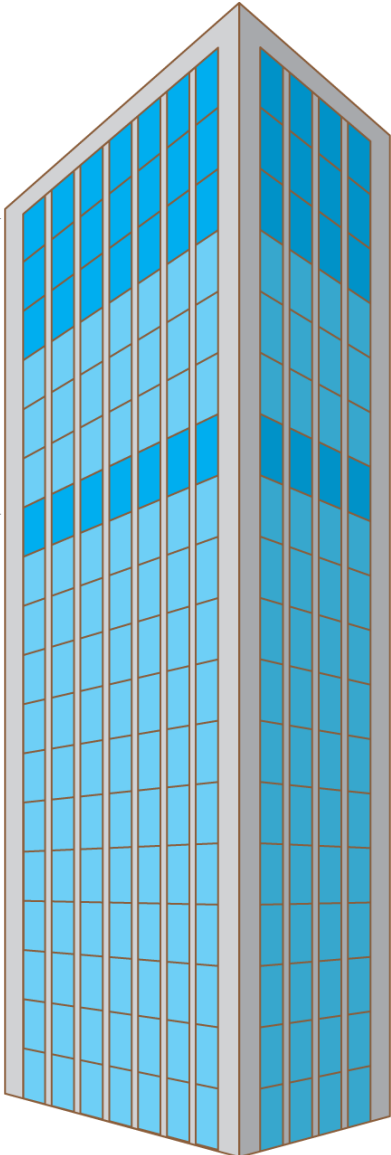
New Options in 2021 IBC
Allowable mass timber building size for
group B occupancy with NFPA 13
Sprinkler

Office
Assembly
Residential

— 270 ft.
(18 stories)

Mercantile
(12 stories)

Type IV-A

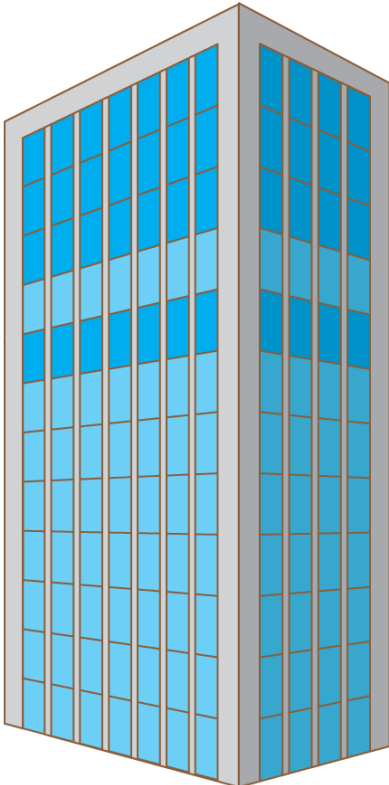


Office
Assembly
Residential

— 180 ft.
(12 stories)

Mercantile
(8 stories)

Type IV-B



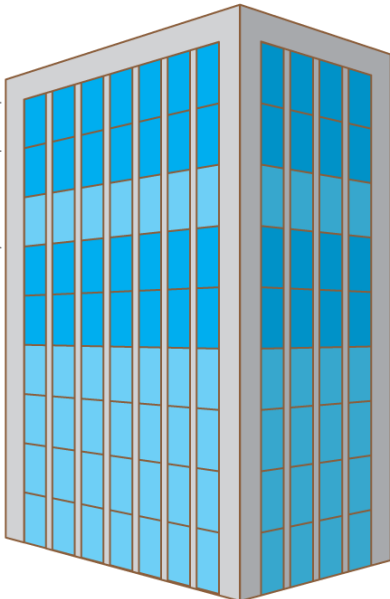
Office
(9 stories)

Residential
(8 stories)

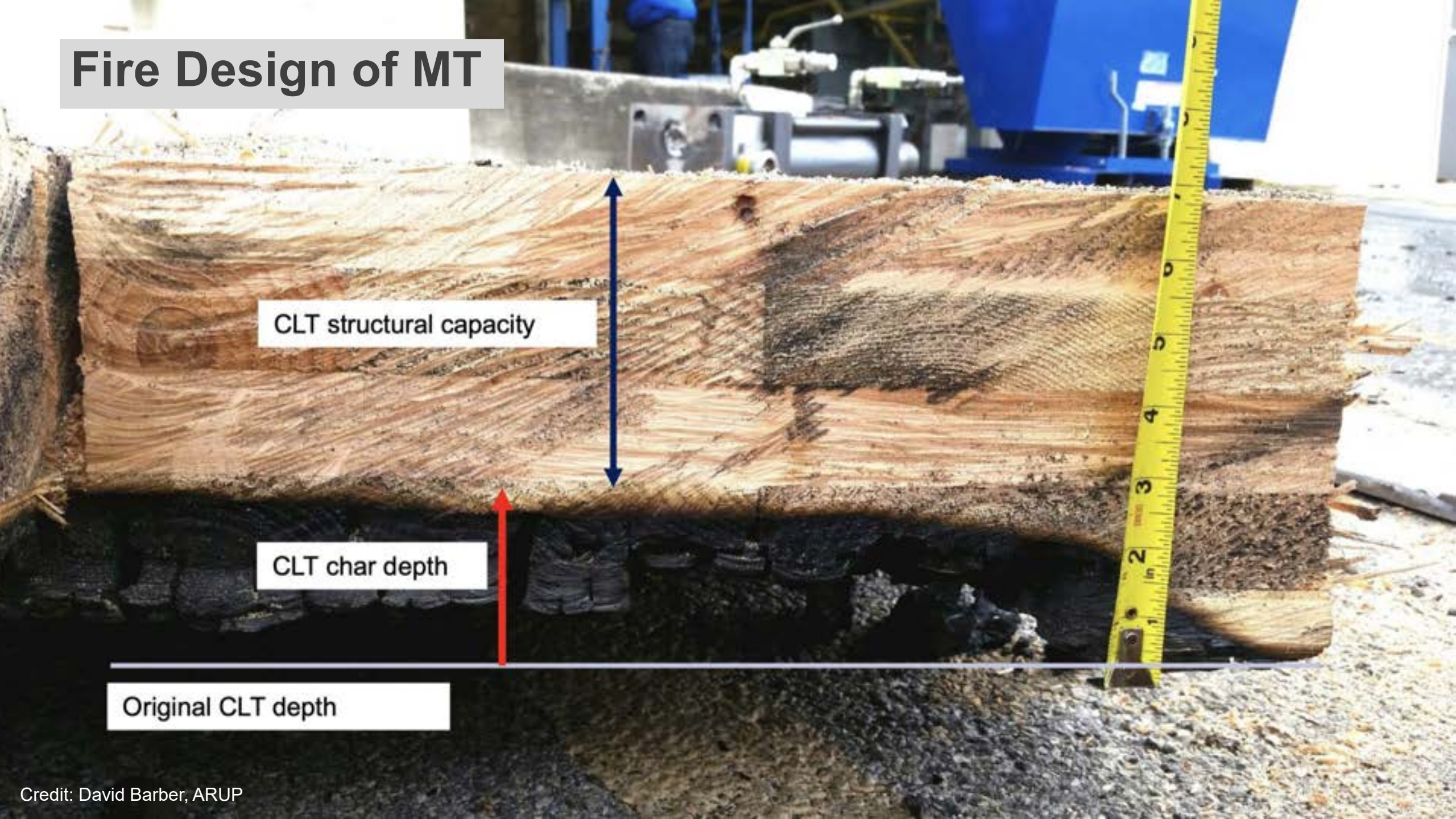
Assembly
Mercantile
(6 stories)

— 85 ft.
(9 stories)

Type IV-C



Fire Design of MT



CLT structural capacity

CLT char depth

Original CLT depth

Key Early Design Decisions

Construction type influences FRR

TABLE 601
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	A	B	A	B	A	B	A	B	C	HT	A	B
Primary structural frame ^f (see Section 202)	3 ^{a, b}	2 ^{a, b, c}	1 ^{b, c}	0 ^c	1 ^{b, c}	0	3 ^a	2 ^a	2 ^a	HT	1 ^{b, c}	0
Bearing walls												
Exterior ^{e, f}	3	2	1	0	2	2	3	2	2	2	1	0
Interior	3 ^a	2 ^a	1	0	1	0	3	2	2	1/HT ^g	1	0
Nonbearing walls and partitions Exterior					See Table 705.5							
Nonbearing walls and partitions Interior ^d	0	0	0	0	0	0	0	0	0	See Section 2304.11.2	0	0
Floor construction and associated secondary structural members (see Section 202)	2	2	1	0	1	0	2	2	2	HT	1	0
Roof construction and associated secondary structural members (see Section 202)	1 ^{1/2, b}	1 ^{b, c}	1 ^{b, c}	0 ^c	1 ^{b, c}	0	1 ^{1/2}	1	1	HT	1 ^{b, c}	0

Key Early Design Decisions

Fire-Resistance Ratings (FRR)

- » Thinner panels (i.e. 3-ply) generally difficult to achieve a 1+ hour FRR
- » 5-ply CLT / 2x6 NLT & DLT panels can usually achieve a 1- or 2-hour FRR
- » Construction Type | FRR | Member Size | Grid (or re-arrange that process but follow how one impacts the others)

Panel	Common Floor Span Ranges*	
	Single Span	Multi-Span
3 ply CLT (4 1/8")	10 to 13 ft	12 to 15 ft
5 ply CLT (6 7/8")	15 to 18 ft	18 to 21 ft
4" SCL CLT	10 to 13 ft	12 to 15 ft
6" SCL CLT	14 to 18 ft	17 to 21 ft
2x4 NLT/DLT (3 1/2")	10 to 12 ft	12 to 14 ft
2x6 NLT/DLT (5 1/2")	15 to 17 ft	17 to 20 ft
3 1/8" GLT	9 to 11 ft	10 to 13 ft
5 1/8" GLT	14 to 16 ft	16 to 19 ft

*Examples from efficient framing layouts in business, educational and residential occupancies. NOT for final design. Allowable spans depend on loading, grade and layup of panel, and performance



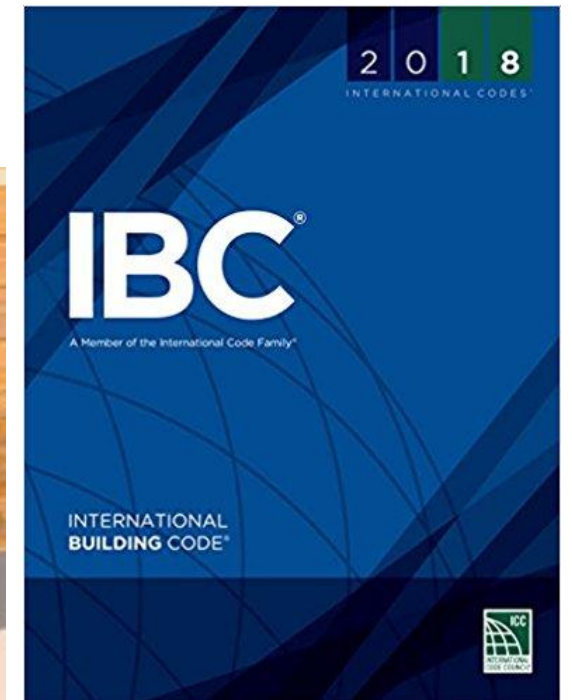
Photo: David Barber, ARUP

Key Early Design Decisions

Construction type influences FRR

- Type IV-HT Construction
 - (minimum sizes: Section 2304.11)
- **Other than type IV-HT**: Demonstrated fire resistance

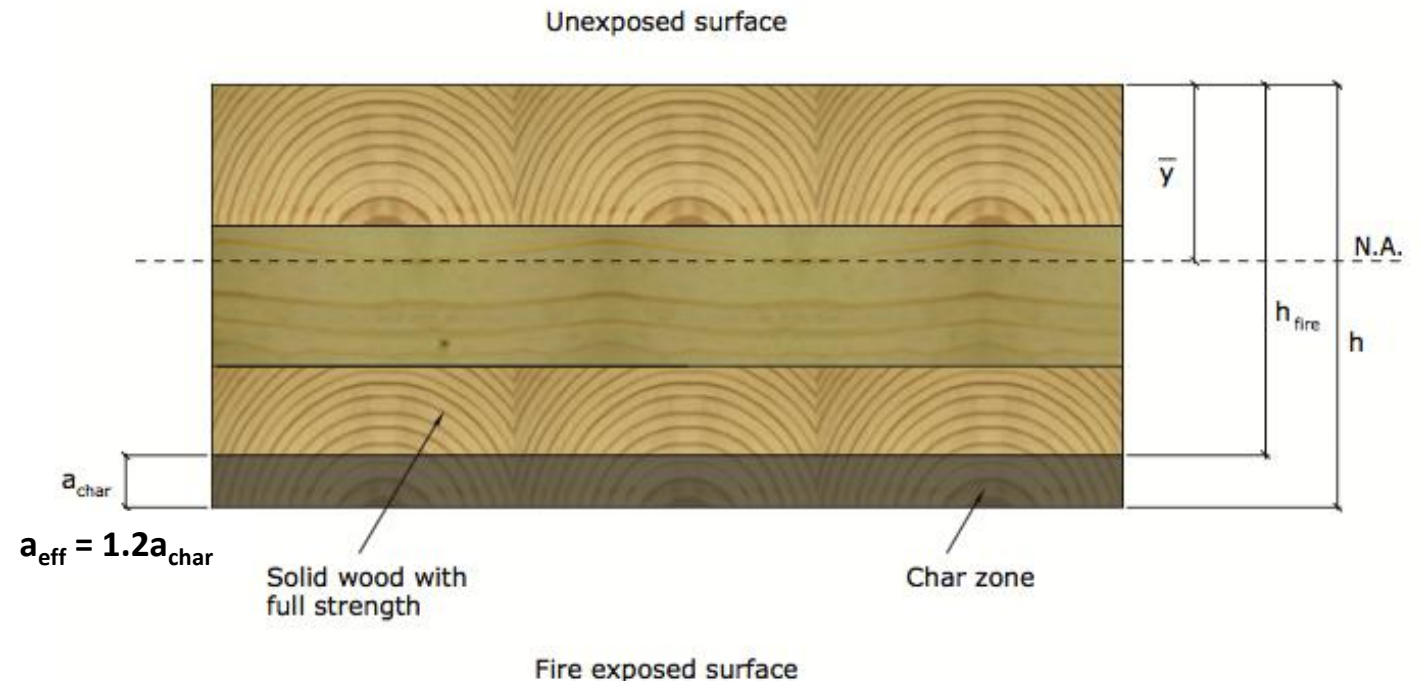
Method of demonstrating FRR (calculations or testing)
can impact member sizing



