

Early Mass Timber Design Decisions + Ascent Tour

September 23, 2026

Presented by:

Eduardo Morales, PE
WoodWorks



Ascent / New Land Enterprises / Korb + Associates Architects / Thornton Tomasetti / Photo VRX Media Group

WoodWorks | The Wood Products Council is a registered provider of AIA-approved continuing education under Provider Number G516. All registered AIA CES Providers must comply with the AIA Standards for Continuing Education Programs. Any questions or concerns about this provider or this learning program may be sent to AIA CES (cessupport@aia.org or (800) AIA 3837, Option 3).

This learning program is registered with AIA CES for continuing professional education. As such, it does not include content that may be deemed or construed to be an approval or endorsement by the AIA of any material of construction or any method or manner of handling, using, distributing, or dealing in any material or product.

AIA continuing education credit has been reviewed and approved by AIA CES. Learners must complete the entire learning program to receive continuing education credit. AIA continuing education Learning Units earned upon completion of this course will be reported to AIA CES for AIA members. Certificates of Completion for both AIA members and non-AIA members are available upon request.

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



Course Description

Seminar 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 Ascent mass timber tower in Milwaukee, Wisconsin. 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 25-story, 284-foot building with members of the development 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

Seminar 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 Milwaukee's 25-story mass timber tower 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

MASS TIMBER OVERVIEW



Ascent / New Land Enterprises / Korb + Associates Architects /
Thorton Tomasetti / photo New Land Enterprises

Wood Construction Terminology

Glue Laminated Timber (Glulam)
Beams & columns



Cross-Laminated Timber (CLT)
Solid sawn laminations



Cross-Laminated Timber (CLT)
SCL laminations



Photo:
Freres Lumber



Photo: StructureCraft



Photo: LendLease



Photo: LEVER Architecture

Wood Construction Terminology

Dowel-Laminated Timber (DLT)



Photo:
StructureCraft

Nail-Laminated Timber (NLT)



Photo: Think Wood

Glue-Laminated Timber (GLT)

Plank orientation



Photo:
StructureCraft



Photo: StructureCraft



Photo: Ema Peter



Photo: Manasc Isaac
Architects/Fast + Epp

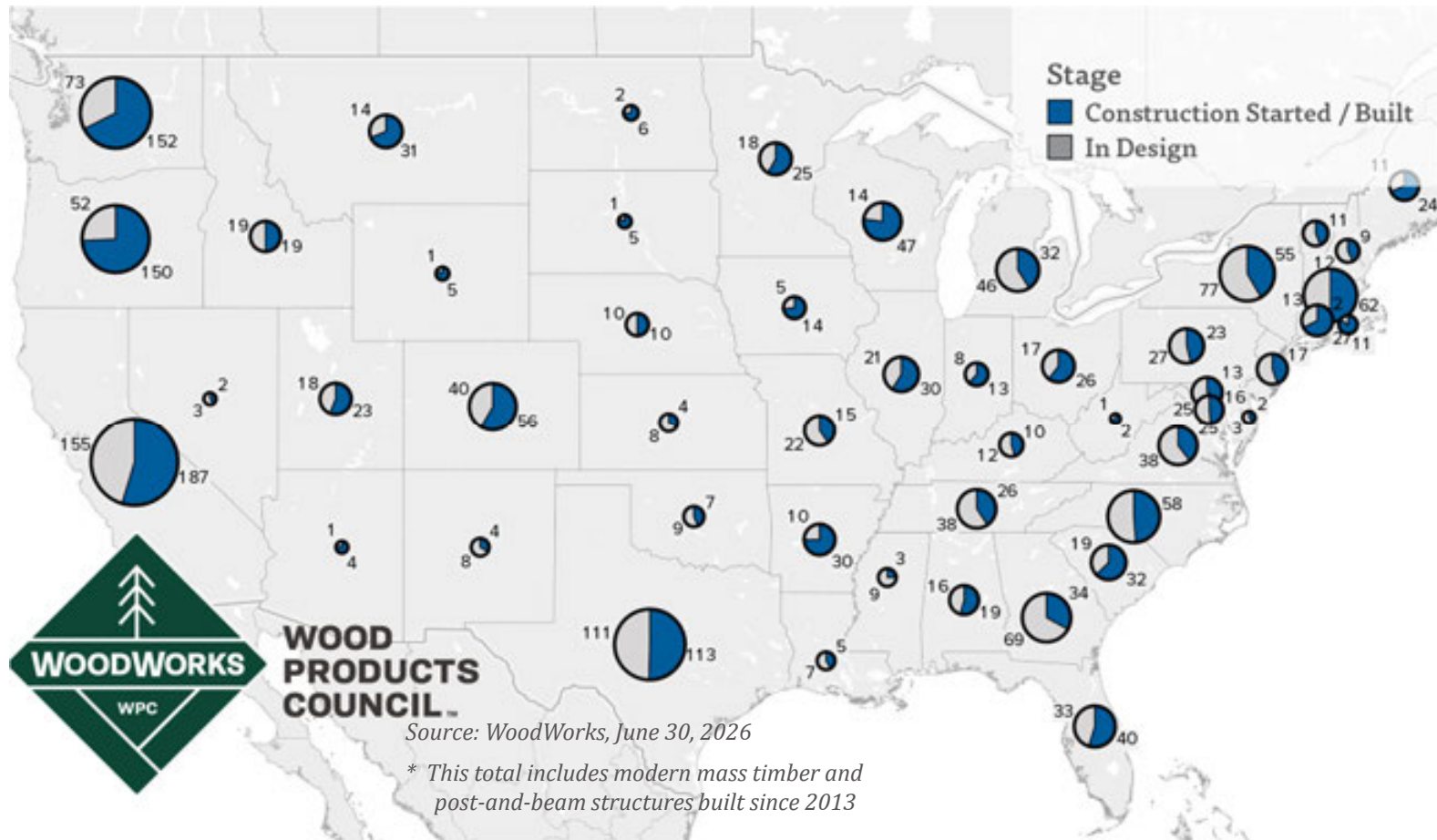
Current State of Mass Timber Projects

As of Q2 2026, in the US, **2,833** multi-family, commercial, or institutional projects have been constructed with, or are in design with, mass timber.

Scan this code or use the url to find the map and more details online.

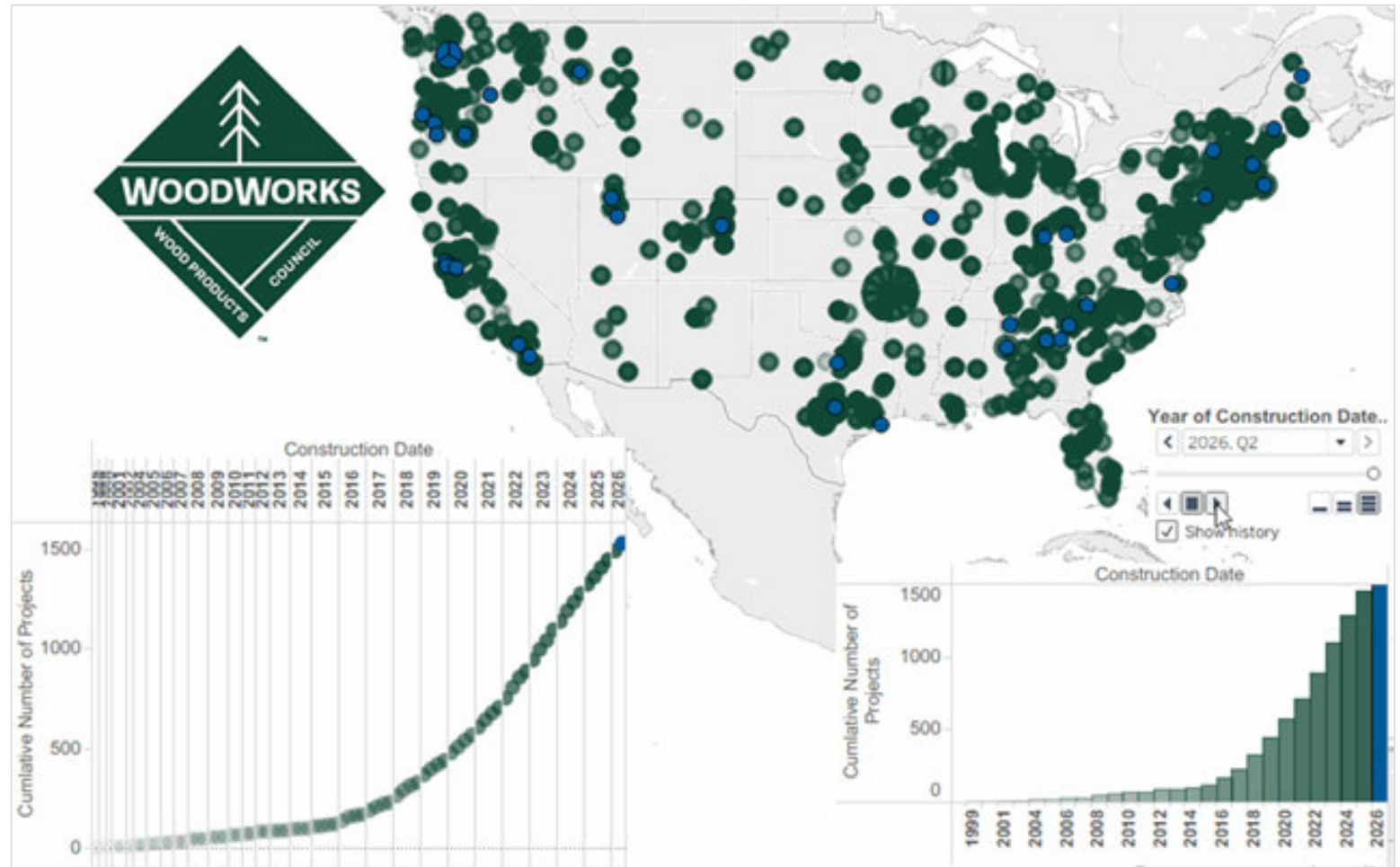


www.woodworks.org/resources/mapping-mass-timber/



Current State of Mass Timber Projects Over Time

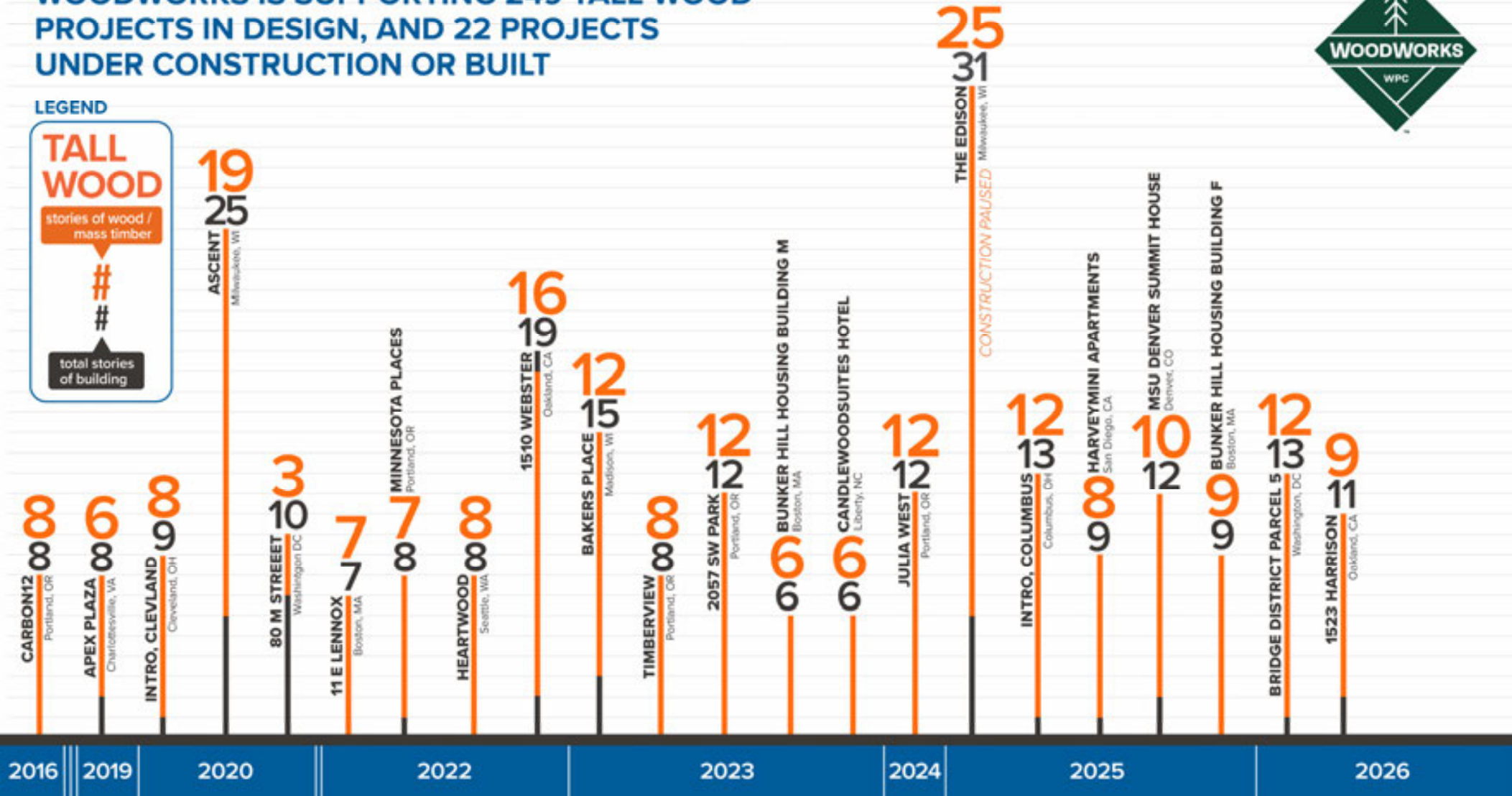
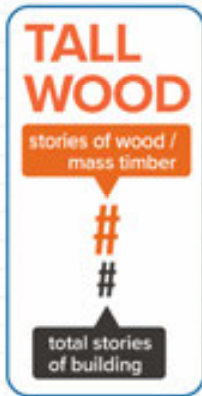
US Market Q2 2026



WOODWORKS IS SUPPORTING 249 TALL WOOD PROJECTS IN DESIGN, AND 22 PROJECTS UNDER CONSTRUCTION OR BUILT



LEGEND

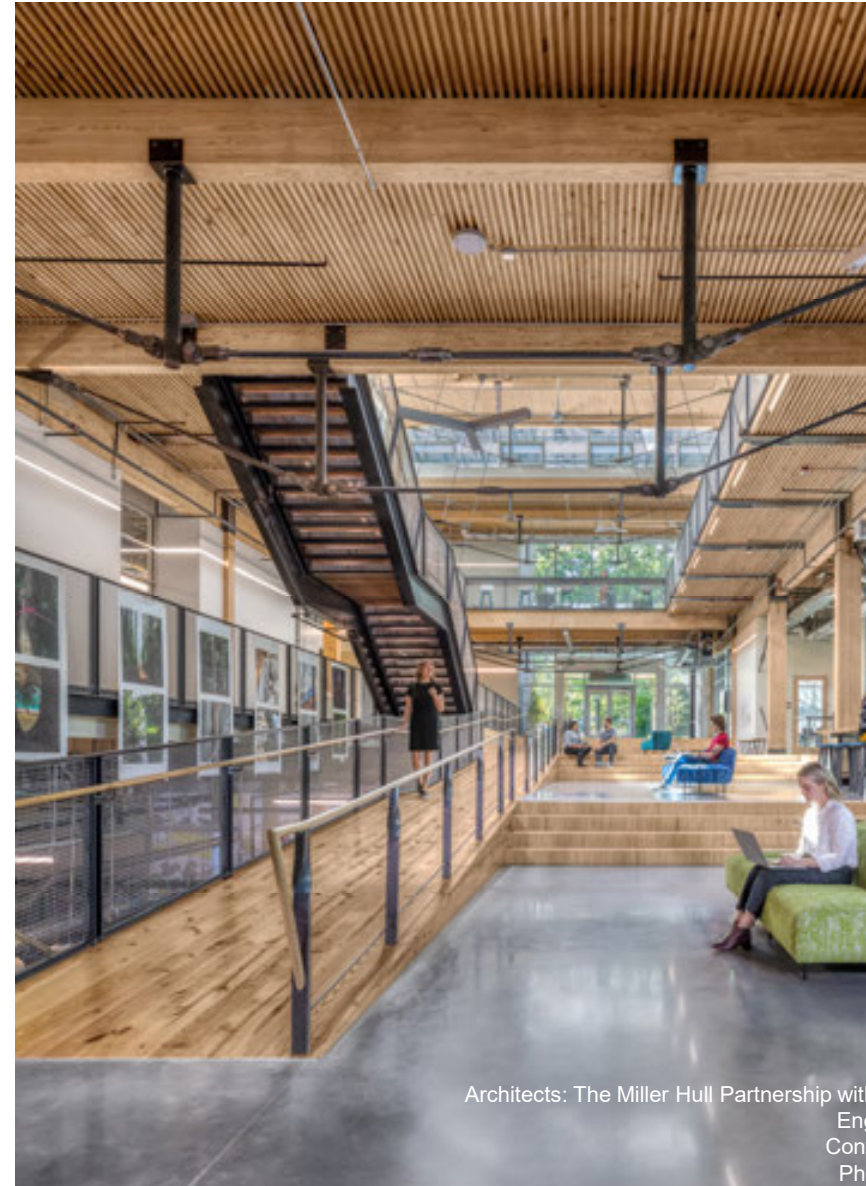


Key Early Design Decisions

One *potential* design route:

1. Building size & occupancy informs construction type
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
Eng
Con
Ph

ASCENT, MILWAUKEE



ASCENT, MILWAUKEE



25 STORIES

19 TIMBER OVER 6 PODIUM, 284 FT

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

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



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

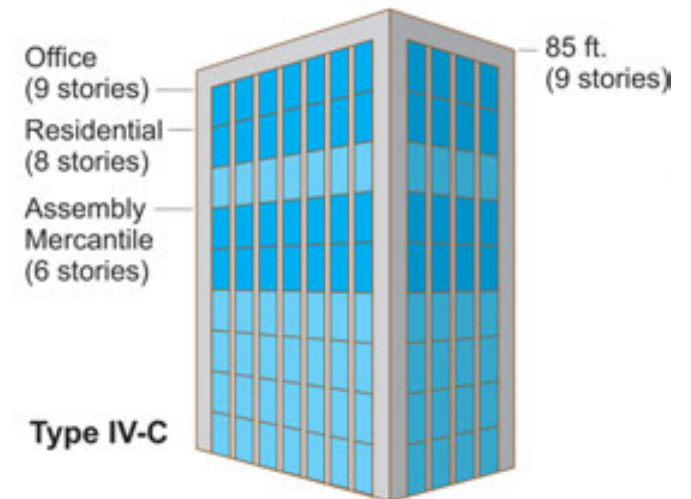
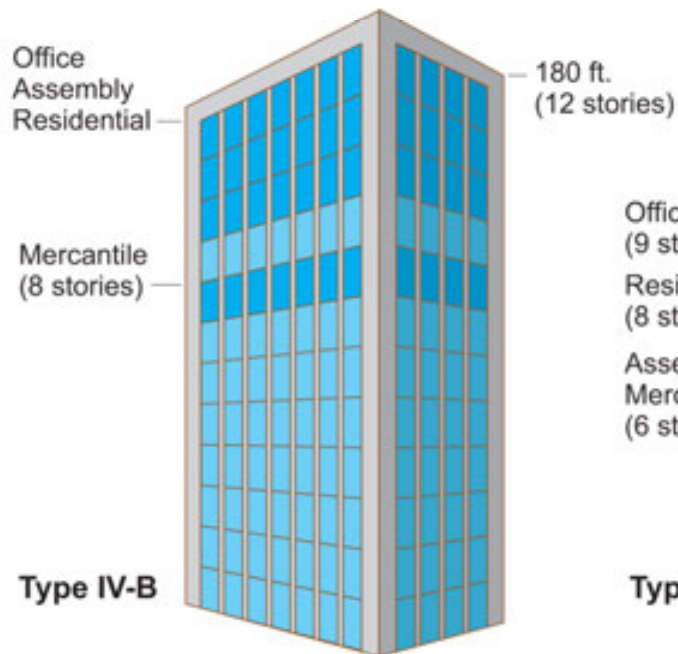
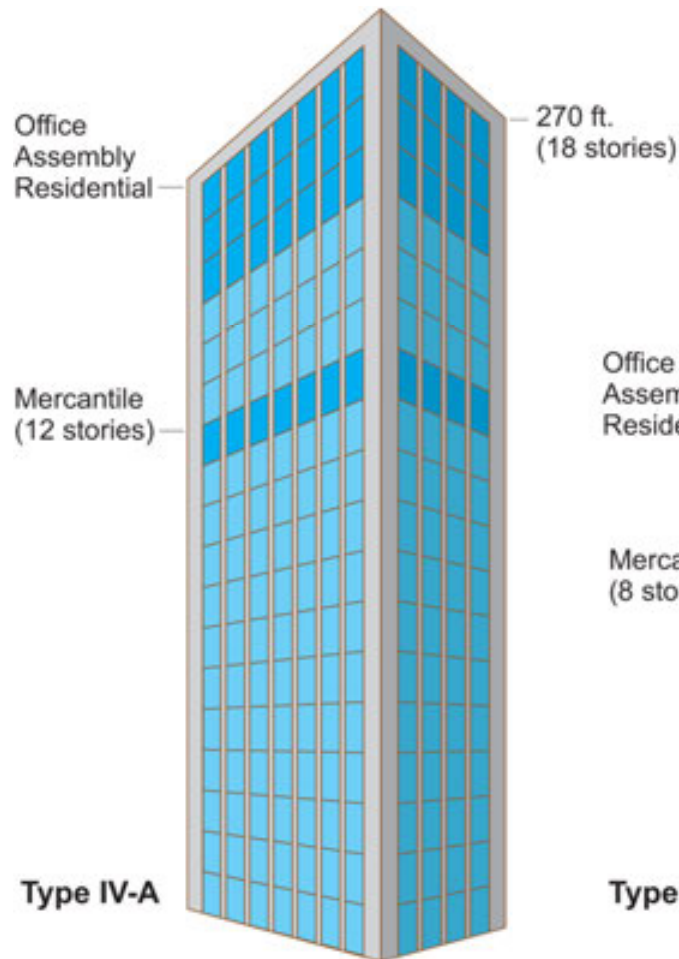
Key Early Design Decisions