Construction type influences FRR

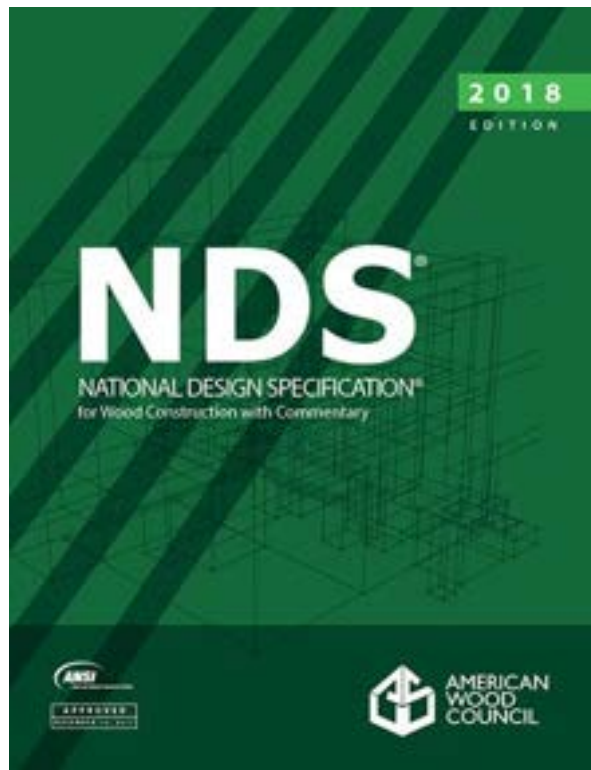
Which Method of Demonstrating FRR of MT is Being Used?

- » Calculations in Accordance with IBC 722 → NDS Chapter 16
- » Tests in Accordance with ASTM E119



FRR Design of MT

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



FIRE DESIGN OF WOOD MEMBERS	
16.1 General	150
16.2 Design Procedures for Exposed Wood Members	150
16.3 Wood Connections	151
Table 16.2.1 Effective Char Rates and Char Layer Thicknesses (for $E_c \geq 1.5 \text{ kN/m}^2$)	150
Table 16.2.2 Adjustment Factors for Fire Design	151



FRR Design of MT

Nominal char rate of 1.5”/HR is recognized in NDS. Effective char depth calculated to account for duration, structural reduction in heat-affected zone



Credit: ARUP

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

Required Fire Resistance (hr.)	Char Depth, a_{char} (in.)	Effective Char Depth, a_{eff} (in.)
1-Hour	1.5	1.8
1½-Hour	2.1	2.5
2-Hour	2.6	3.2

Table 16.2.1B Effective Char Depths (for CLT with $\beta_n=1.5$ in./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

FRR Design of MT

Tested FRR of Exposed MT:

Many successful Mass Timber ASTM E119 fire tests have been completed by industry & manufacturers

Fire Testing Laboratory
NGC Testing Services
IAS Accredited Testing Laboratory TL-216

TEST REPORT
for
American Wood Council
222 Caloctin Circle SE, Suite 201
Leesburg, VA 20175

Standard Methods of
Fire Tests of Building Construction and Materials
ASTM E 119 - 11a

Page 1 of 53

Test Report No: WP-1850
Assignment No: K-1089
Subject Material: Cross-Laminated Timber and Gypsum Board Wall Assembly (Load-Bearing)
Test Date: October 4, 2012
Report Date: October 15, 2012

Prepared by: Michael J. Pilla
Test Engineer

Reviewed by: Robert J. Menchetti
Director, Laboratory Facilities and Testing Services

The results reported in this document apply to specific samples submitted for measurement. No responsibility is assumed for performance of any other specimen. This report may not be reproduced, except in full, without the written approval of the laboratory. The laboratory's test report is its way of certifying or implying product certification, approval or endorsement by the laboratory.

Intertek

REPORT NUMBER: 102891256SAT-001
ORIGINAL ISSUE DATE: February 27, 2017
REVISED DATE: N/A

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RENDERED TO
Structurlam Products LP
2176 Government Street
Penticton, BC V2A 8B5
Canada

TEST REPORT

PRODUCT EVALUATED: CrossLam® CLT Un-restrained Load-Bearing Floor/Ceiling Assembly
EVALUATION PROPERTY: Fire Resistance

Report of Testing a CrossLam® CLT Un-restrained Load-Bearing Floor/Ceiling Assembly for compliance with the applicable requirements of the following criteria: ASTM E119-16a, Standard Test Methods for Fire Tests of Building Construction and

FPInnovations
NRC-CNRC

Project No. 301066155
Final Report 2012/13

Preliminary CLT Fire Resistance Testing Report

by
Lindsay Osborne, M.A.Sc.
Christian Dagenais, Eng., M.Sc.
Scientists
Advanced Building Systems - Serviceability and Fire Group

and
Neuroddine Binichou, Ph.D.
Senior Research Officer
National Research Council of Canada - Fire Research Resource Centre

July 2012

WoodWorks Inventory of Fire Tested MT Assemblies

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



CLT Panel	Manufacturer	CLT Grade or Major x Minor Grade	Coiling 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 1450 Fb 1.5 EMSR 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)	Strucorlam	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	EI	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	EI	1 layer of 5/8" Type X gypsum under Z-channels and furring strips with 3 5/8" Rhombarc joists	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	EI	None	Topside Spline	3/4 in. proprietary gypcrete over Maxxon acoustical mat	Reduced 50% Moment Capacity	1.5	3	UL
5-ply CLT (175mm 6.875")	Nordic	EI	1 layer 5/8" normal gypsum	Topside Spline	3/4 in. proprietary gypcrete over Maxxon acoustical mat or proprietary sound board	Reduced 50% Moment Capacity	2	4	UL
5-ply CLT (175mm 6.875")	Nordic	EI	1 layer 5/8" Type X Gyp under Resilient Channel under 7 3/8" I-Joists with 3 1/2" Mineral Wool between Joists	Half-Lap	None	Loaded, See Manufacturer	2	21	Intertek 8/24/2012
5-ply CLT (175mm 6.875")	Strucorlam	EI 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	VI	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")	Strucorlam	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")	Strucorlam	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	VI	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	VI	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 (148mm 5.827")	KLH	CV3M1	None	Half-Lap & Topside Spline	None	Loaded, See Manufacturer	1	18	SwRI

FRR Design of MT

Method of demonstrating FRR (calculations or testing) can impact member sizing

Each has unique benefits:

- » **Testing:**

- » Can result in higher FRR for some assemblies when compared to calculations (i.e. 2-hr FRR with 5-ply CLT panel).
- » Seen as more acceptable by some building officials

- » **Calculations:**

- » Can provide more design flexibility
- » Allows for project span and loading specific analysis



Scott Brannen, PhD, PE, SE
WoodWorks / Wood Products Council

Fire Design of Mass Timber Structural Members

Demonstrating Fire-Resistance Ratings of Mass Timber Products

Traditionally, the role of the structural engineer on building projects has focused on structure-related tasks—member sizing, connection detailing, general notes, and specifications for structural components. Design criteria such as fire-resistance ratings (FRR), acoustics, and aesthetics have primarily been the architect's domain. However, when it comes to mass timber, the structure often contributes to the building's passive fire resistance. This can happen when the structure is functioning as an exposed finish or when partial fire resistance is provided by a covering over the timber and the rest is provided by the timber itself. This combination of structure, finish, and fire resistance makes the mass timber design process a necessarily collaborative effort between architect and engineer.

This paper presents several methods for demonstrating the FRR of a mass timber element, particularly when the mass timber structural members are required to be fire-resistance-rated. These elements include horizontal assemblies (floors, roofs) and walls, which serve both structural and fire containment purposes, and structural members such as beams and columns where the purpose is merely structural. While much of the information is introductory, it covers how to evaluate the suitability of tested horizontal cross-laminated timber (CLT) assemblies with reduced

load ratings for different spans and loading conditions and the different models for calculating structural FRRs of nail-protected timber (NLT).

Sources of FRR Requirements

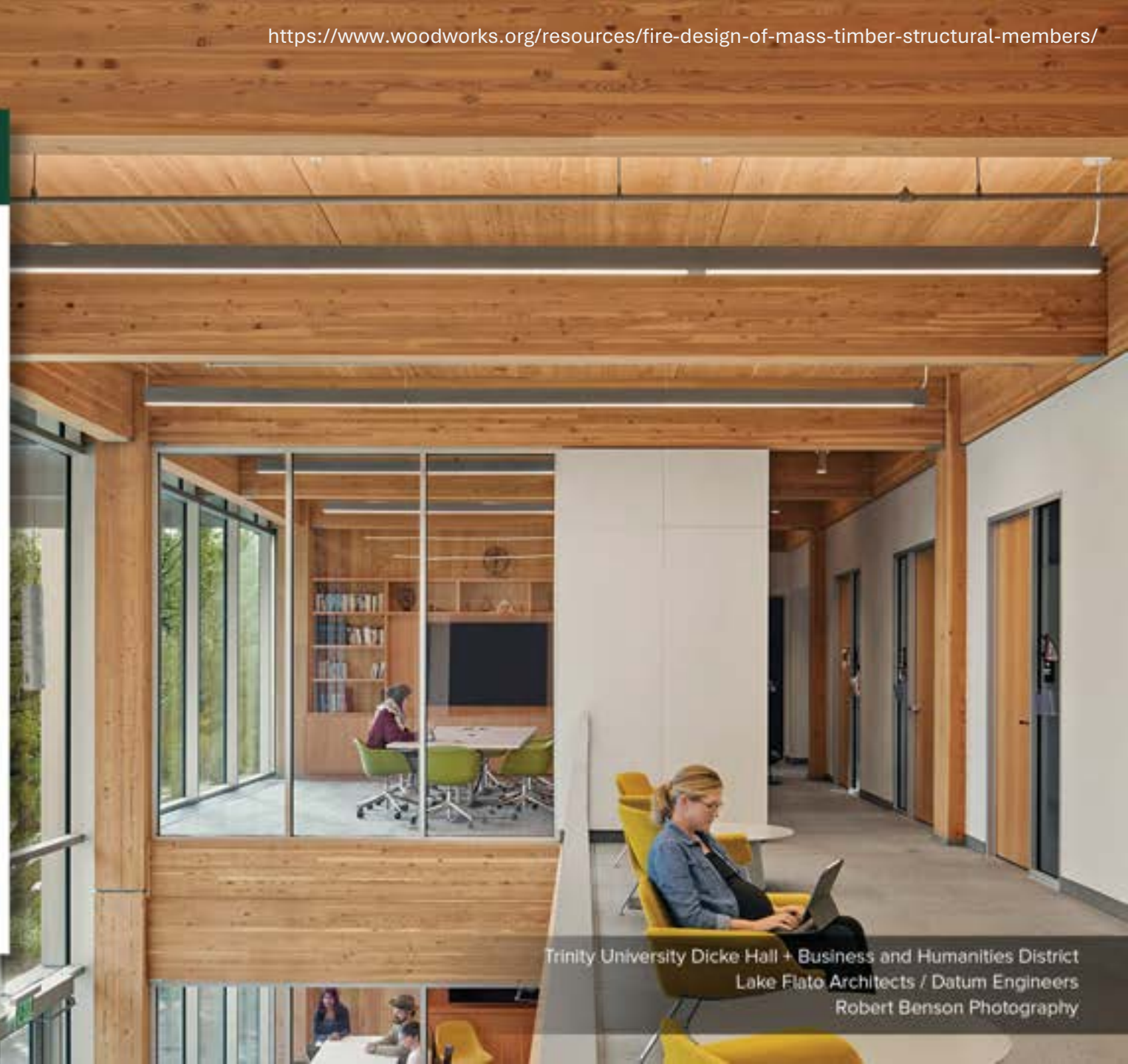
For buildings designed under the International Building Code (IBC), construction type is one of the major determinants of which timber products can be used, whether the timber products can be left exposed to view, and the FRR requirements for building elements, including

those constructed with mass timber products. For information on selecting construction type and determining the FRR of building elements, see the IBC and the WoodWorks publication, *Fire Requirements for Mass Timber Elements: Code Applications, Construction Types, and Fire Ratings*. The latter provides a detailed review of the sources and types of the requirements, applicable to mass timber buildings.