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

Construction Types

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



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)

Photo Credit: Hacker Architects, Jeremy Bittermann

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

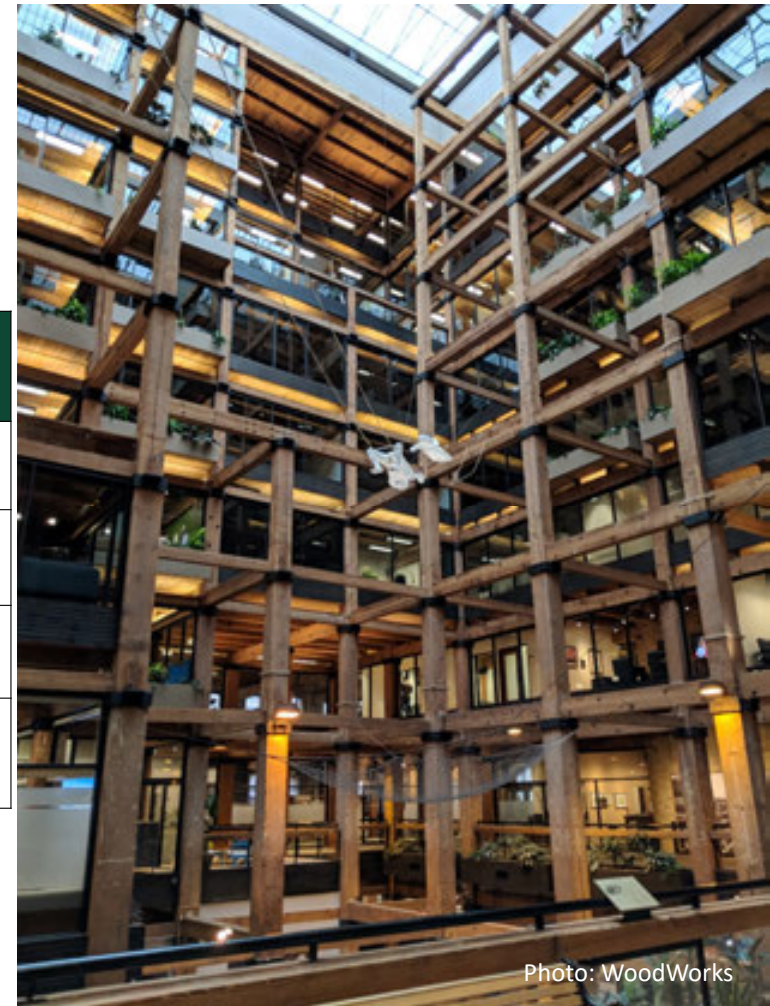


Photo: WoodWorks

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

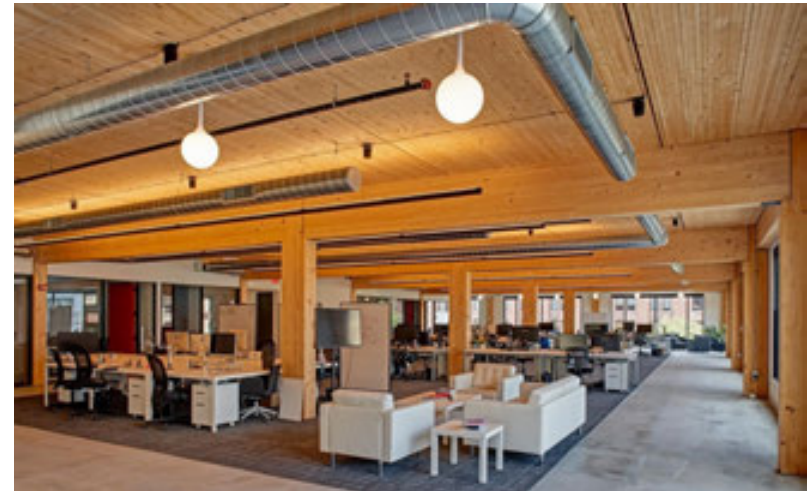


Photo: StructureCraft

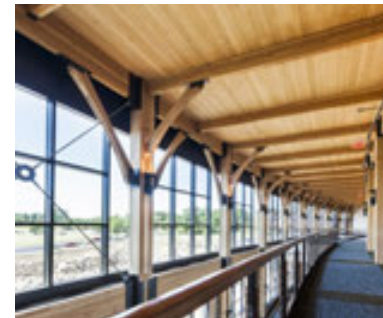
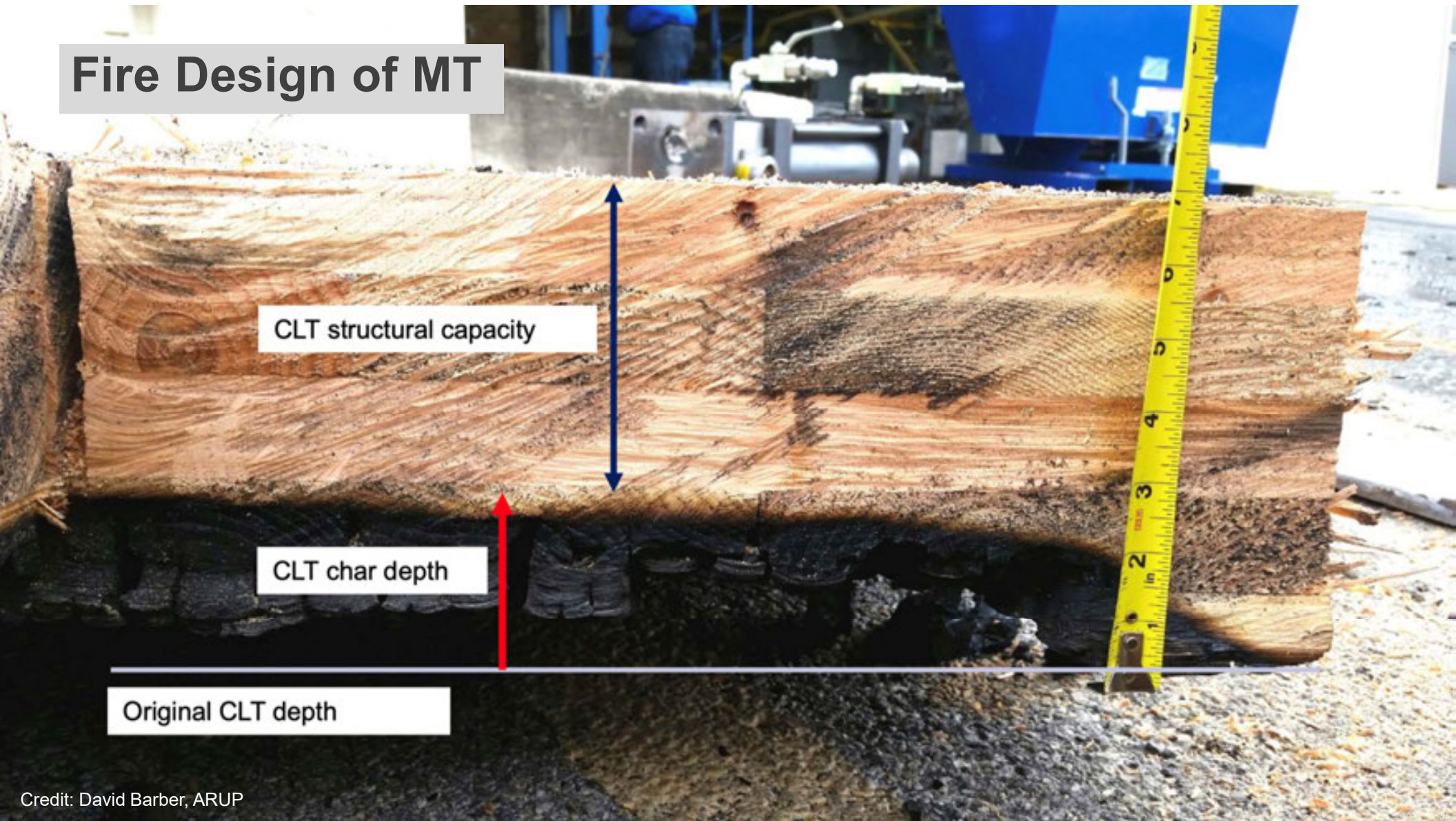


Photo: Aitor Sanchez/ Ewing Cole



Photo: WoodWorks

Fire Design of MT



Key Early Design Decisions

Construction type influences FRR

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 ^{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

Source: 2021 IBC

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



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

Member Sizing

- » Impact of FRR on sizing
- » Impact of sizing on efficient spans
- » Consider connections – can drive member sizing



Credit: ARUP

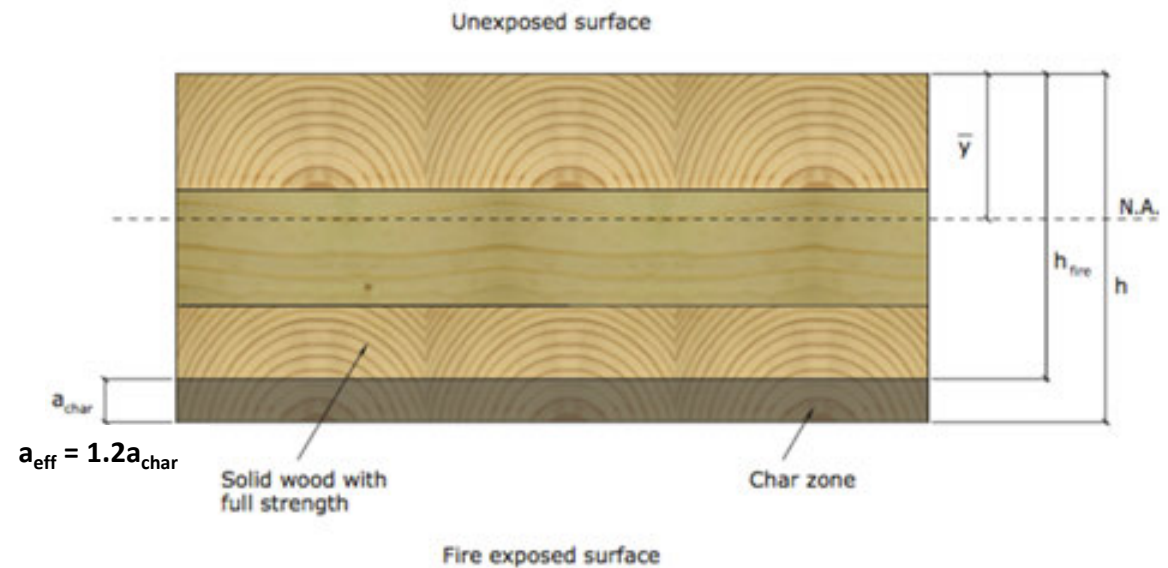


Credit: Kaiser+Path

Construction type influences FRR

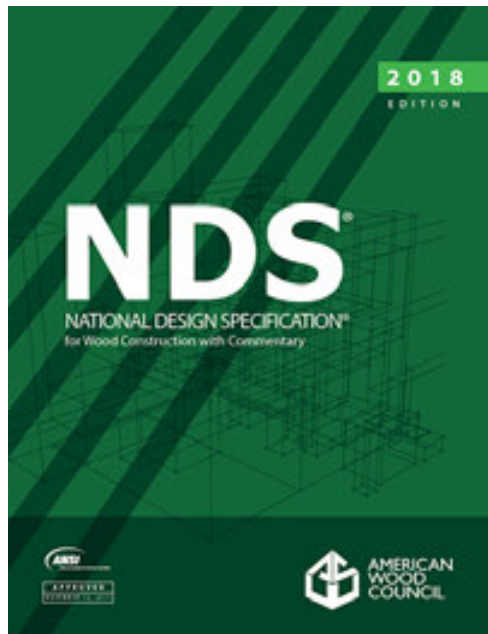
Which Method of Demonstrating FRR of MT is Being Used?

- » 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



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** 

TEST REPORT Page 1 of 53
for
American Wood Council
222 Catoclin Circle SE, Suite 201
Leesburg, VA 20175

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

Test Report No: WP-1050
Assignment No: 6-1068
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. Riley
Test Engineer

Reviewed by: 
Robert J. Marshall
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 specimens. This report may not be reproduced, stored in a retrieval system, or used in any way without the written approval of the laboratory. The laboratory's test report in no way constitutes or implies product certification, approval or endorsement by the laboratory.

Intertek

REPORT NUMBER: 162891256SAT-001
ORIGINAL ISSUE DATE: February 27, 2017
REVISED DATE: N/A

EVALUATION CENTER
16015 Shady Falls Road
Elmendorf, TX 78112
Phone: (210) 635-8100
Fax: (210) 635-8101
www.intertek.com

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

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

TEST REPORT

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 Materials**

FPInnovations 
NRC-CNRC

Project No. 301006155
Final Report 2012/13

Preliminary CLT Fire Resistance Testing Report

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

and
Nourddine Ibrahim, Ph.D.
Senior Research Officer
National Research Council of Canada – Fire Research Resource Centre

July 2012

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 mainly 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-laminated 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, unrated construction is allowed in some buildings up to four stories (Type II-B), and 1-hour-rated construction is permitted in some buildings up to six stories (Type II-A). For the heavier Type III-C and IV-B construction types, which can be a



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

Robert Benson Photography

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

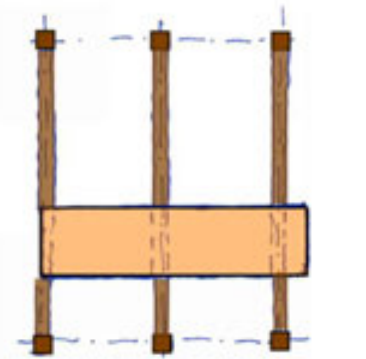
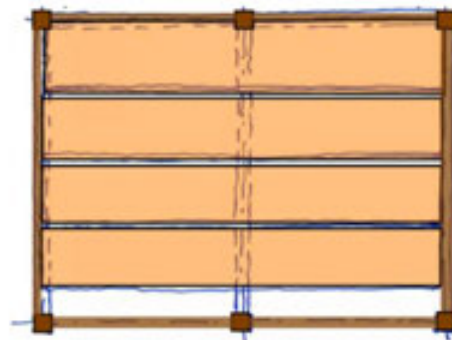
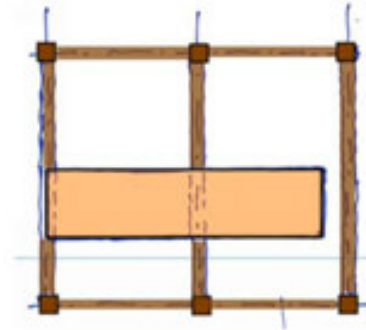
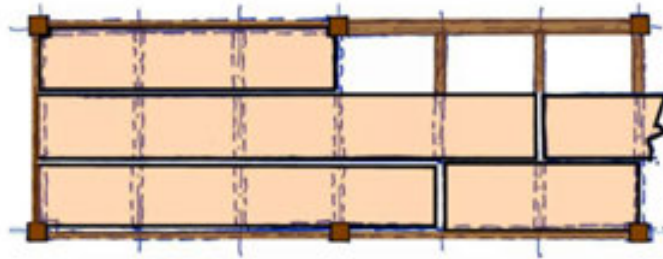
Outline

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



Structural Grid

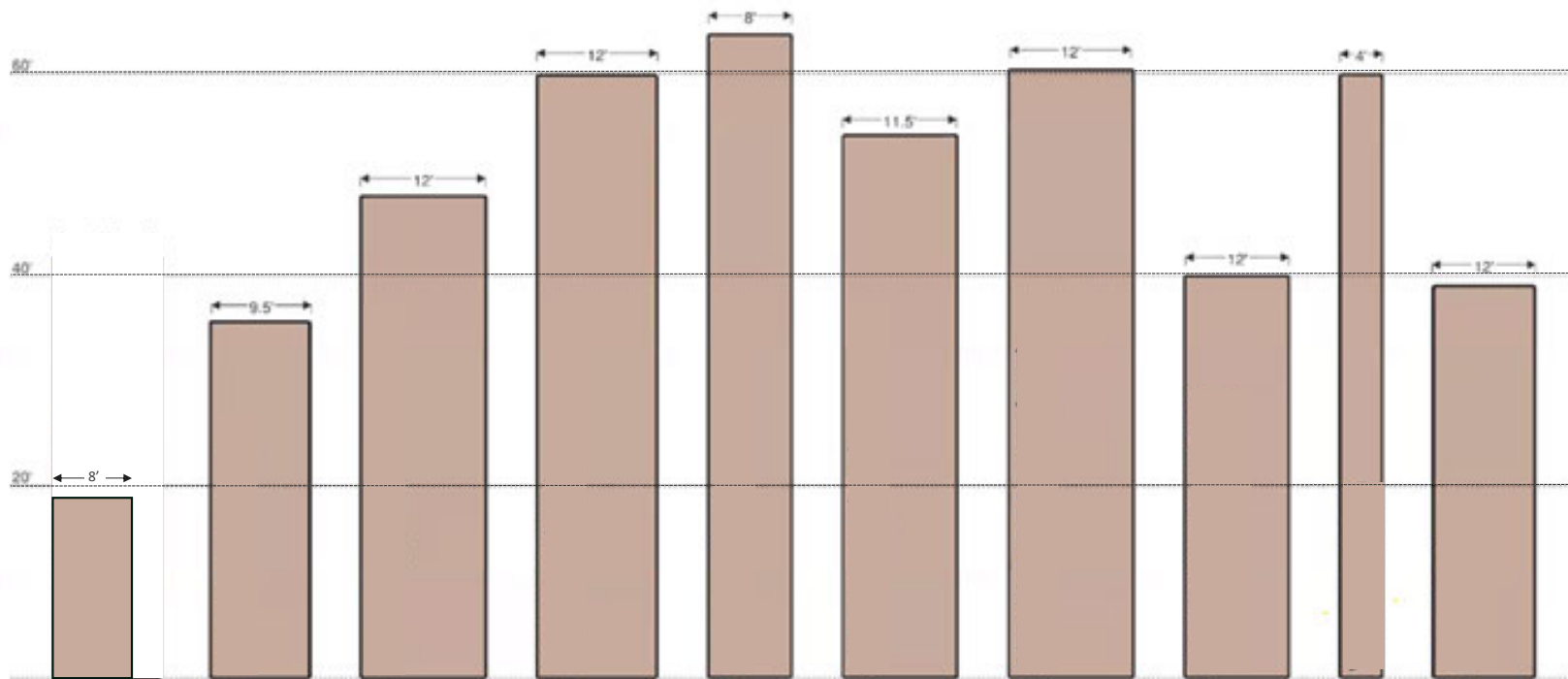
- » Consider Efficient Layouts
- » Repetition & Scale
- » Manufacturer Panel Sizing
- » Transportation



Credit: Tanya Luthi, Entuitive

Key questions affecting structural layout:

Size limitations based on manufacturing and transportation: CLT Panel



Credit: TimberLab

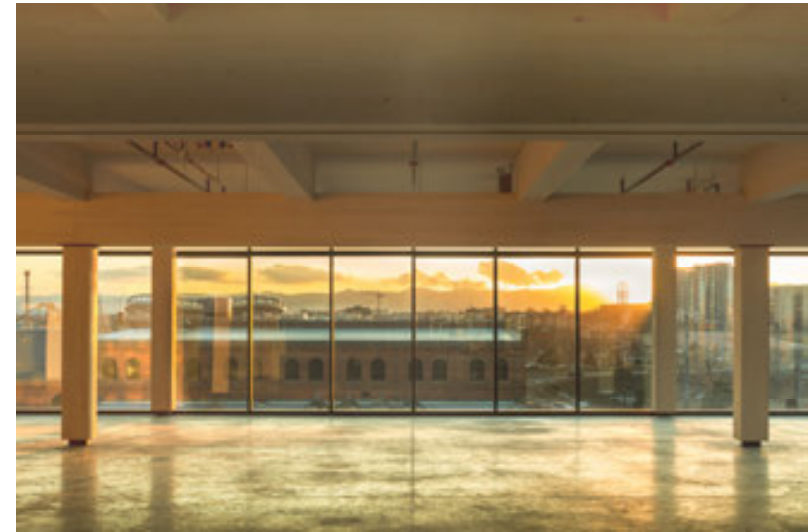
Structural Grid

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



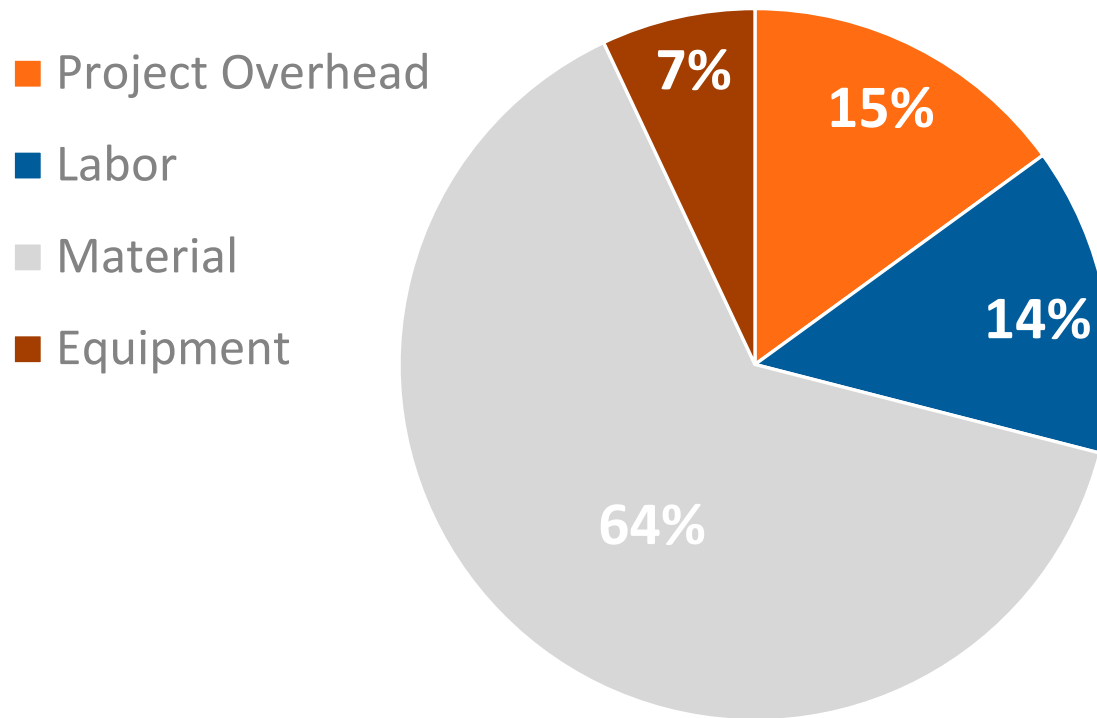
Clay Creative, Portland, OR
30x30 Grid, 1 purlin per bay
2x6 NLT
Image: Mackenzie

Key Early Design Decisions

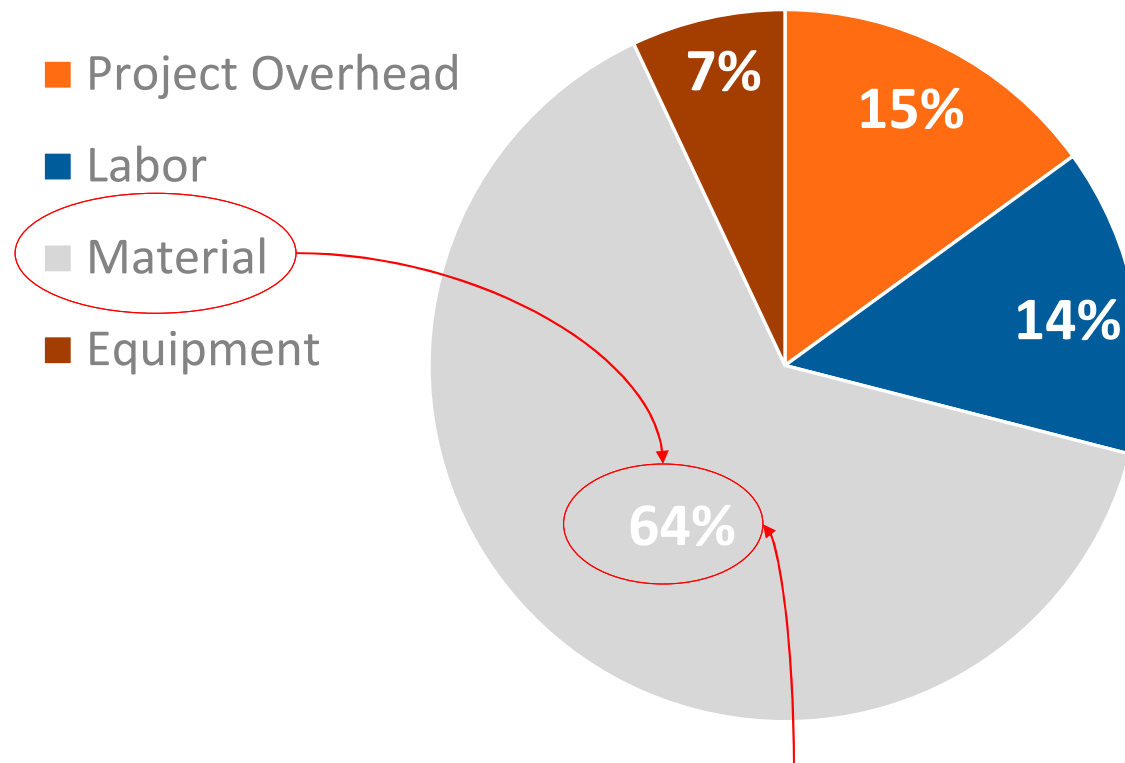
Why so much focus on panel thickness?



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

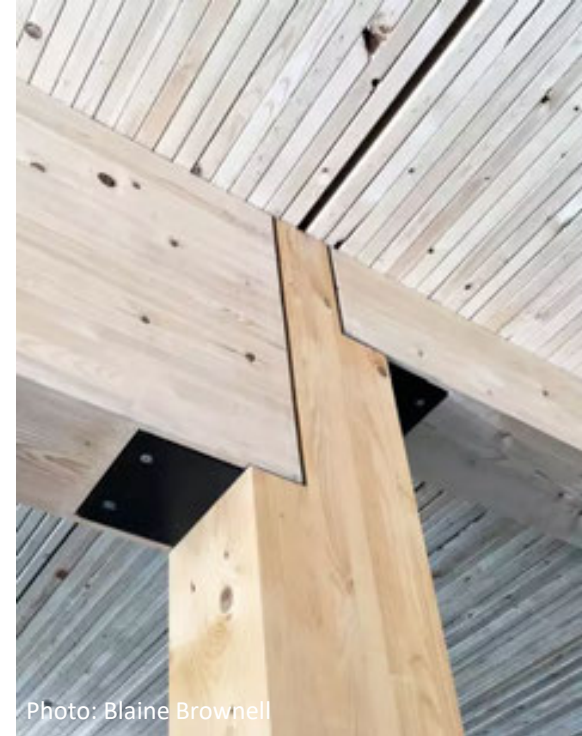
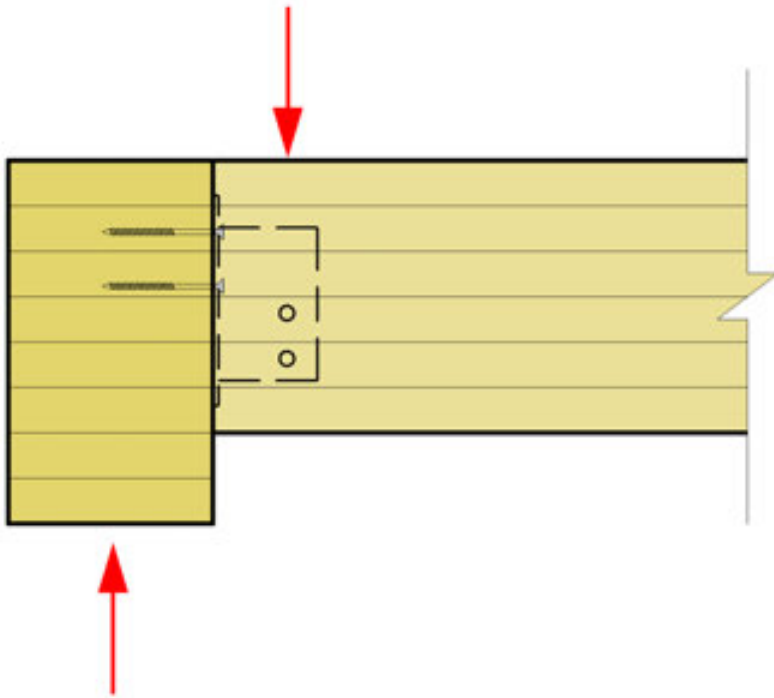


Photo: Blaine Brownell

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

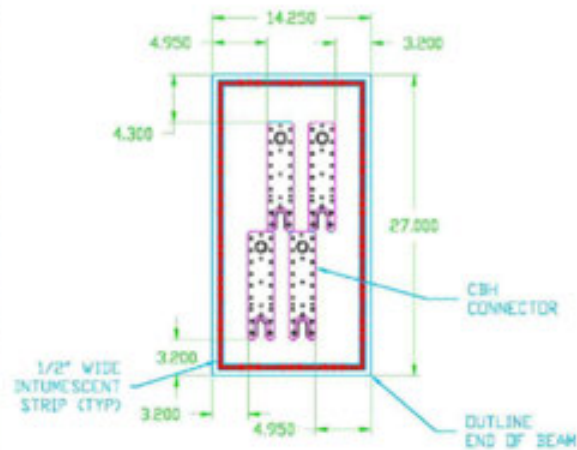


Photo: LEVER Architecture

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

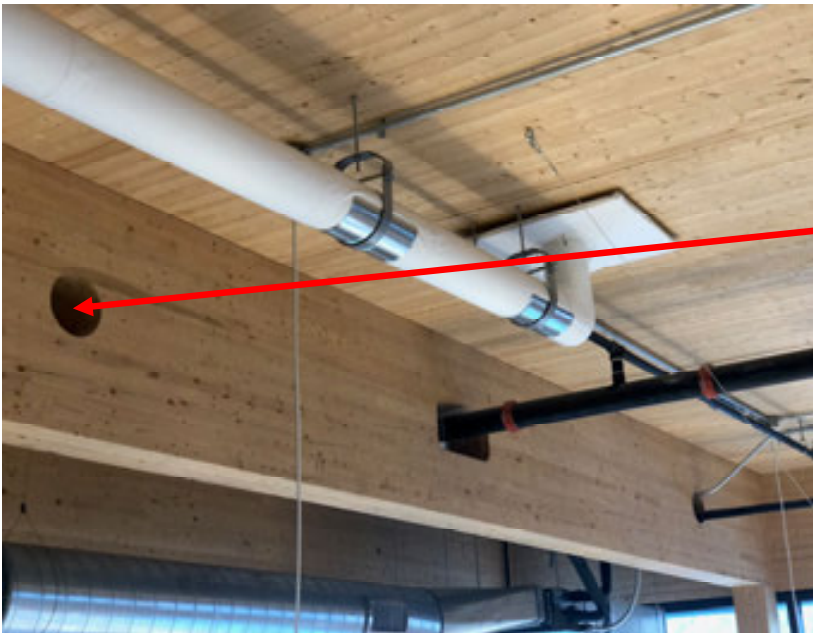


Photo: Alex Schreyer

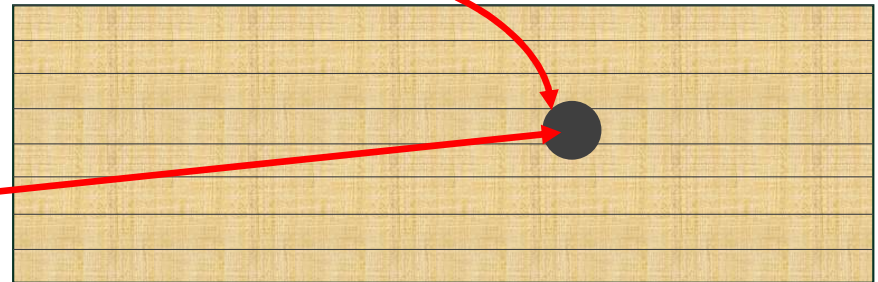
Penetrations & Firestopping

Beam penetrations:

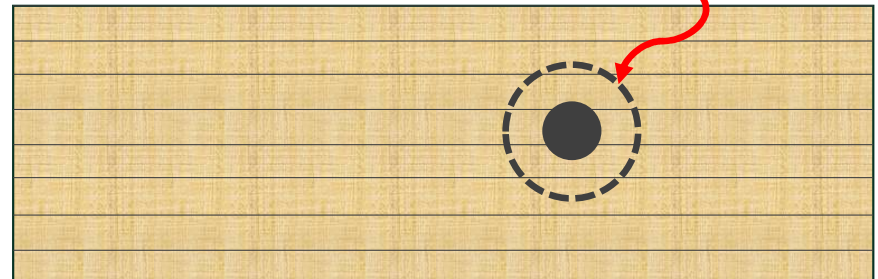
- » If FRR = 0-hr, analyze structural impact of hole diameter only
- » If FRR > 0-hr, account for charred hole diameter or firestop penetration



Hole diameter



Hole diameter after 1-hr char



Outline

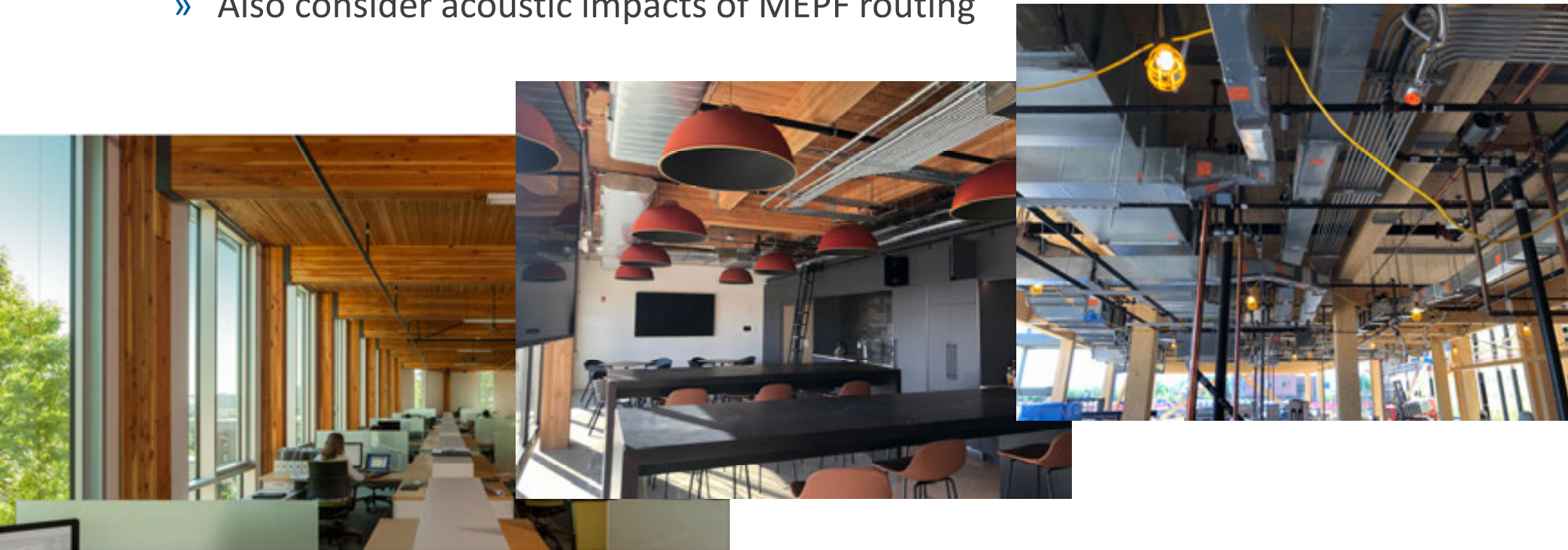
- » Key Early Design Decisions
- » Construction Types
- » Fire Design
- » Structural Grid
- » Connections
- » Penetrations & Firestopping
- **MEP Layout and Integration**
- » Lateral Systems
- » Acoustics



MEP Layout & Integration

Set Realistic Owner Expectations About Aesthetics

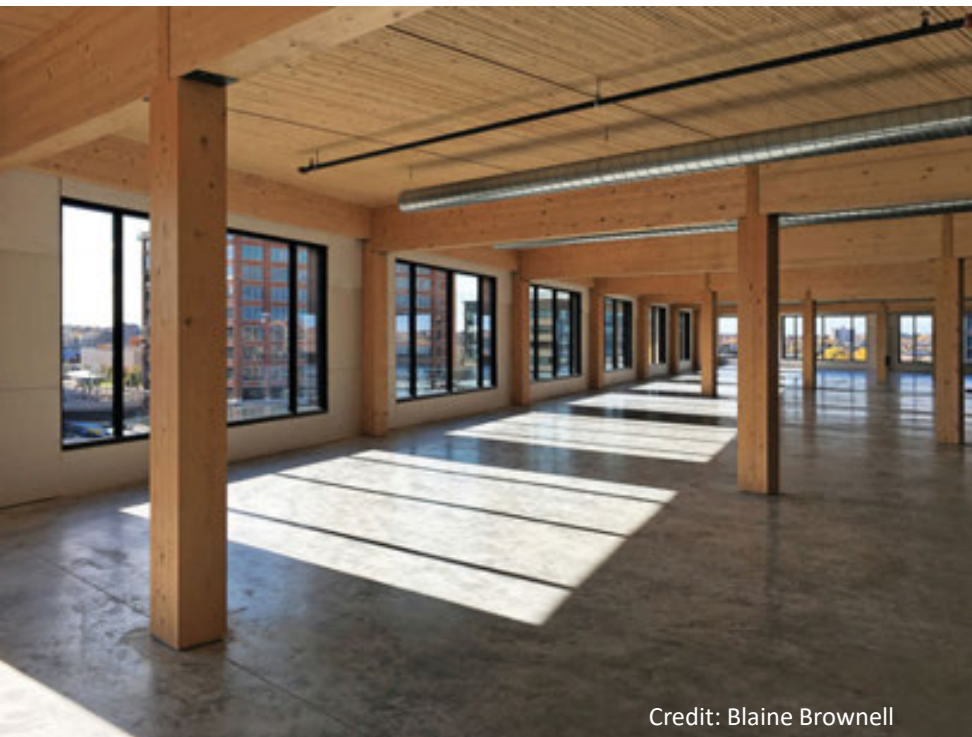
- » MEP fully exposed with MT structure, or limited exposure?
- » Also consider acoustic impacts of MEPF routing



MEP Layout & Integration

Smaller grid bays at central core (more head height)