Generally, the IBC requires lower FRRs for smaller buildings and higher FRRs for larger buildings, using business occupancies (B) as an example. Protected construction is allowed in some buildings up to four stories (Type II-A) and 1-hour rated construction is permitted in some buildings up to six stories (Type III-A). For the newer Type IV-C and IV-B construction types, which can be a



Robert Benson Photography



Trinity University Dicke Hall + Business and Humanities District
Lake Flato Architects / Datum Engineers
Robert Benson Photography

Outline

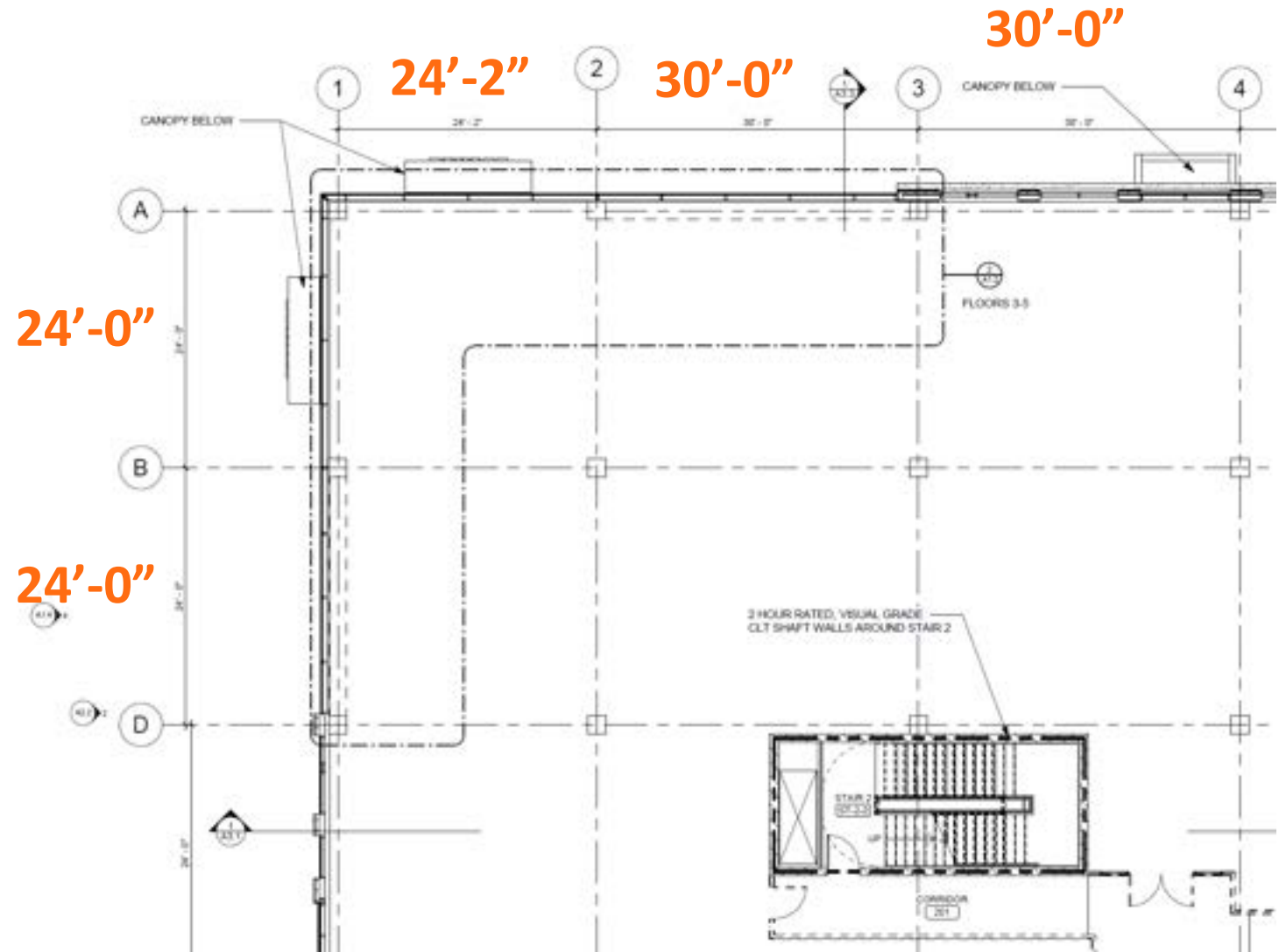
- » Key Early Design Decisions
- » Construction Types
- » Fire Design
- **Structural Grid**
 - » Connections
 - » Penetrations & Firestopping
 - » MEP Layout and Integration
 - » Lateral Systems
 - » Acoustics



Structural Grid

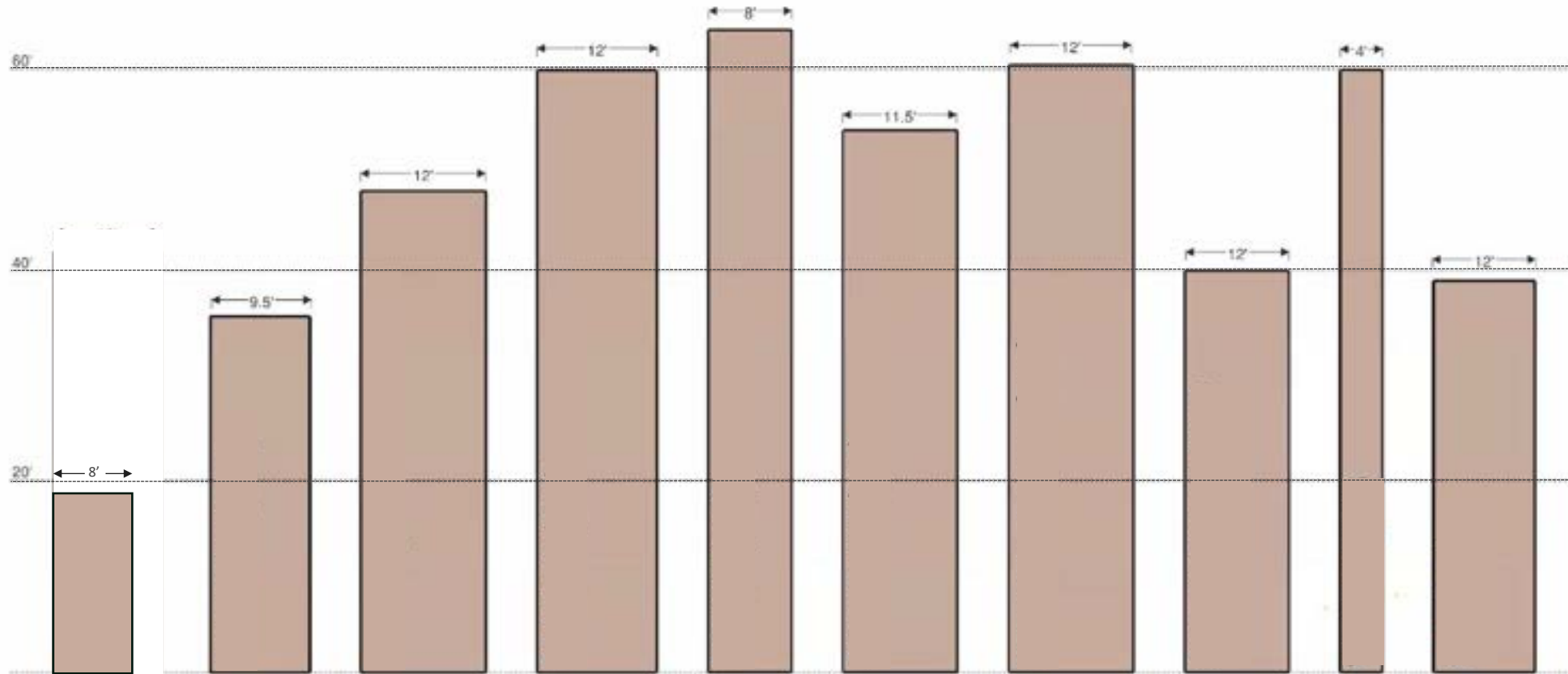
Grids & Spans

- » Consider Efficient Layouts
- » Repetition & Scale
- » Manufacturer Panel Sizing
- » Transportation



Key questions affecting structural layout:

Size limitations based on manufacturing and transportation: CLT Panel



Credit: TimberLab

Structural Grid

Member Sizes

- » Impact of FRR on Sizing
- » Impact of Sizing on Efficient Spans
- » Consider connections – can drive member sizing

0 HR FRR: Consider 3-ply Panel

- » Efficient Spans of 10-12 ft
- » Grids of 20x20 (1 purlin) to 30x30 (2 purlins) may be efficient



Platte Fifteen, Denver, CO
30x30 Grid, 2 purlins per bay
3-ply CLT
Image: JC Buck

Structural Grid

Member Sizes

- » Impact of FRR on Sizing
- » Impact of Sizing on Efficient Spans
- » Consider connections – can drive member sizing

1 or 2 HR FRR: Likely 5-ply Panel

- » Efficient spans of 14-17 ft
- » Grids of 15x30 (no purlins) to 30x30 (1 purlin) may be efficient



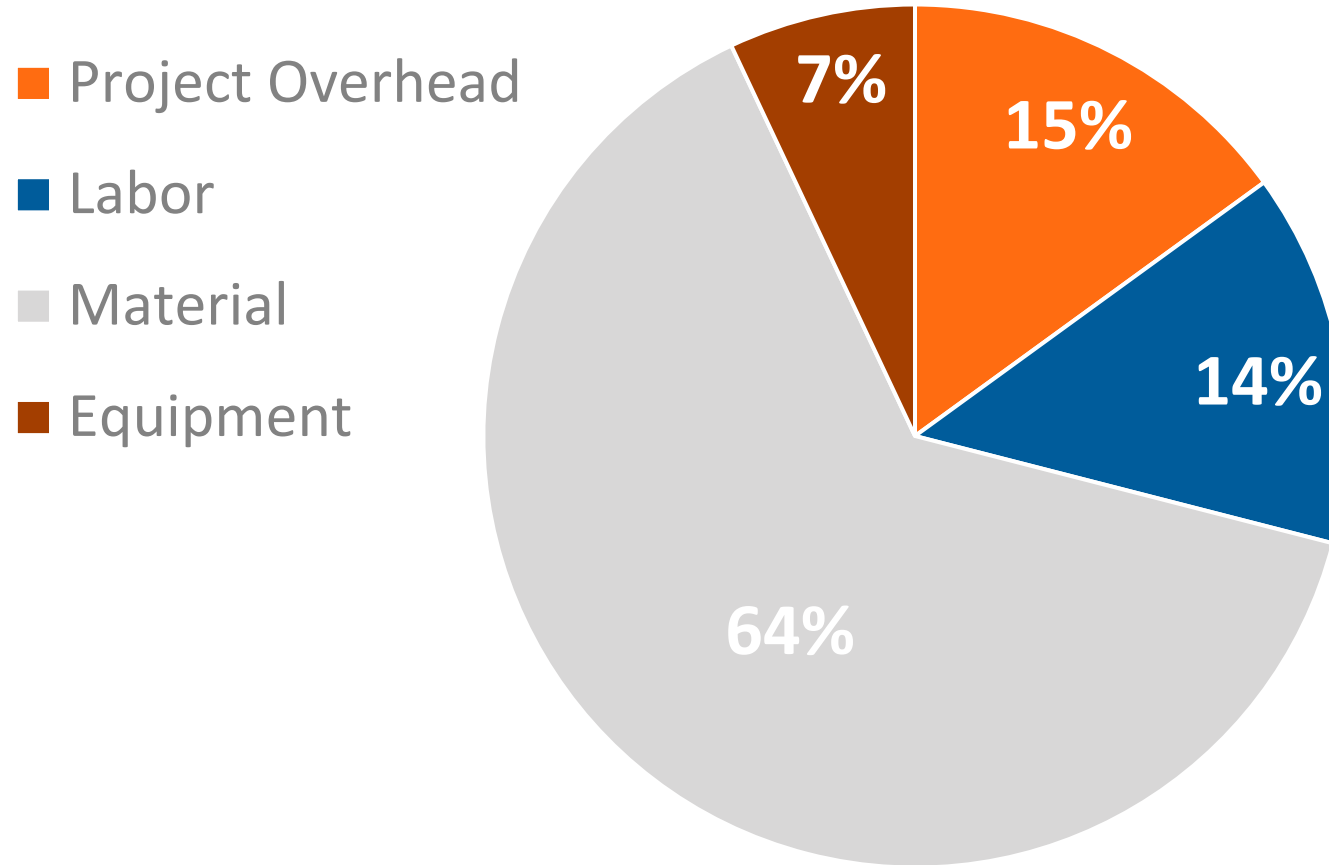
Clay Creative, Portland, OR
30x30 Grid, 1 purlin per bay
2x6 NLT
Image: Mackenzie

Key Early Design Decisions

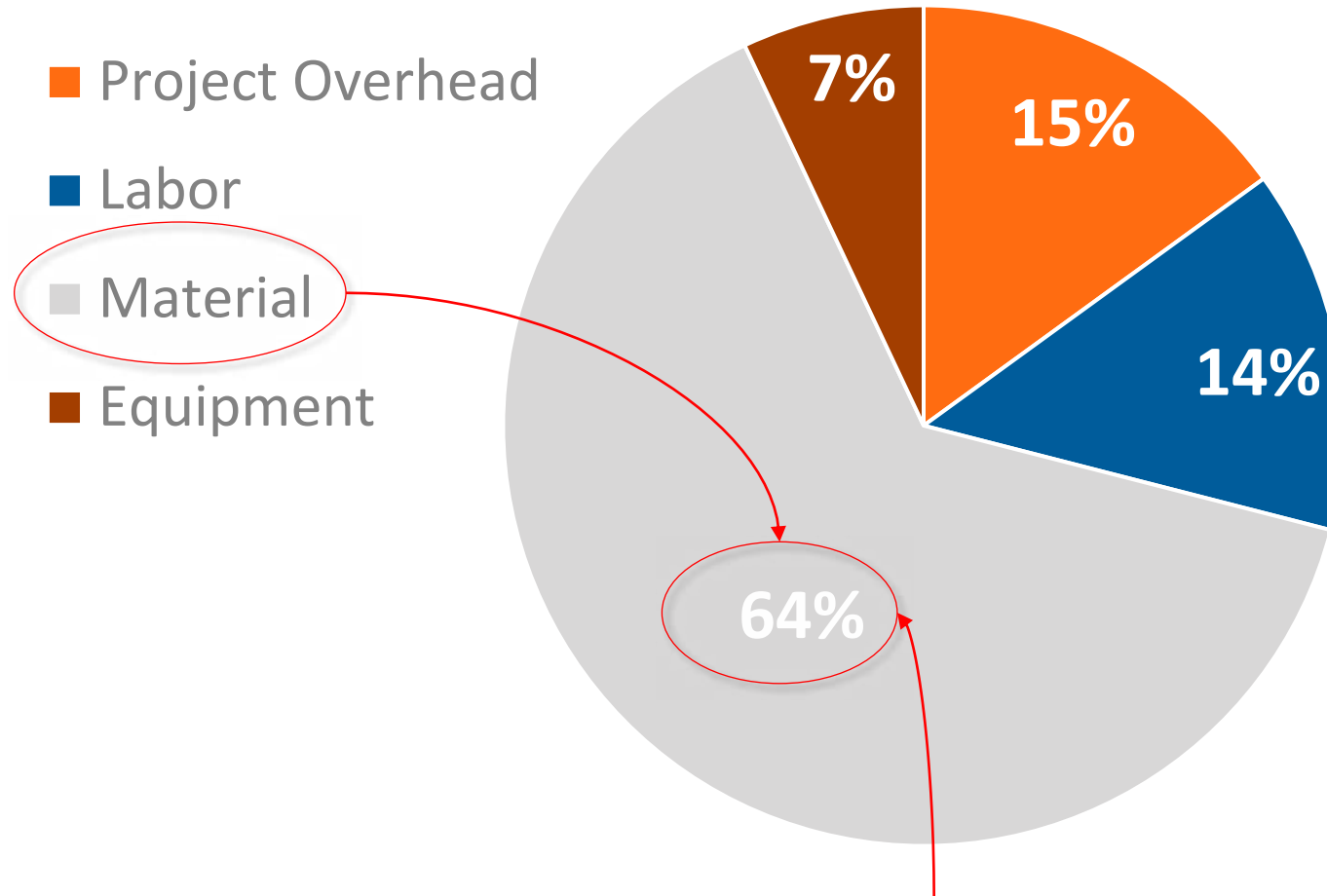
Why so much focus on panel thickness?



Typical MT Package Costs



Typical MT Package Costs



Panels are the biggest part of the biggest piece of the cost pie

Outline

- » Key Early Design Decisions
- » Construction Types
- » Fire Design
- » Structural Grid
- **Connections**
 - » Penetrations & Firestopping
 - » MEP Layout and Integration
 - » Lateral Systems
 - » Acoustics



Connections

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



Photo: John Stamets



Photo: Josh Partee



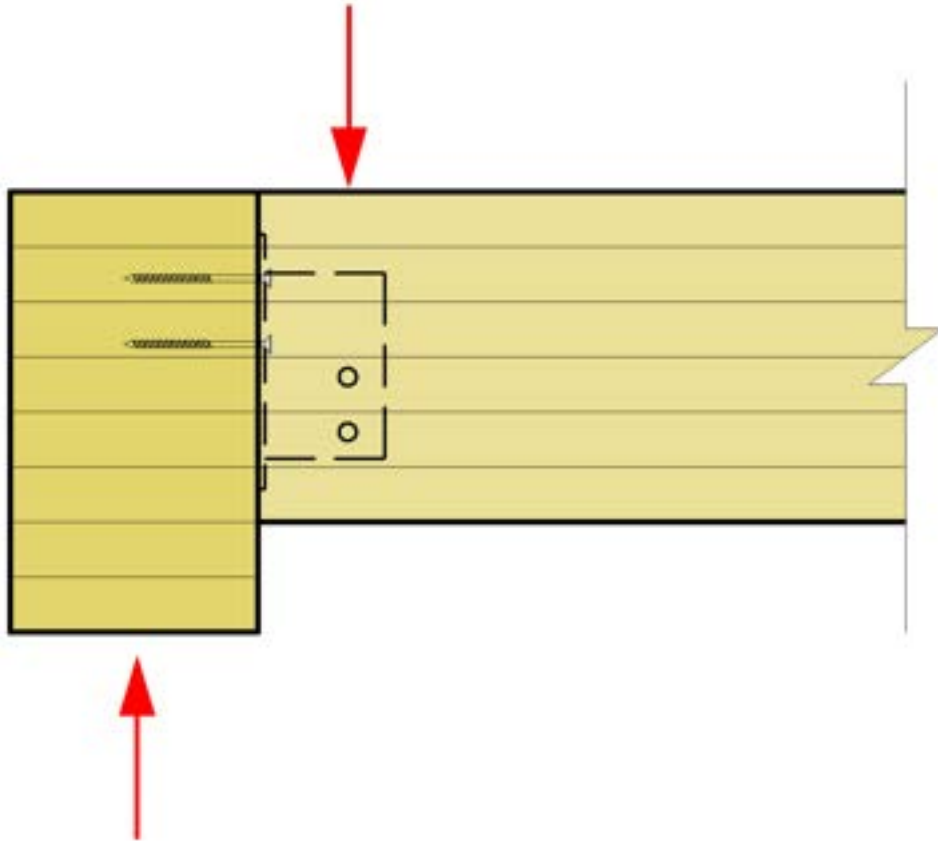
Photo: Christian Columbres



Photo: Blaine Brownell

Connections

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



Connections

Connection FRR and beam reactions could impact required beam/column sizes



Photos: Simpson Strong-Tie

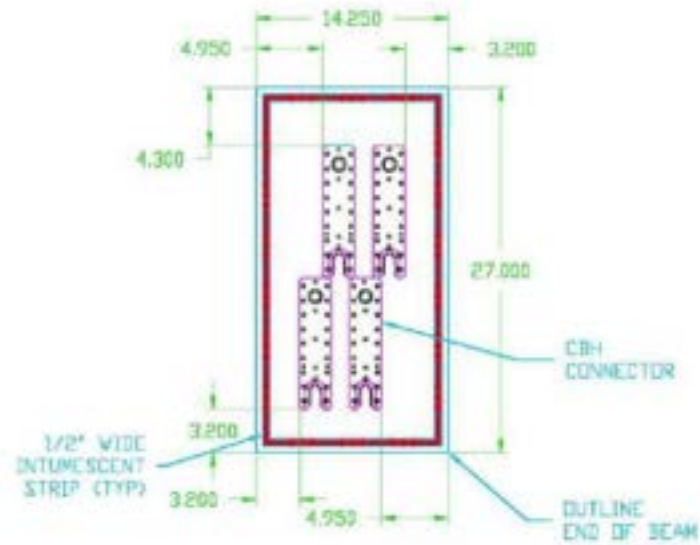


Photo: LEVER Architecture

Key Early Design Decisions

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



Connections

Member to member bearing also commonly used, can avoid some/all steel hardware at connection





WoodWorks Index of Mass Timber Connections

*A compilation of connections
used in mass timber construction*

Platte Fifteen / OZ Architecture / KL&A Engineers & Builders
Photo Alan Ferrin

<https://www.woodworks.org/resources/index-of-mass-timber-connections/>

Outline

- » Key Early Design Decisions
- » Construction Types
- » Fire Design
- » Structural Grid
- » Connections
- **Penetrations & Firestopping**
 - » MEP Layout and Integration
 - » Lateral Systems
 - » Acoustics



Photo: Alex Schreyer

Penetrations & Firestopping

Construction Type Impacts FRR | FRR impacts penetration firestopping requirements

714.1.1 Ducts and air transfer openings. Penetrations of fire-resistance-rated walls by ducts that are not protected with *dampers* shall comply with Sections 714.3 through 714.4.3. Penetrations of *horizontal assemblies* not protected with a shaft as permitted by Section 717.6, and not required to be protected with *fire dampers* by other sections of this code, shall comply with Sections 714.5 through 714.6.2. Ducts and air transfer openings that are protected with *dampers* shall comply with Section 717.

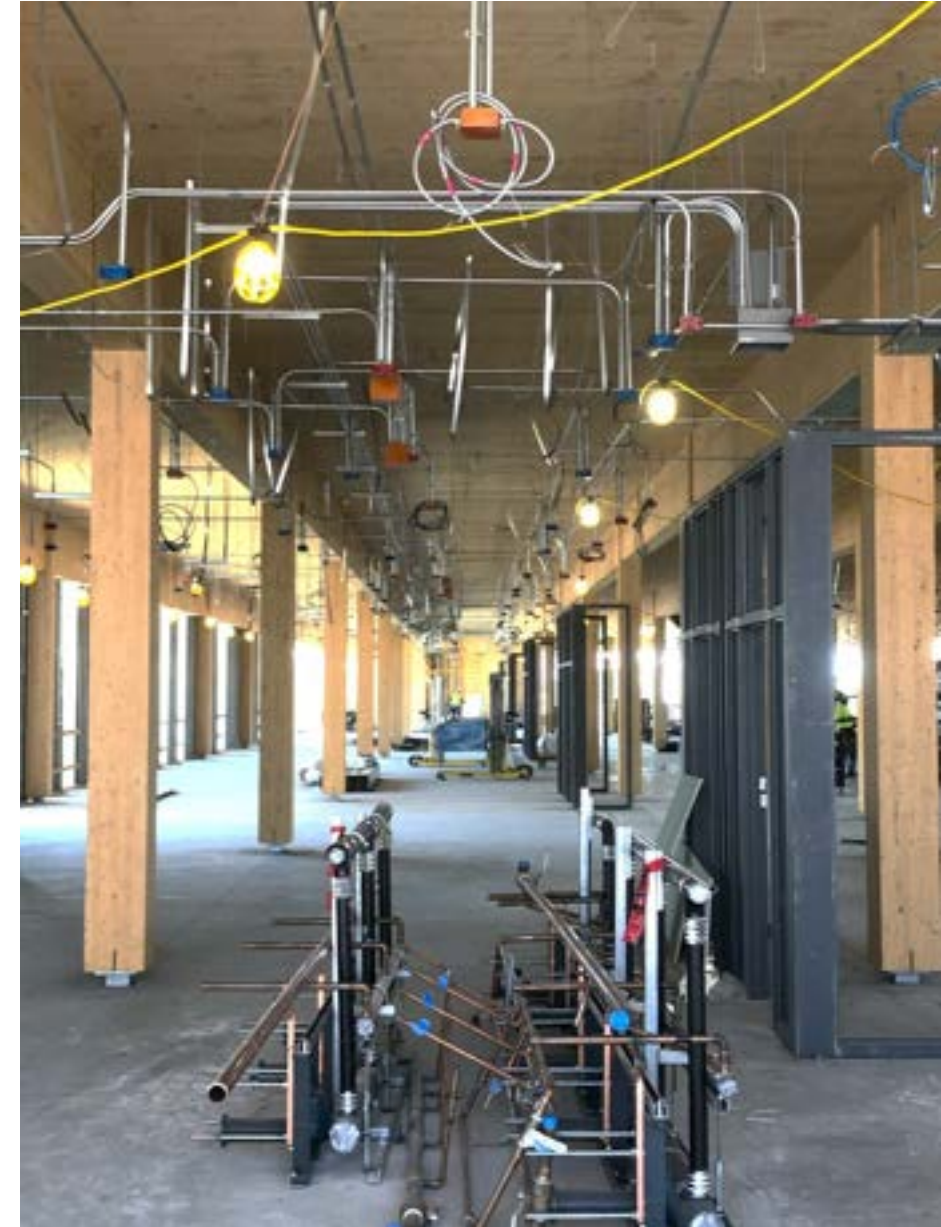


Penetrations & Firestopping

Code options for firestopping through penetrations

714.4.1.1 Fire-resistance-rated assemblies. *Through penetrations* shall be protected using systems installed as tested in the *approved* fire-resistance-rated assembly.

714.4.1.2 Through-penetration firestop system. *Through penetrations* shall be protected by an *approved penetration firestop* system installed as tested in accordance with ASTM E814 or UL 1479, with a minimum positive pressure differential of 0.01 inch (2.49 Pa) of water and shall have an *F rating* of not less than the required *fire-resistance rating* of the wall penetrated.