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

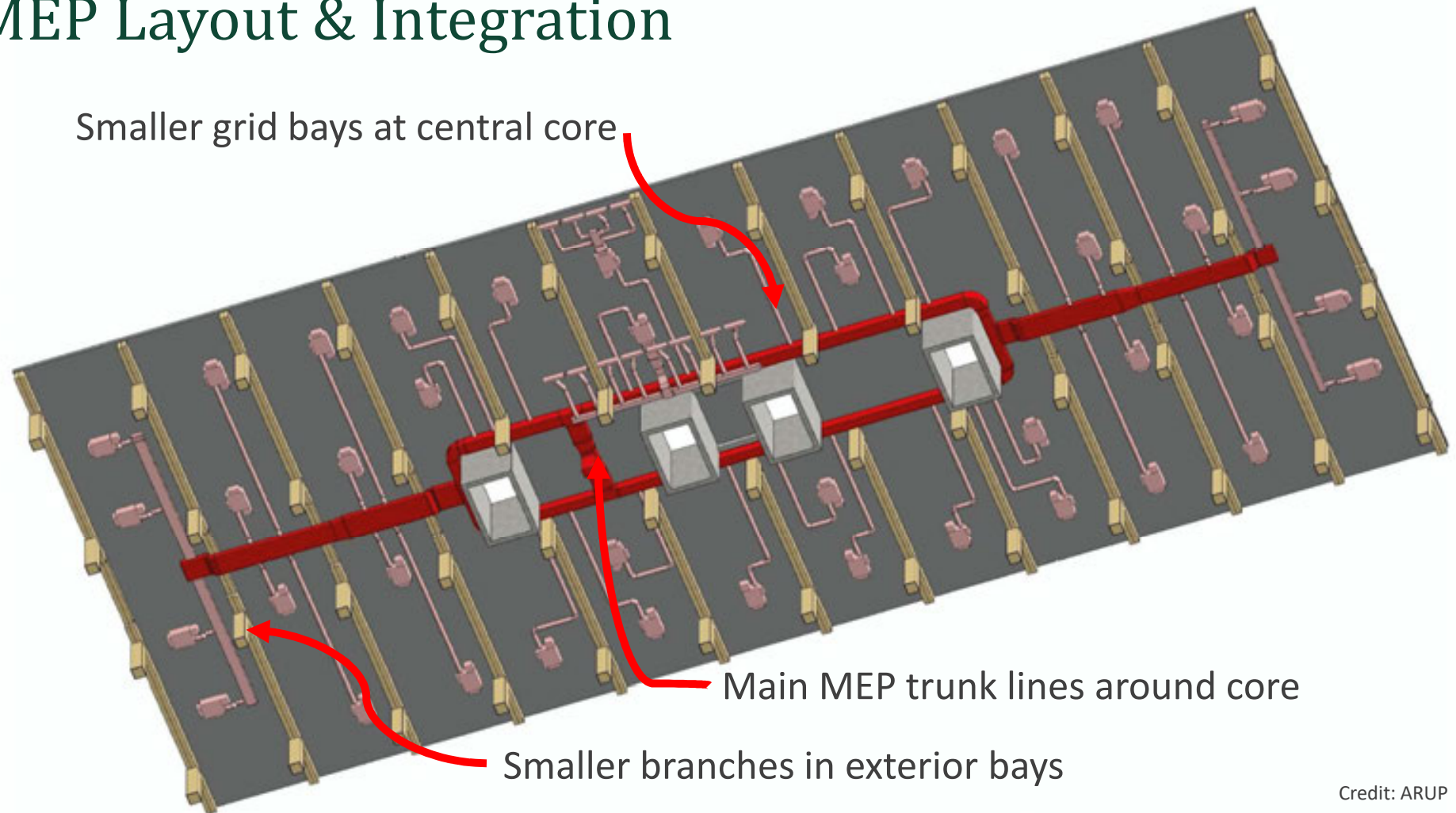


Credit: Blaine Brownell



Credit: WoodWorks

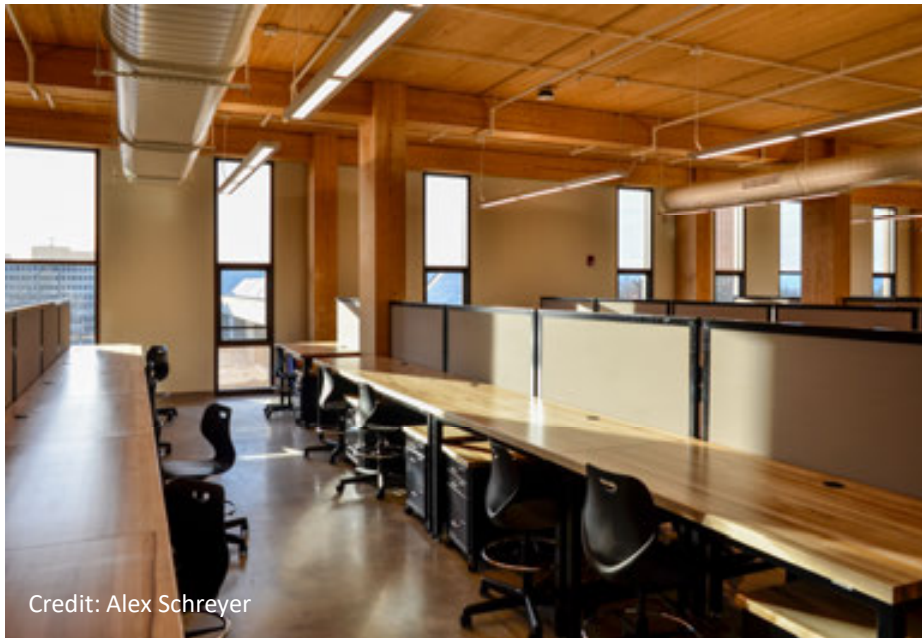
MEP Layout & Integration



MEP Layout & Integration

Dropped below MT framing

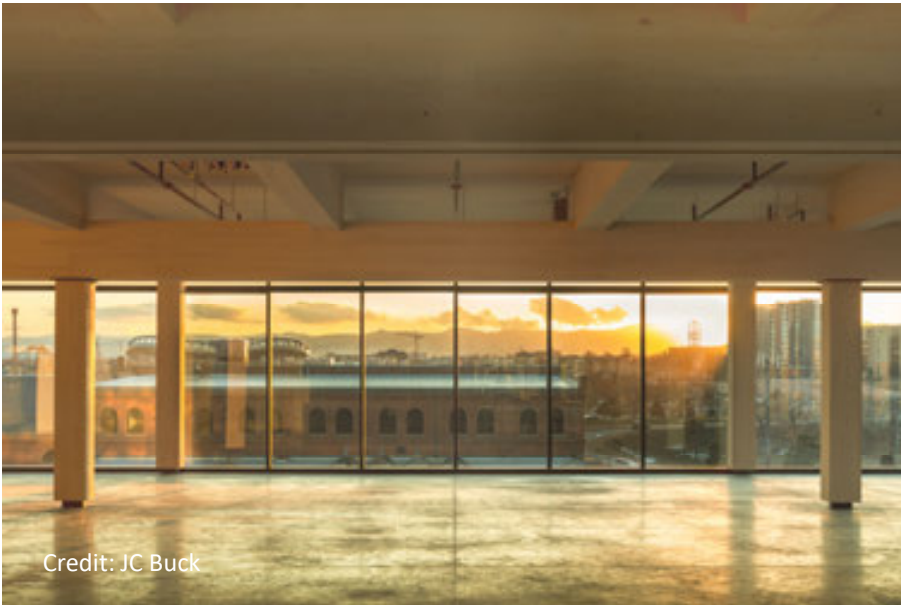
- » Can simplify coordination (fewer penetrations)
- » Bigger impact on head height



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 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 at Platte 15

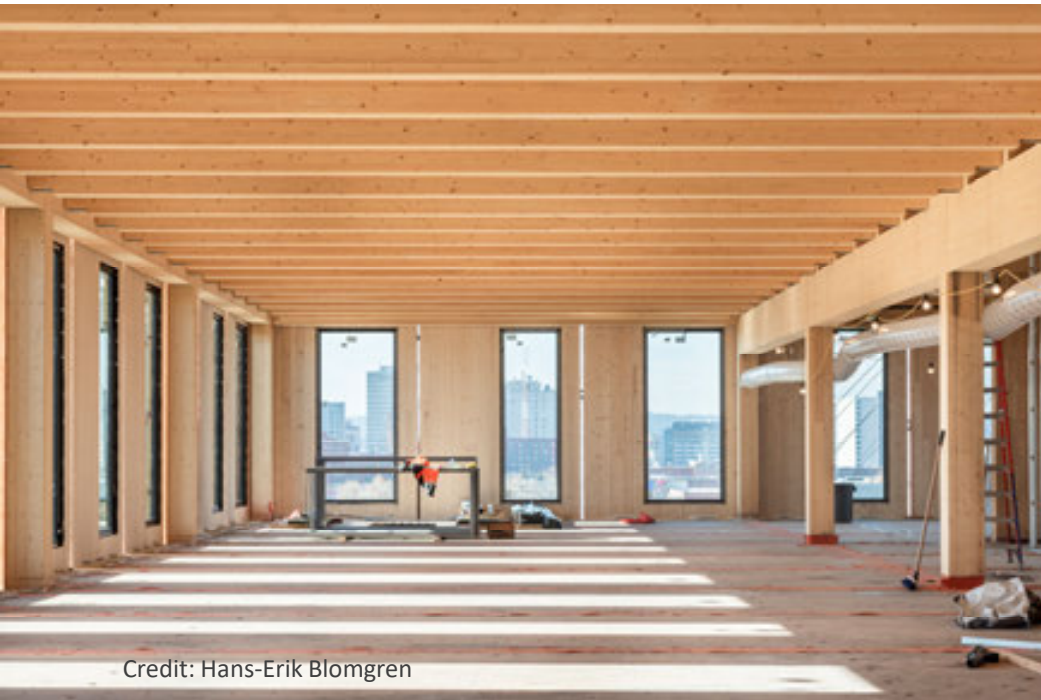
- » 30x30 grid, purlins at 10 ft, 3-ply CLT



MEP Layout & Integration

In chases above beams and below panels at Catalyst

- » 30x30 grid, 5-ply CLT ribbed beam system



Credit: Hans-Erik Blomgren



MEP Layout & Integration

In gaps between MT panels

- » Fewer penetrations, can allow for easier modifications later



MEP Layout & Integration

In gaps between MT panels

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



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



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

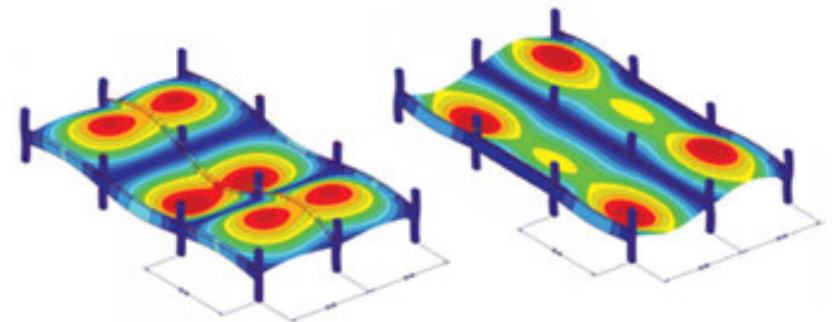
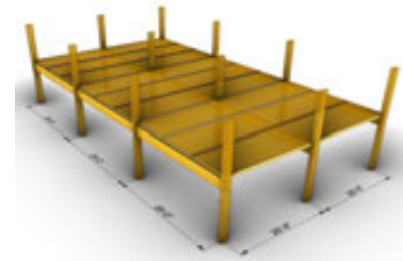


Credit: Alex Schreyer

Mass Timber Floor Vibration Guide

Worked office, lab and residential Examples

Covers simple and complex methods for bearing wall and frame supported floor systems



Lateral System Choices & Impacts



Lateral System Choices

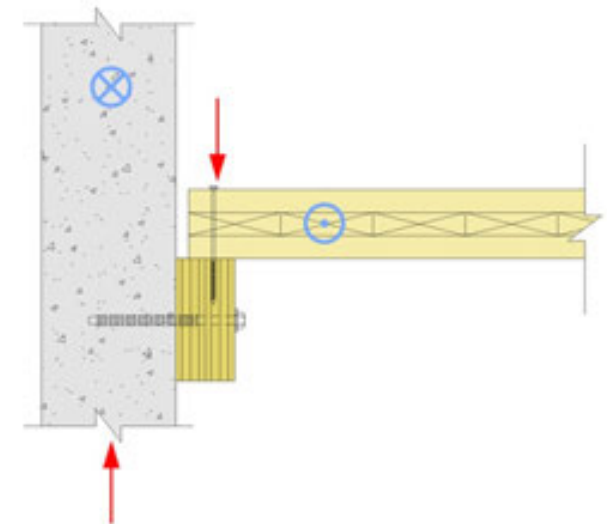
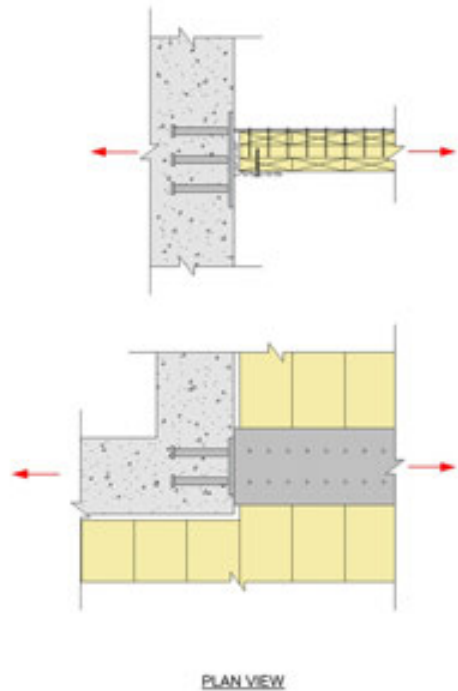
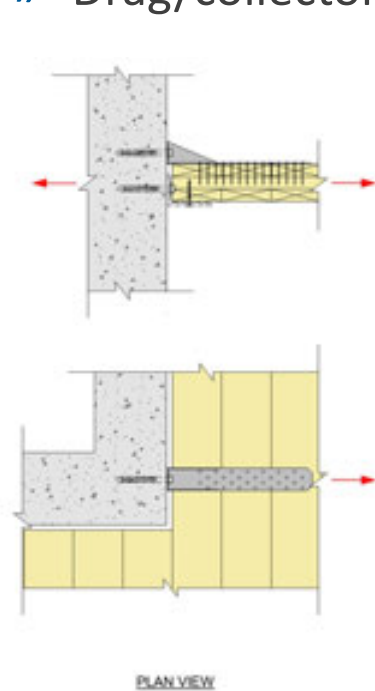
Concrete Shear walls



Lateral System Choices

Connections to concrete core

- » Tolerances & adjustability
- » Drag/collector forces



Lateral System Choices

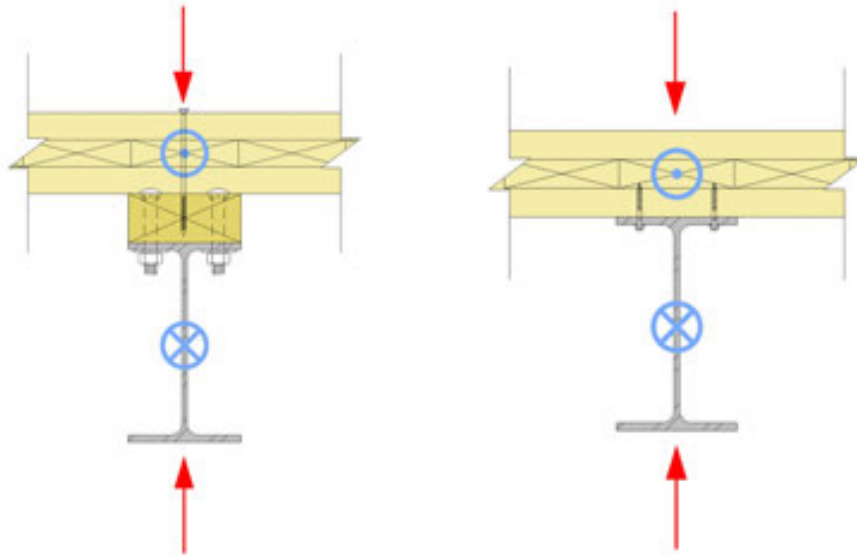
Steel Braced Frame



Lateral System Choices

Connections to steel frame

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



Lateral System Choices

Wood-Frame Shear walls



Credit: KL&A Engineers & Builders

Lateral System Choices

Wood-frame Shear walls:

- » Code compliance
- » Standard of construction practice well known
- » Limited to 65 ft shear wall height, 85 ft overall building height

(Type IIIA construction)



Credit: Jeremy Bittermann
& Kaiser + Path

Lateral System Choices

MT Shear walls



Lateral System Choices

MT Rocking Shear walls

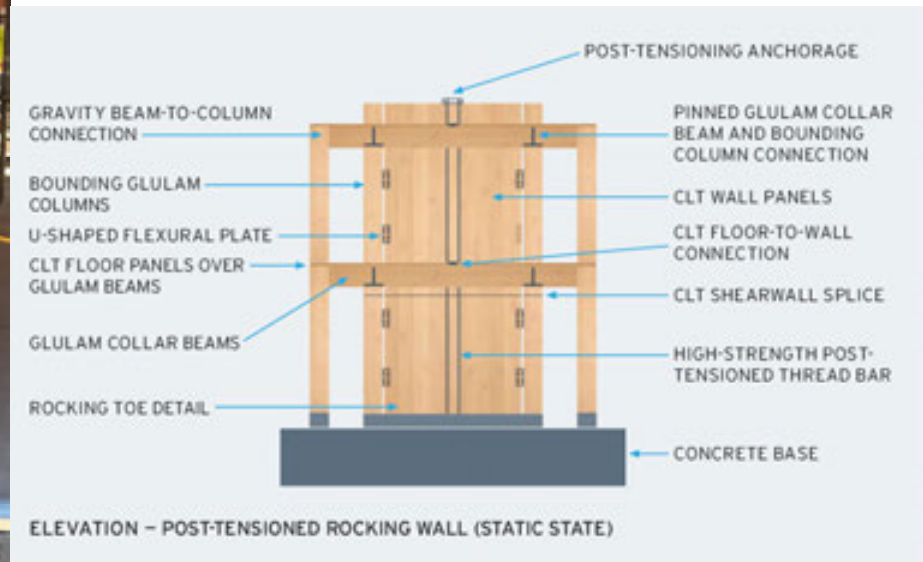


Image: KPFF

Lateral System Choices

Timber Braced Frame



Credit: Alex Schreyer

Lateral System Choices

Prescriptive Code Compliance

Concrete Shear walls



Steel Braced Frames



Light Wood-Frame Shear walls



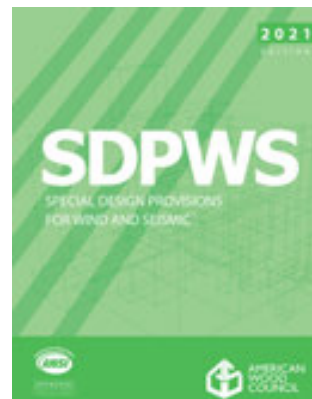
CLT Shear walls



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

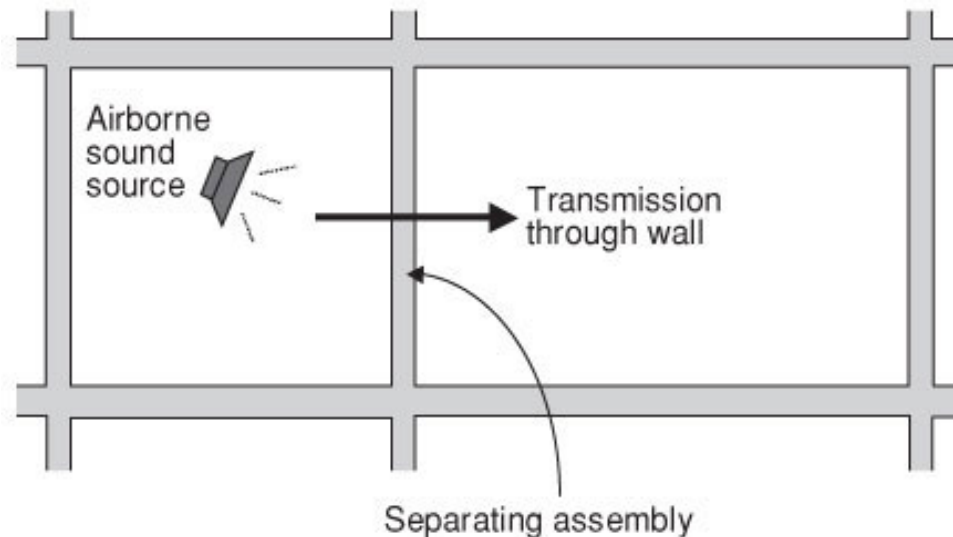
Acoustics

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

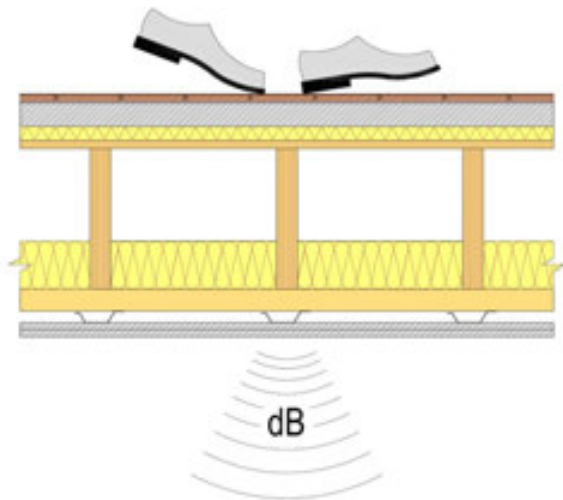


Acoustics & Sound Control

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

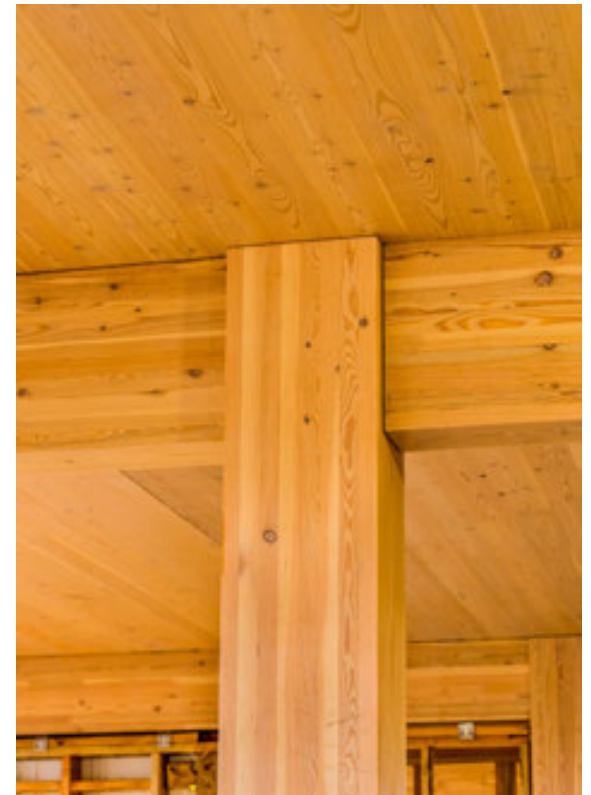
Min. IIC of 50 (45 if field tested) for:

- » Floor/Ceiling Assemblies



Acoustics & Sound Control

MT: Structure Often is Finish



Photos: Baumberger Studio/PATH Architecture/Marcus Kauffman | Architect: Kaiser + PATH

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



Credit: AcoustiTECH

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

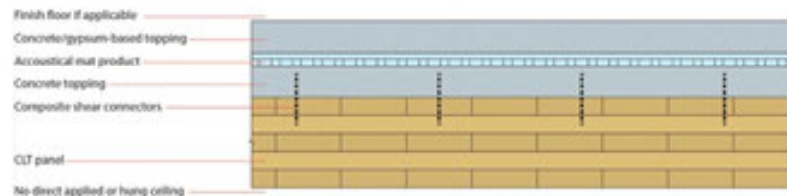
Application Type

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

Mass Timber Panel

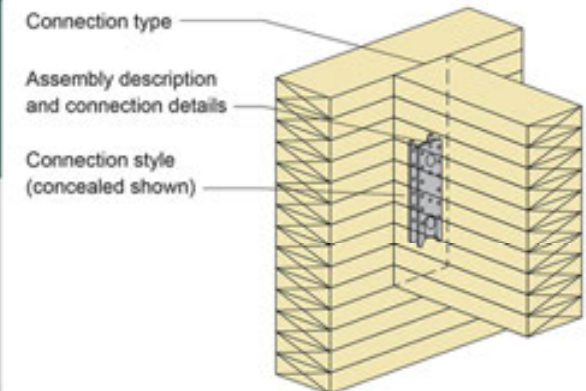
- ☐ CLT 507
- ☐ CLT (SCL) 56
- ☐ NLT 72
- ☐ DLT 22

CLT-Concrete Composite Floor Assemblies, Ceiling Side Exposed



This illustration is for specific conditions 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



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.



Eduardo Morales, PE
Regional Director – IL, MN, WI
(773) 815-5584
Eduardo.morales@woodworks.org

Survey



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