Penetrations & Firestopping

Option 1: MT penetration firestopping via tested products

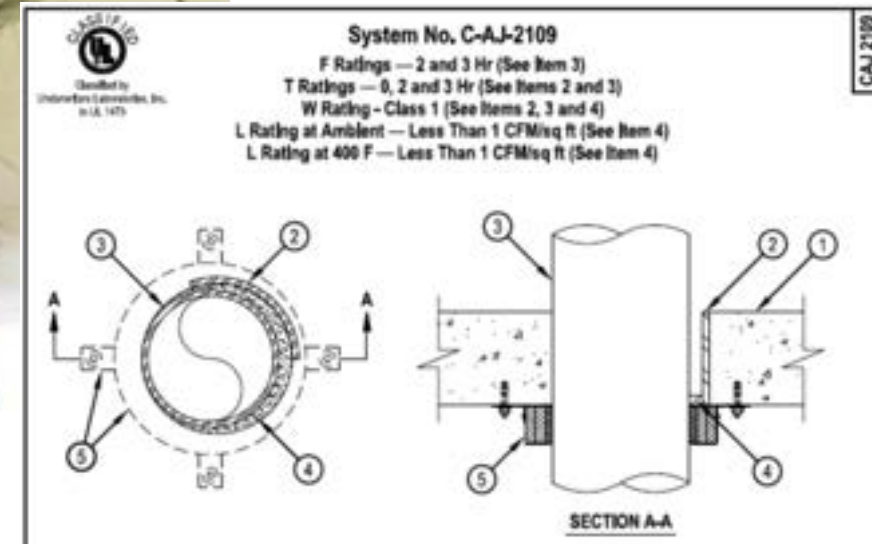
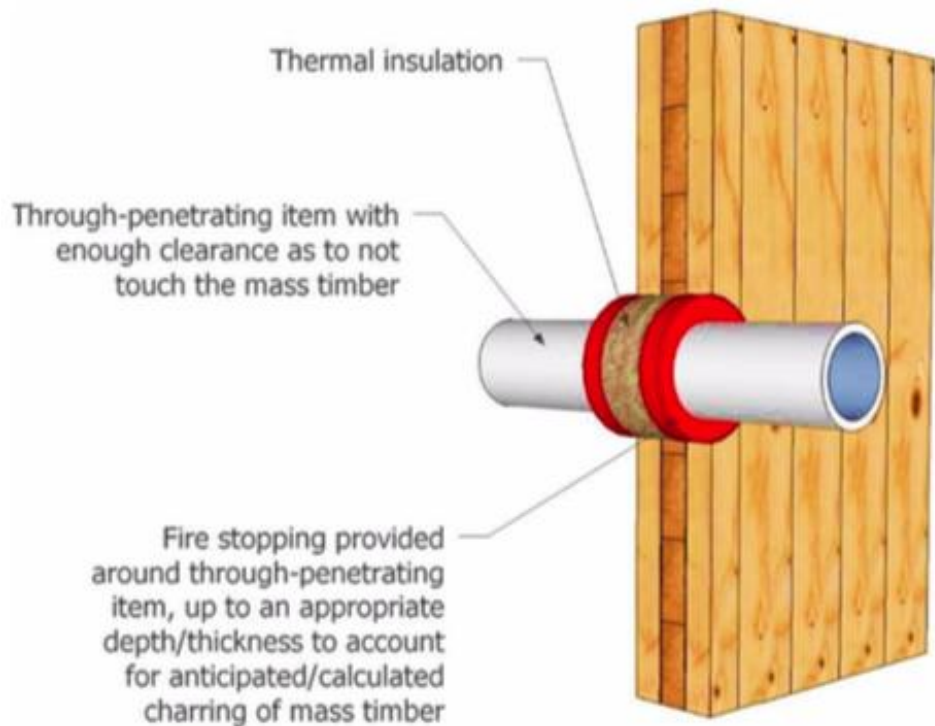


Photos: AWC/FPInnovations



Penetrations & Firestopping

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



Penetrations & Firestopping

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CHEMISTRY AND CHEMICAL ENGINEERING DIVISION

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FIRE RESISTANCE PERFORMANCE EVALUATION OF A PENETRATION FIRESTOP SYSTEM TESTED IN ACCORDANCE WITH ASTM E814-13A, STANDARD TEST METHOD FOR FIRE TESTS OF PENETRATION FIRESTOP SYSTEMS

FINAL REPORT
Consisting of 18 Pages

SwRI® Project No. 01.21428.01.001a
Test Date: September 30, 2015
Report Date: October 22, 2015

Prepared for:

American Wood Council
222 Catoctin Circle SE
Leesburg, VA 20175



FIRE PERFORMANCE OF FIRESTOPS, PENETRATIONS, AND FIRE DOORS IN MASS TIMBER ASSEMBLIES

Lindsay Ranger¹, Christian Dagenais¹, Conroy Lum¹, Tony Thomas¹

ABSTRACT: Integrity and continuity must be maintained for fire separations required to provide fire resistance to prevent passage of hot gases or increased temperature on the unexposed side. Vulnerable locations, where penetrations are introduced into mass timber systems, are susceptible to fire spread. Service and closure penetrations through mass timber fire separation have been investigated. Many of the fire stop systems were able to achieve 1-hr fire resistance in accordance with CAN/ULC-S115, which would be required for 2-hr fire resistance rated assemblies, such as in tall wood buildings. Construction details are outlined which ensure adequate fire performance of these penetrations.

KEYWORDS: Firestop, through-penetrations, fire rated door, mass timber, cross-laminated timber, tall wood buildings, fire resistance

1 INTRODUCTION

Many tall wood buildings using mass timber are planned or are currently being designed for construction around the world. A few have been built in Canada, including an 18 storey cross-laminated timber (CLT) and glulam building in British Columbia. The prescriptive requirements in the National Building Code of Canada (NBCC) [1] do not (yet) permit the construction of wood buildings taller than six stories, however an alternative solutions approach can be used to demonstrate equivalent performance to prescriptive acceptable solutions requiring noncombustible construction. The

construction, as well as in several alternative building designs.

Although the general fire performance of mass timber is well documented, there are still several areas that warrant further investigation to ensure that safety levels are met and a number of solutions are available for designers to use. Generating generic assemblies will reduce the need for testing completed on an individual construction which will help ease the approvals process and encourage widespread adoption of tall wood building



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FIRESTOPPING TEST WITNESS REPORT

for

NORDIC STRUCTURES

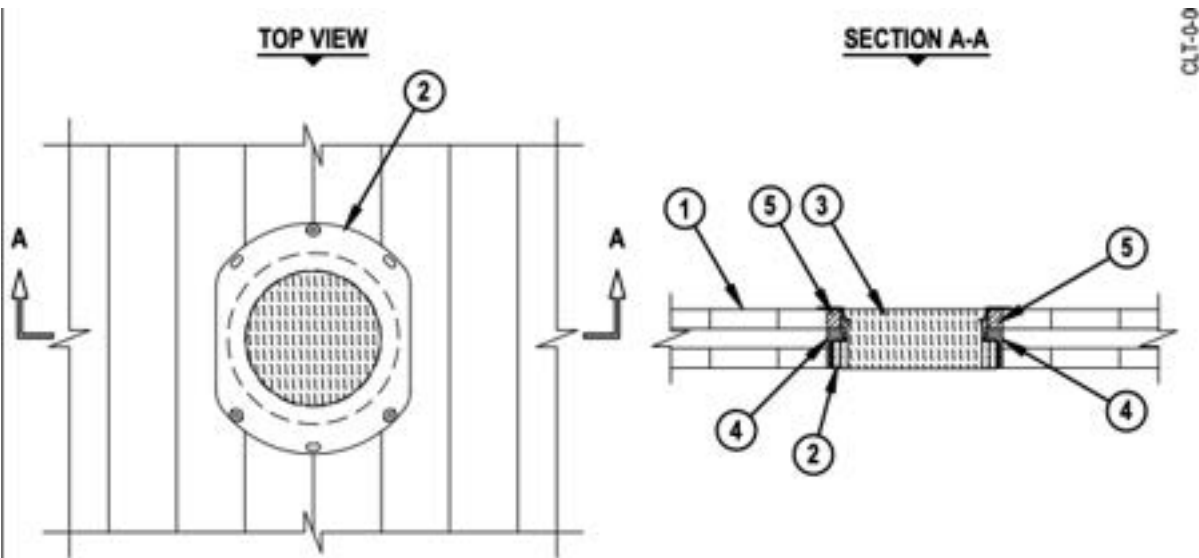
Inventory of Fire Tested Penetrations in MT Assemblies

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

CLT Panel	Exposed Side Protection	Penetrating Item	Penetrant Centered or Offset in Hole	Firestopping System Description	F Rating	T Rating	Stated Test Protocol	Source	Testing Lab
3-ply (78mm 3.07")	None	1.5" diameter data cable bunch	Centered	3.5 in. diameter hole. Mineral wool was installed in the 1 in. annular space around the data cables to a total depth of approximately 2 – 5/64 in. The remaining 1 in. annular space from the top of the mineral wool to the top of the floor assembly was filled with Hilti FS-One Max caulking.	1 hour	0.5 hour	CANULC S115	26	Intertek March 30, 2016
3-ply (78mm 3.07")	None	2" copper pipe	Centered	4.375 in. diameter hole. Pipe wrap was installed around the copper pipe to a total depth of approximately 2 – 5/64 in. The remaining 1 in. annular space starting at the top of the mineral wool to the top of the floor assembly was filled with Hilti FS-One Max caulking.	1 hour	NA	CANULC S115	26	Intertek March 30, 2016
3-ply (78mm 3.07")	None	2.5" sched. 40 pipe	Centered	4.92 in. diameter hole. Pipe wrap was installed around the schedule 40 pipe to a total depth of approximately 2 – 5/64 in. The remaining 1 in. annular space starting at the top of the pipe wrap to the top of the floor assembly was filled with Hilti FS-One Max caulking.	1 hour	NA	CANULC S115	26	Intertek March 30, 2016
3-ply (78mm 3.07")	None	6" cast iron pipe	Centered	8.35 in. diameter hole. Mineral wool was installed in the 1 in. annular space around the cast iron pipe to a total depth of approximately 2 – 5/64 in. The remaining 1 in. annular space starting at the top of the pipe wrap to the top of the floor assembly was filled with Hilti FS-One Max caulking.	1 hour	NA	CANULC S115	26	Intertek March 30, 2016
3-ply (78mm 3.07")	None	Hilti 6 in. drop in device. System No.: F-B-2049	Centered	9.01" diameter hole. Mineral wool was installed in the 1 – 1/8 in. annular space around the drop-in device to a total depth of approximately 1 – 7/64 in. and the remaining 1 in. annular space from the top of the mineral wool to the top edge of the 9 – 1/64 in. hole in the CLT was filled with Hilti FS-One Max caulking.	1 hour	0.75 hour	CANULC S115	26	Intertek March 30, 2016
5-ply CLT (131mm 5.16")	None	1.5" diameter data cable bunch	Centered	3.5" diameter hole. Mineral wool was installed in the 1 in. annular space around the data cables to a total depth of approximately 4 – 5/32 in. The remaining 1 in. annular space from the top of the mineral wool to the top of the floor assembly was filled with Hilti FS-One Max caulking.	2 hours	1.5 hours	CANULC S115	26	Intertek March 30, 2016
5-ply CLT (131mm 5.16")	None	2" copper pipe	Centered	4.375 in. diameter hole. Pipe wrap was installed around the copper pipe to a total depth of approximately 4 – 5/32 in. The remaining 1 in. annular space starting at the top of the mineral wool to the top of the floor assembly was filled with Hilti FS-One Max caulking.	2 hours	NA	CANULC S115	26	Intertek March 30, 2016
5-ply CLT (131mm 5.16")	None	2.5" sched. 40 pipe	Centered	4.92 in. diameter hole. Pipe wrap was installed around the schedule 40 pipe to a total depth of approximately 4 – 5/32 in. The remaining 1 in. annular space starting at the top of the pipe wrap to the top of the floor assembly was filled with Hilti FS-One Max caulking.	2 hours	0.5 hour	CANULC S115	26	Intertek March 30, 2016
5-ply CLT (131mm 5.16")	None	6" cast iron pipe	Centered	8.35 in. diameter hole. Mineral wool was installed in the 1 in. annular space around the cast iron pipe to a total depth of approximately 4 – 5/32 in. The remaining 1 in. annular space starting at the top of the pipe wrap to the top of the floor assembly was filled with Hilti FS-One Max caulking.	2 hours	NA	CANULC S115	26	Intertek March 30, 2016
5-ply CLT (131mm 5.16")	None	Hilti 6 in. drop in device. System No.: F-B-2049	Centered	9.01" diameter hole. Mineral wool was installed in the 1 – 1/8 in. annular space around the drop-in device to a total depth of approximately 1 – 7/64 in. and the remaining 1 in. annular space from the top of the mineral wool to the top edge of the 9 – 1/64 in. hole in the CLT was filled with Hilti FS-One Max caulking.	2 hours	1.5 hours	CANULC S115	26	Intertek March 30, 2016
5-ply (175mm 6.875")	None	1" nominal PVC pipe	Centered	4.21 in. diameter with a 3/4 in. plywood reducer flush with the top of the slab reducing the opening to 2.28 in. Two wraps of Hilti CP 648-E W45/1-3/4" Firestop wrap strip at two locations with a 30 gauge steel sleeve which extended from the top of the slab to 1 in. below the slab. The first location was with the bottom of the wrap strip flush with the bottom of the steel sleeve and the second was with the bottom of the wrap strip 3 in. from the bottom of the slab. The void between the steel sleeve and the CLT and between the steel sleeve and pipe at the top was filled with Roxul Safe mineral wool leaving a 3/4 in. deep void at the top of the assembly. Hilti FS-One Max Intumescent Firestop Sealant was applied to a depth of 3/4 in. on the top of the assembly between the plywood and steel sleeve as well as the steel sleeve and pipe.	2 hours	2 hours	ASTM E814	24	QAI Laboratories March 3, 2017
5-ply (175mm 6.875")	2 layers 5/8" Type X gypsum	1.5 inch O.D. closed PVC pipe	Centered	Hilti System C-AJ-2109 modified: no steel sleeve, 3.5" long wood screws used to attach the collar; pipe placed concentrically within hole; 2.5" sealant depth	2 hours	2 hours	ASTM E814	23	SuRI September 30, 2015

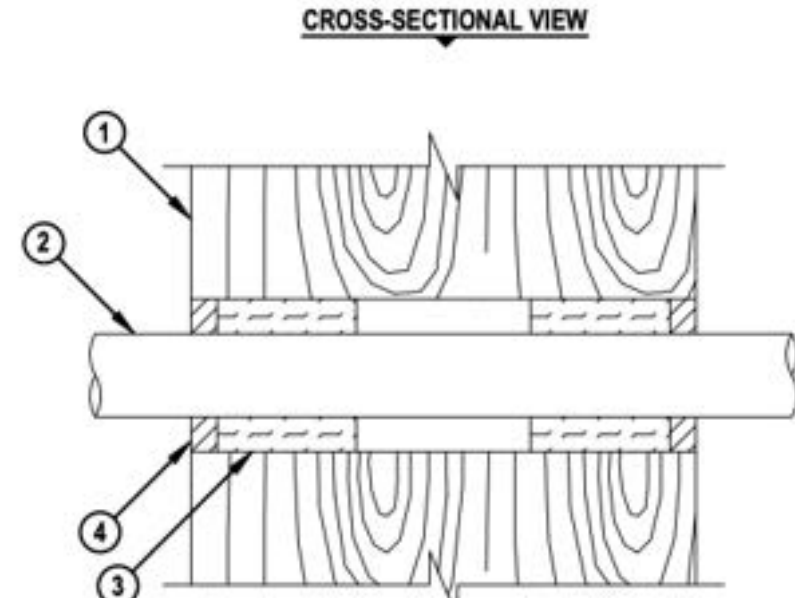
Penetrations & Firestopping

Option 2: MT penetration firestopping of penetrations via engineering judgement details (contact firestop manufacturer)



1. 3-PLY CROSS LAMINATED TIMBER FLOOR ASSEMBLY (MINIMUM 3" THICK) (1-HR. FIRE-RATING).
2. HILTI CFS-DID FIRESTOP DROP-IN DEVICE INSERTED INTO OPENING (SEE TABLE BELOW) AND SECURED TO TOP SURFACE OF CROSS LAMINATED TIMBER FLOOR ASSEMBLY WITH THREE 1/4" x 1" LONG STEEL WOOD SCREWS WITH WASHERS.
3. MINIMUM 3" THICKNESS MINERAL WOOL (MIN. 4 PCF DENSITY) TIGHTLY PACKED, AND FLUSH WITH TOP AND BOTTOM SURFACE OF CFS-DID FIRESTOP DROP-IN DEVICE.
4. MINERAL WOOL (MIN. 4 PCF DENSITY) TIGHTLY PACKED, RECESSED TO ACCOMMODATE SEALANT, AND COMPLETELY FILLING SPACE BETWEEN CFS-DID FIRESTOP DROP-IN DEVICE AND PERIPHERY OF OPENING.
5. MINIMUM 1" DEPTH HILTI FS-ONE MAX INTUMESCENT FIRESTOP SEALANT BETWEEN CFS-DID FIRESTOP DROP IN DEVICE AND PERIPHERY OF OPENING.

F-RATING = 1-HR. OR 2-HR. (SEE NOTE NO. 3 BELOW)

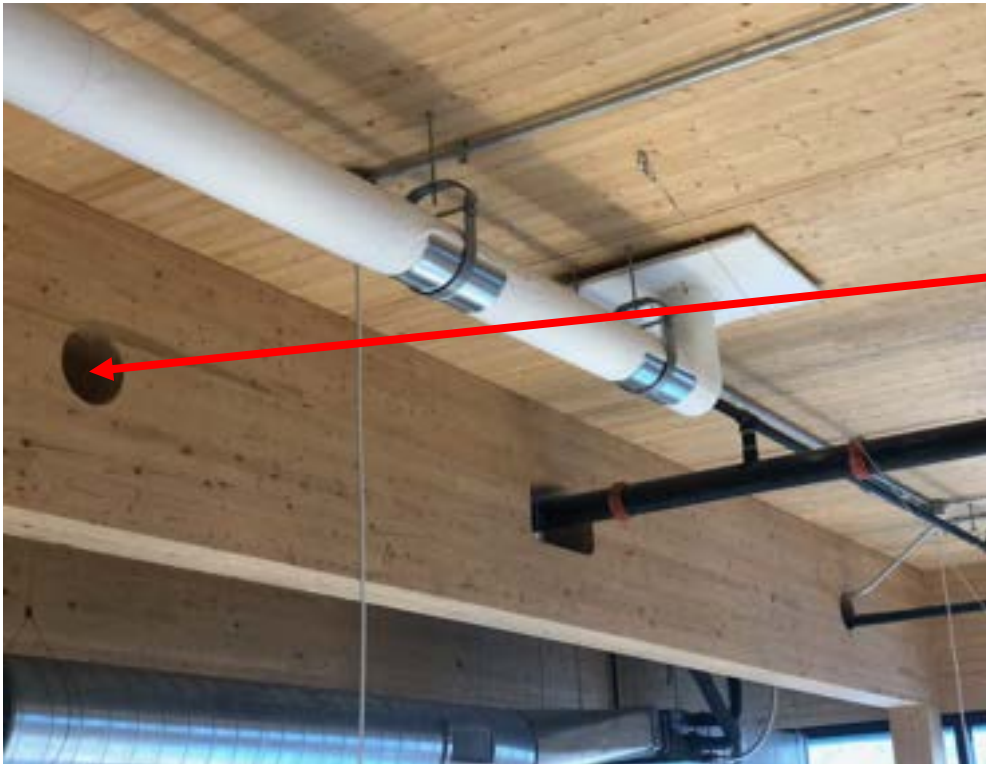


1. MASS TIMBER WALL ASSEMBLY (MINIMUM 12" THICK) (1-HR. OR 2-HR. FIRE-RATING).
2. MAXIMUM 2" NOMINAL DIAMETER PVC PLASTIC PIPE (SCH 40).
3. MINIMUM 4" THICKNESS MINERAL WOOL (MIN. 4 PCF DENSITY) TIGHTLY PACKED AND RECESSED TO ACCOMMODATE SEALANT.
4. MINIMUM 3/4" DEPTH HILTI FS-ONE MAX INTUMESCENT FIRESTOP SEALANT.

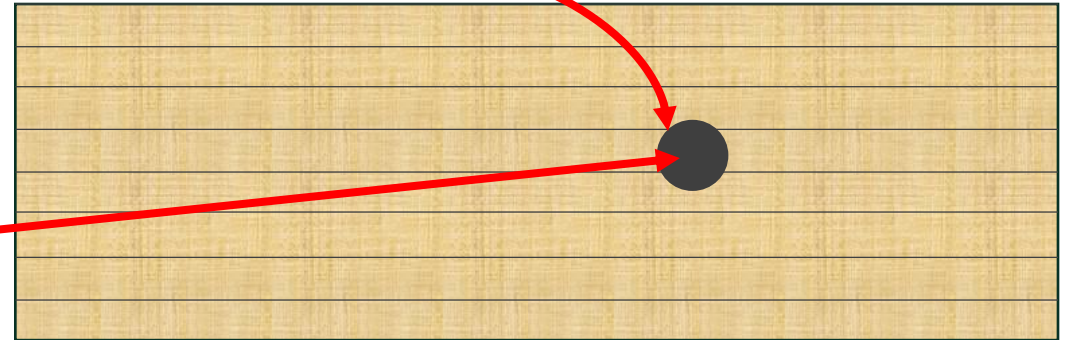
Penetrations & Firestopping

Beam penetrations:

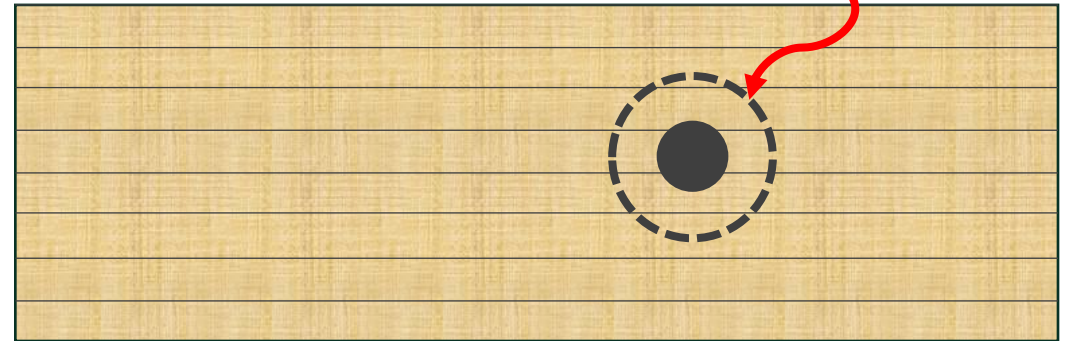
- » If FRR = 0-hr, analyze structural impact of hole diameter only
- » If FRR > 0-hr, account for charred hole diameter or firestop penetration



Hole diameter



Hole diameter after 1-hr char



Outline

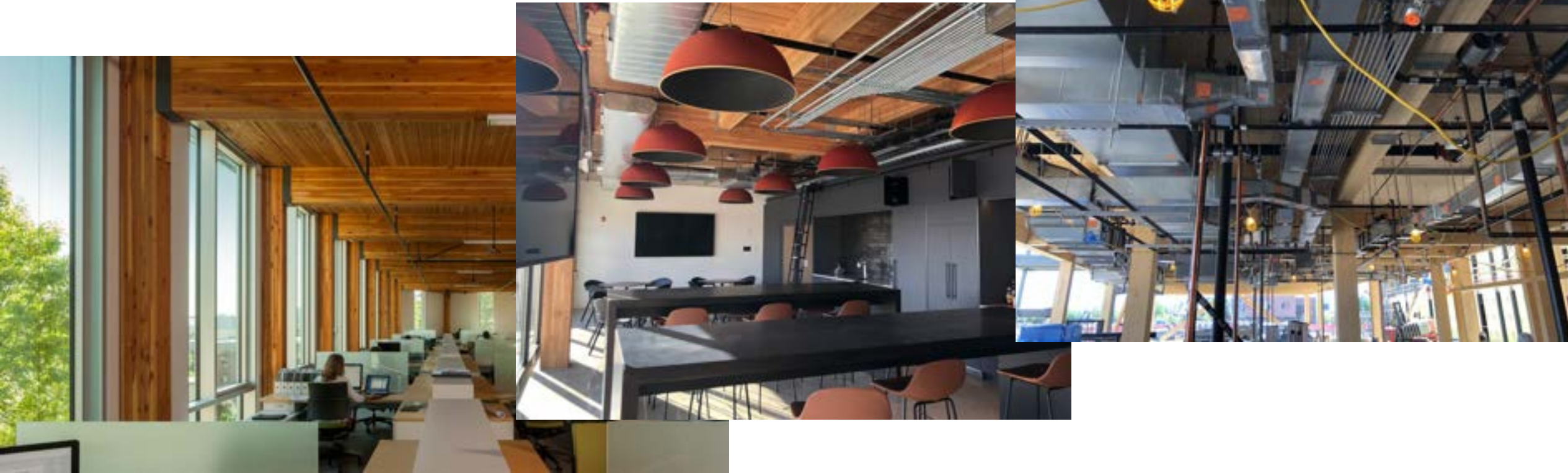
- » Key Early Design Decisions
- » Construction Types
- » Fire Design
- » Structural Grid
- » Connections
- » Penetrations & Firestopping
- **MEP Layout and Integration**
- » Lateral Systems
- » Acoustics



MEP Layout & Integration

Set Realistic Owner Expectations About Aesthetics

- » MEP fully exposed with MT structure, or limited exposure?
- » Also consider acoustic impacts of MEPF routing



MEP Layout & Integration

Smaller grid bays at central core (more head height)

» Main MEP trunk lines around core, smaller branches in exterior bays



Credit: Blaine Brownell



Credit: WoodWorks

MEP Layout & Integration

Dropped below MT framing

- » Can simplify coordination (fewer penetrations)
- » Bigger impact on head height



MEP Layout & Integration

In penetrations through MT framing

- » Requires more coordination (penetrations)
- » Bigger impact on structural capacity of penetrated members
- » Minimal impact on head height



MEP Layout & Integration

In chases above beams and below panels

- » Fewer penetrations
- » Bigger impact on head height (overall structure depth is greater)
- » FRR impacts: top of beam exposure



Credit: JC Buck



Credit: KL&A Engineers & Builders

MEP Layout & Integration

In gaps between MT panels

- » Fewer penetrations, can allow for easier modifications later



Credit: Ema Peter/MGA



Credit: Hacker Architects

MEP Layout & Integration

In gaps between MT panels

- » Aesthetics: often uses ceiling panels to cover gaps
- » Acoustic impacts: rely more on topping



Credit: Ema Peter/MGA

MEP Layout & Integration

In raised access floor (RAF) above MT

- » Aesthetics (minimal exposed MEP)
- » Acoustic impacts (usually thinner topping req'd)



RAF



NON-RAF

MEP Layout & Integration

In raised access floor (RAF) above MT

- » Impact on head height
- » Concealed space code provisions



Credit: Global IFS



MEP Layout & Integration

In topping slab above MT

- » Greater need for coordination prior to slab pour
- » Limitations on what can be placed (thickness of topping slab)
- » No opportunity for renovations later



Outline

- » Key Early Design Decisions
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- » Penetrations & Firestopping
- » MEP Layout and Integration
- **Lateral Systems**
 - » Acoustics
 - » Design Example



Lateral System Choices

Concrete Shear walls

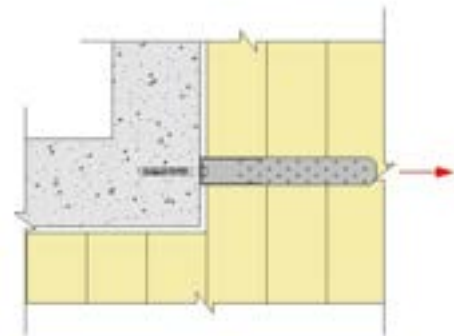
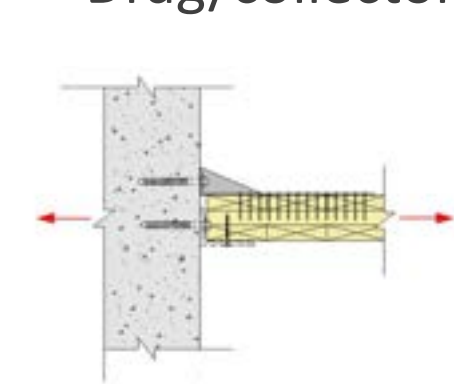


Credit: Hacker Architects

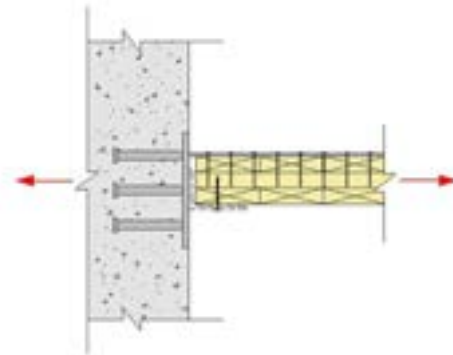
Lateral System Choices

Connections to concrete core

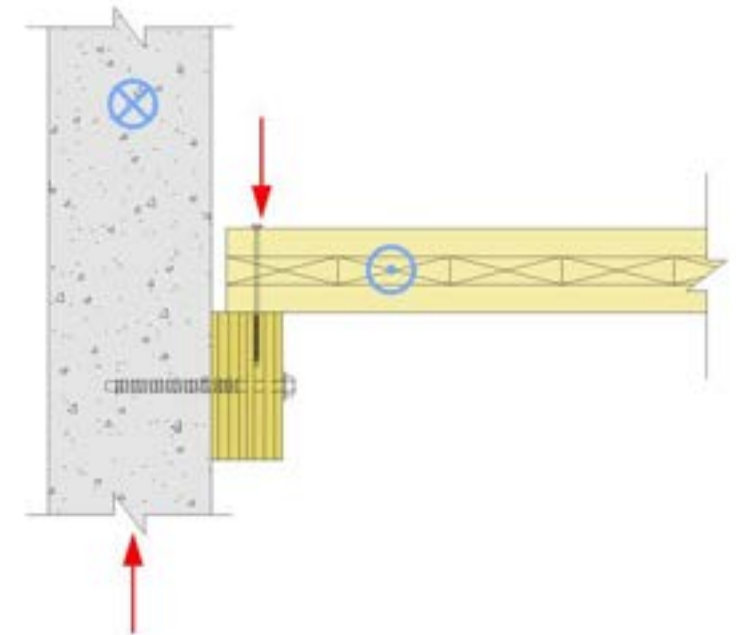
- » Tolerances & adjustability
- » Drag/collector forces



PLAN VIEW



PLAN VIEW



Lateral System Choices

Steel Braced Frame



Lateral System Choices

Connections to steel frame

- » Tolerances & adjustability
- » Consider temperature fluctuations
- » Ease of installation

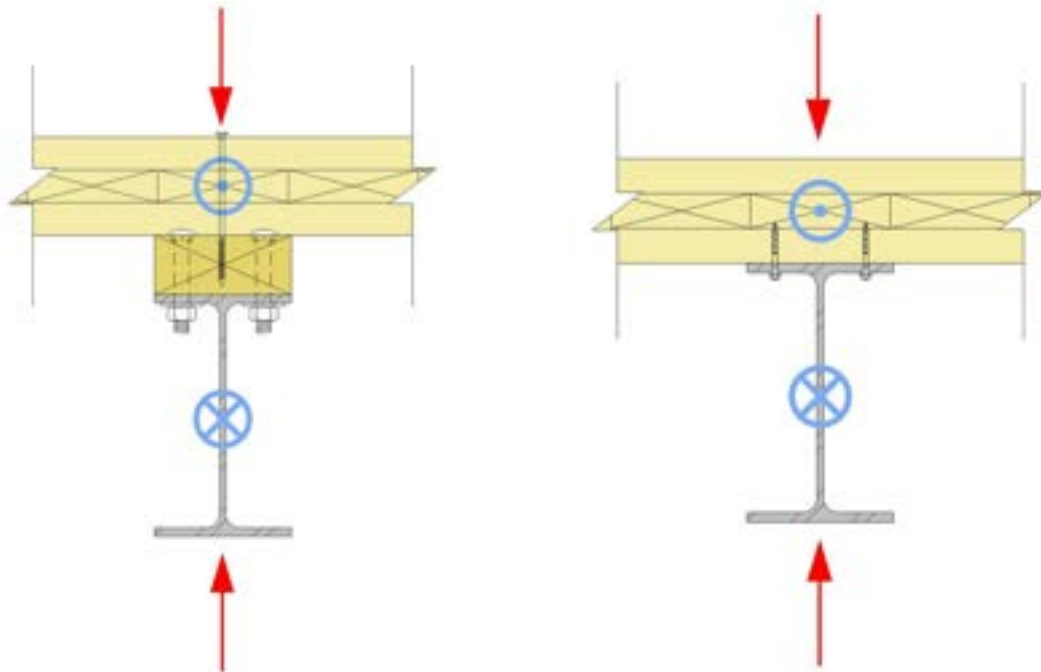


Photo: Marcus Kauffmann, ODF

Lateral System Choices

Wood-Frame Shear walls



Credit: KL&A Engineers & Builders

Lateral System Choices

MT Shear walls

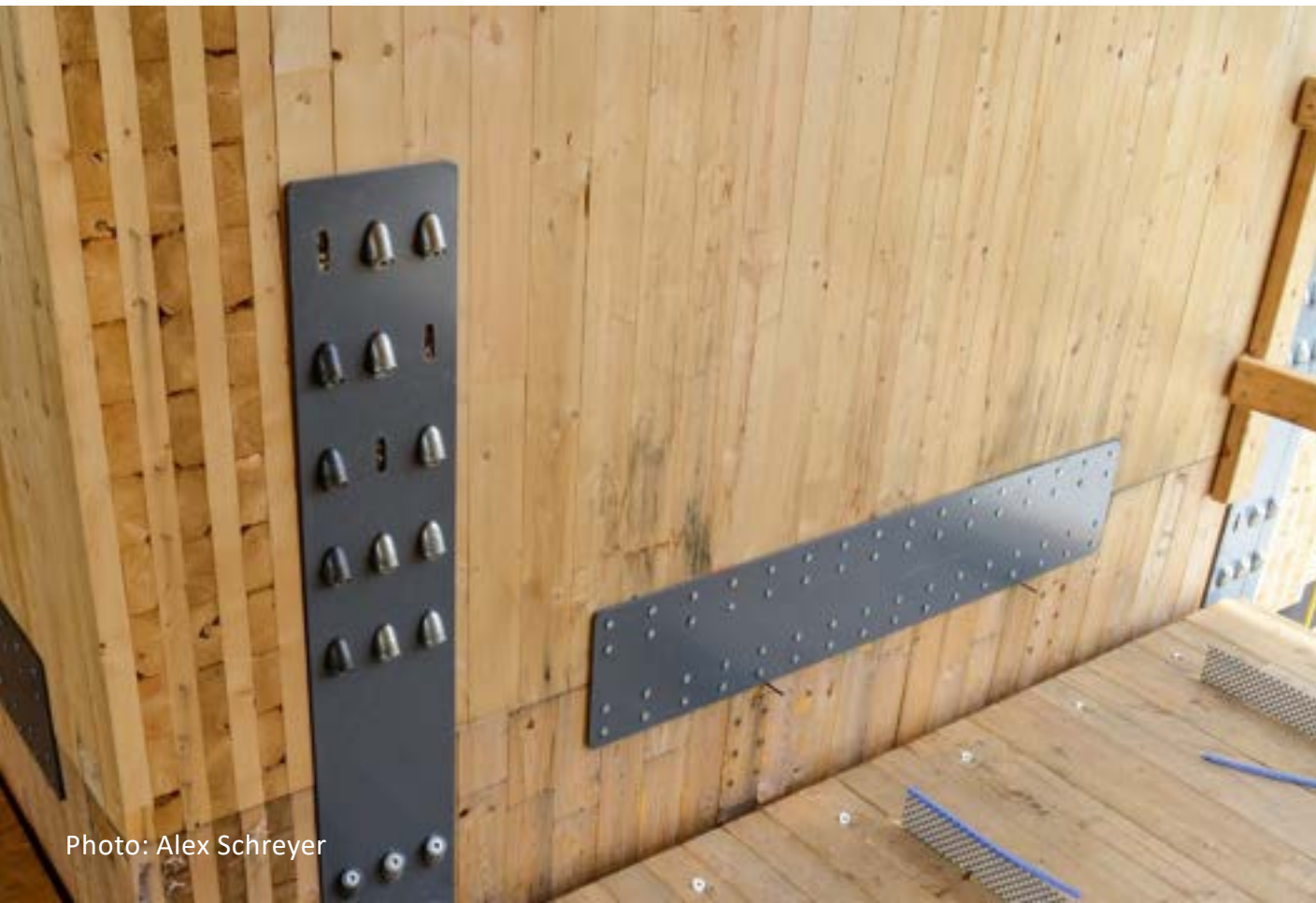


Photo: Alex Schreyer



Lateral System Choices

MT Rocking Shear walls



Photo: WoodWorks

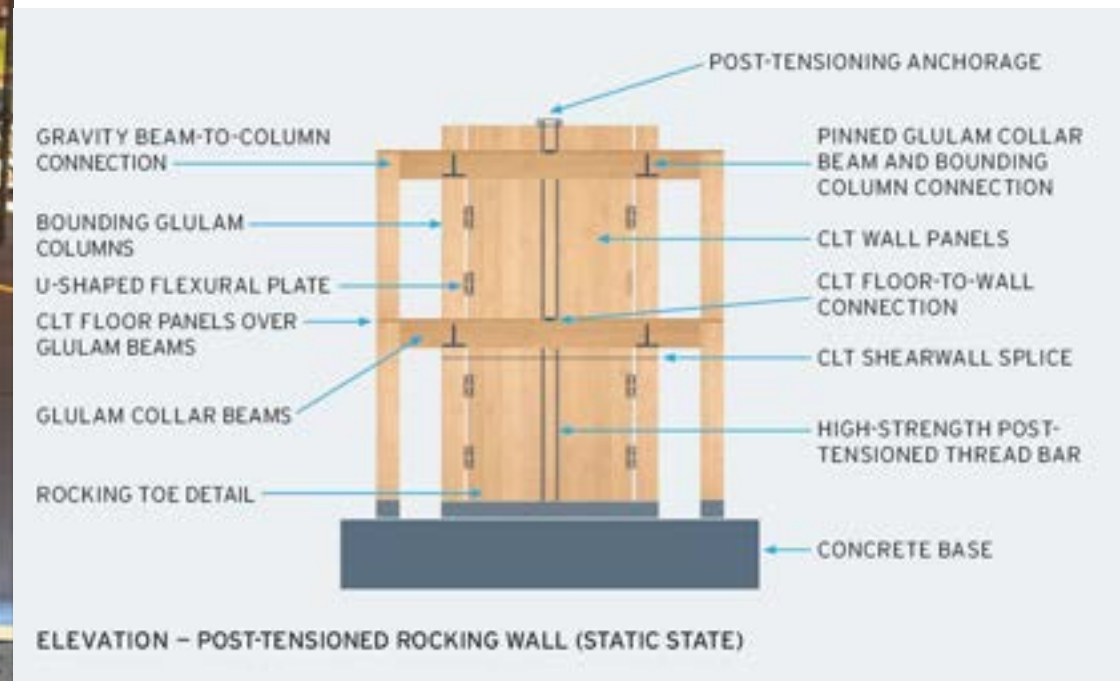


Image: KPFF

Lateral System Choices

Timber Braced Frame



Lateral System Choices

Prescriptive Code Compliance

Concrete Shear walls



Steel Braced Frames



Light Wood-Frame Shear walls



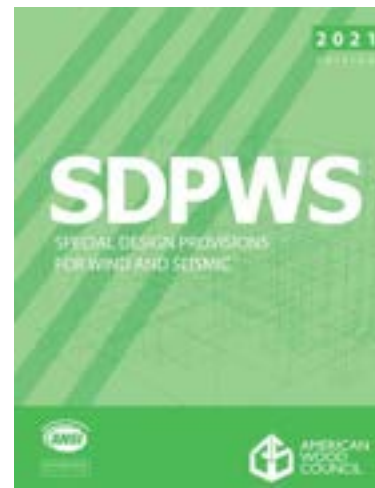
CLT Shear walls



CLT Rocking Walls



Timber Braced Frames



2021 SDPWS
ASCE 7-22

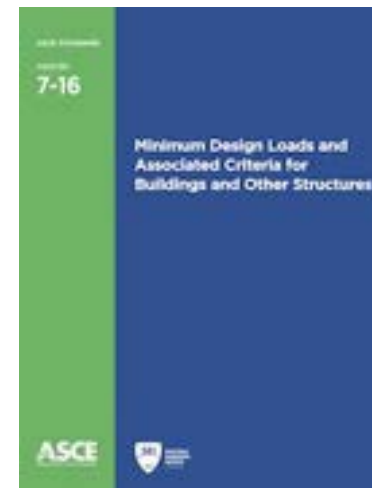


Photo: WoodWorks



Outline

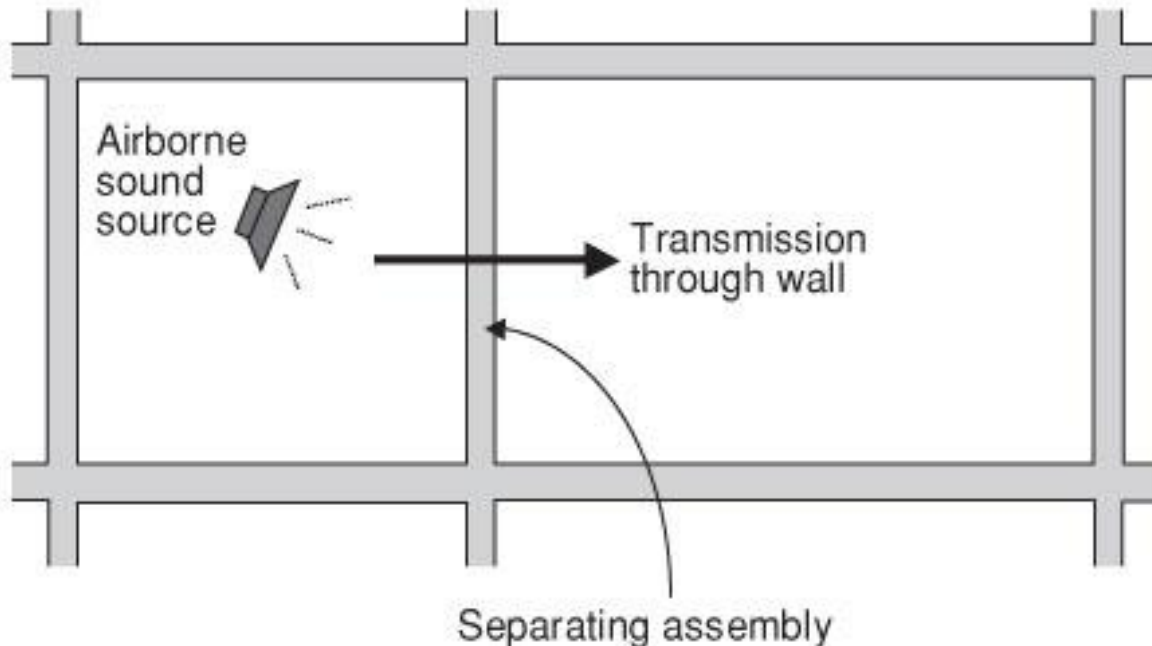
- » Key Early Design Decisions
- » Construction Types
- » Fire Design
- » Structural Grid
- » Connections
- » Penetrations & Firestopping
- » MEP Layout and Integration
- » Lateral Systems
- Acoustics

Acoustics & Sound Control

Air-Borne Sound:

Sound Transmission Class (STC)

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

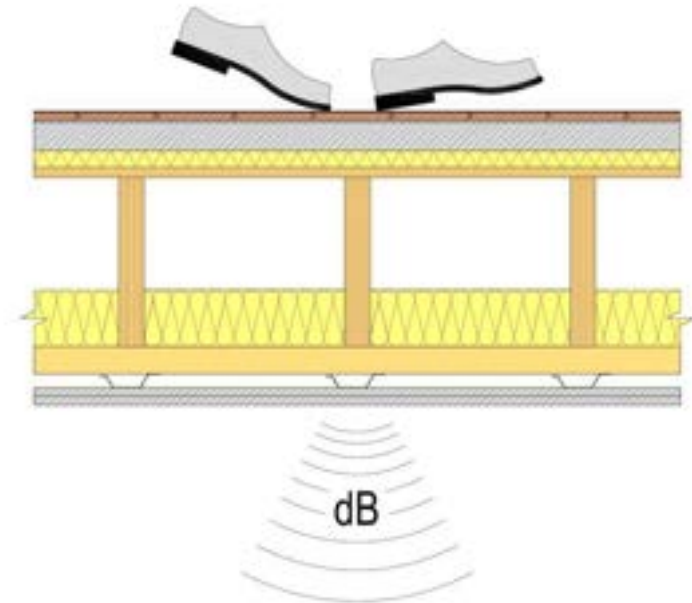


Acoustics & Sound Control

Structure-Borne Sound:

Impact Insulation Class (IIC)

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



Acoustics & Sound Control

Code requirements only address residential occupancies:

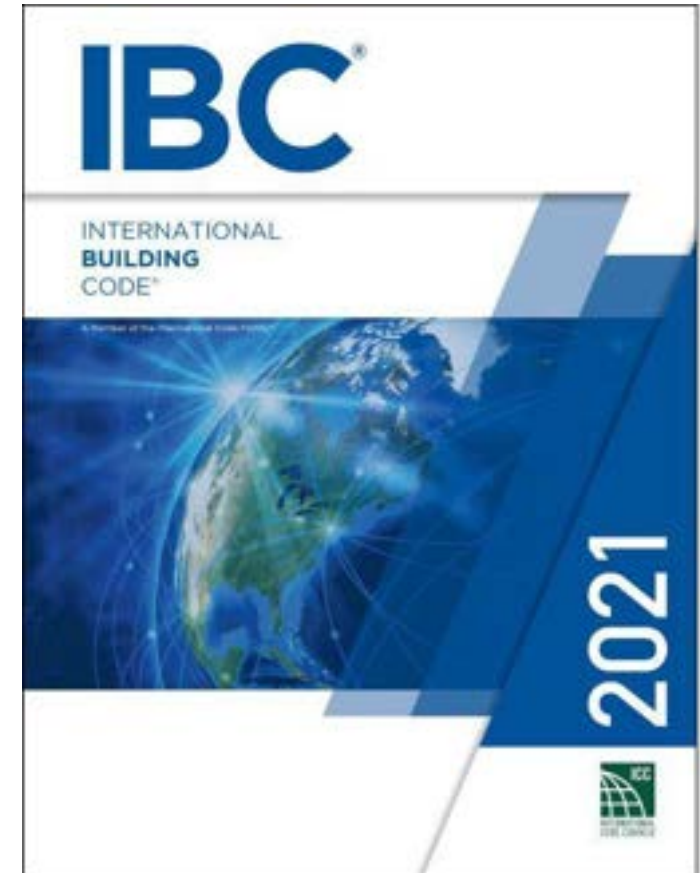
For unit to unit or unit to public or service areas:

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

» Walls, Partitions, and Floor/Ceiling Assemblies

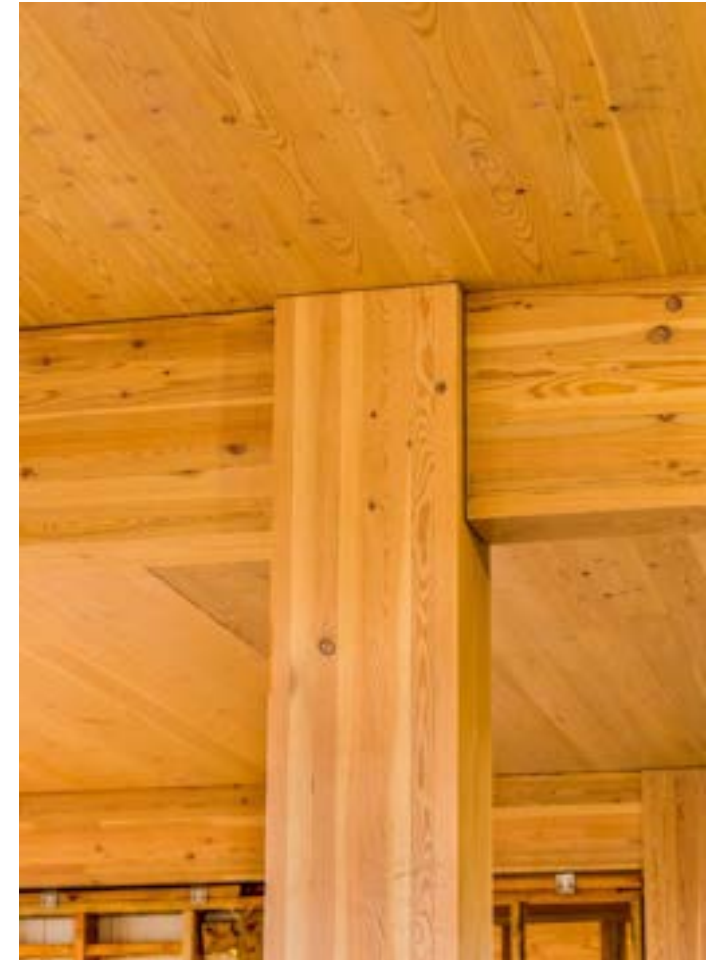
Min. IIC of 50 (45 if field tested) for:

» Floor/Ceiling Assemblies



Acoustics & Sound Control

MT: Structure Often is Finish



Acoustics & Sound Control

TABLE 1:

Examples of Acoustically-Tested Mass Timber Panels

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

Source: Inventory of Acoustically-Tested Mass Timber Assemblies, WoodWorks⁷

Acoustics & Sound Control



Concrete Slab:

6" Thick

80 PSF

STC 53



CLT Slab:

6-7/8" Thick

18 PSF

STC 41



Acoustics & Sound Control

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

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



Image credit: Christian Columbres

Acoustics & Sound Control

Common mass timber floor assembly:

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



Mass Timber Fire & Acoustic Database

Search tested and approved assemblies

<https://www.woodworks.org/mass-timber-fire-acoustic-database/>

< Back to Mass Timber Fire & Acoustic Database

Assembly Type

- ☐ Floor/Roof 532
- ☐ Wall 147

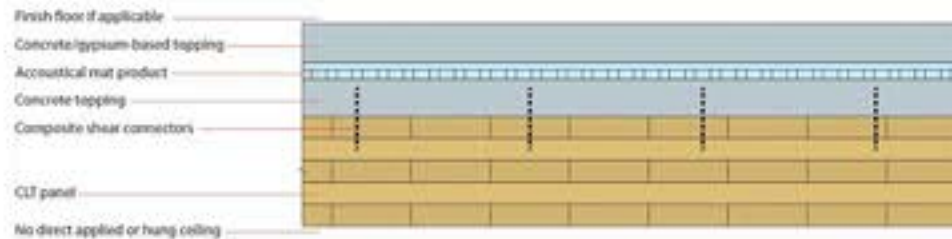
Application Type

- ☐ CLT/Concrete Composite 7
- ☐ Concealed Ceiling 201
- ☐ Concrete/Gypsum Topping 138
- ☐ Other 108
- ☐ Raised Access Floor or Wood Sleepers 78

Mass Timber Panel

- ☐ CLT 507
- ☐ CLT (SCL) 56
- ☐ NLT 72
- ☐ DLT 22

CLT-Concrete Composite Floor Assemblies, Ceiling Side Exposed



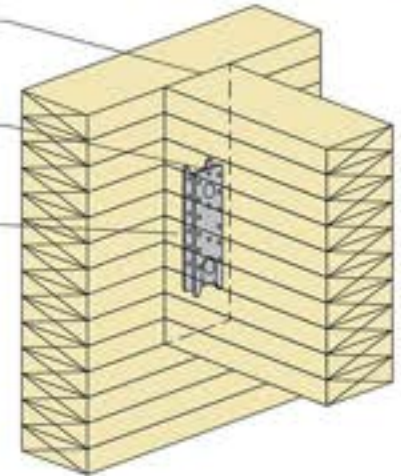
This illustration is for specific construction details only.

Mass Timber Panel	Topping	Acoustical Mat Products Between Concrete Composite and Upper Topping	Upper Topping	Finish Floor	Sound Rating	Impact Rating	Method of Compliance
5-layer 5.40" CLT	2.25" Concrete	Maxxon Acousti-Mat® 3/8	1" Gyp-Crete®	52	STC ●	50 IIC ●	Maxxon / Intertek Report # K3094.97-113-11-R0 Contact Product Manufacturer for More Information
5-layer 5.40" CLT	2.25" Concrete	Maxxon Acousti-Mat® 3/8	1" Gyp-Crete®	53	STC ●	52 IIC ●	Maxxon / Intertek Report # K3094.69-113-11-R0 Contact Product Manufacturer for More Information
5-layer 5.40" CLT	2.25" Concrete	Maxxon Acousti-Mat® SBR over Maxxon Acousti-Mat® 3/4 Premium	1.5" Gyp-Crete®	56	STC ●	57 IIC ●	Maxxon / Intertek Report # K3094.98-113-11-R0 Contact Product Manufacturer for More Information
5-layer 5.40" CLT	2.25" Concrete	Maxxon Acousti-Mat® SBR over Maxxon Acousti-Mat® 3/4 Premium	1.5" Gyp-Crete®	57	STC ●	61 IIC ●	Maxxon / Intertek Report # K4507.06-113-11-R0 Contact Product Manufacturer for More Information
5-layer 5.40" CLT	2.25" Concrete	Maxxon Acousti-Mat® SBR over Maxxon Acousti-Mat® 3/4 Premium	2" Gyp-Crete®	60	STC ●	61 IIC ●	Maxxon / Intertek Report # K3094.86-113-11-R0 Contact Product Manufacturer for More Information
5-layer 5.40" CLT	2.25" Concrete	Maxxon Acousti-Mat® SBR over Maxxon Acousti-Mat® 3/4 Premium	2" Gyp-Crete®	58	STC ●	63 IIC ●	Maxxon / Intertek Report # K3094.86-113-11-R0 Contact Product Manufacturer for More Information
5-layer 5.40" CLT	2.25" Concrete	5/8" OSB on 5/8" Georgia Pacific Dens Deck® on Kinetics® Ultra Quiet SR	None	60	STC ●	62 IIC ●	Veneklasen Associates / Intertek Report # K3094.19-113-11-R0 Contact Product Manufacturer for More Information

Connection type

Assembly description and connection details

Connection style (concealed shown)



Keys to Mass Timber Success:

Know Your WHY

Design it as Mass Timber From the Start

Leverage Manufacturer Capabilities

Understand Supply Chain

Optimize Grid

Take Advantage of Prefabrication & Coordination

Expose the Timber

Discuss Early with AHJ

Work with Experienced People

Let WoodWorks Help for Free



Photo Credit: Hacker Architects, Jeremy Bittermann

Questions? Ask us anything.



Survey



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