Designing and Building with Mass Timber:

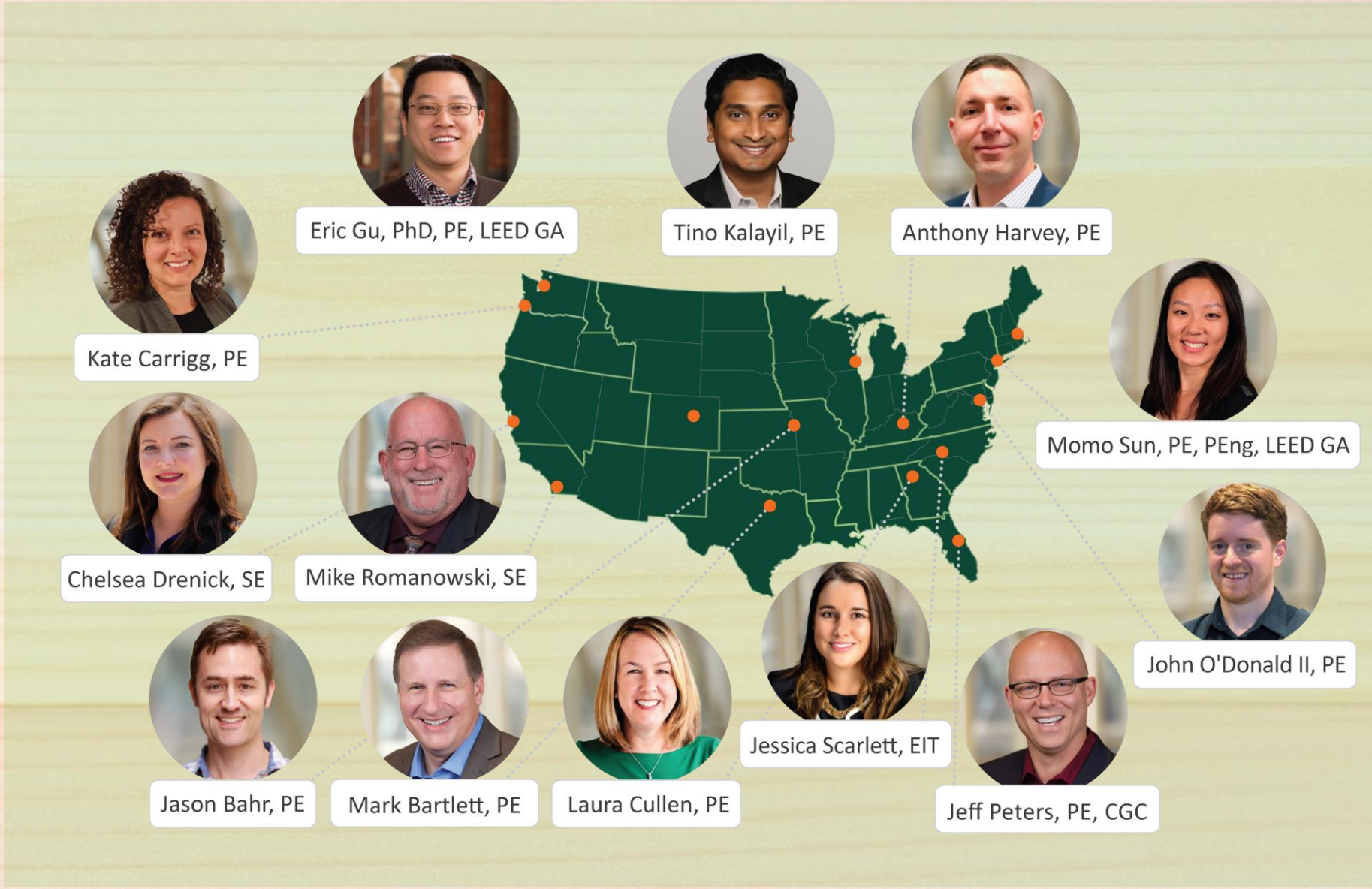
Design, Planning and Performance

Presented By:

Jason Bahr, PE

October 5, 2023

Regional Directors: **One-on-One Project Support**



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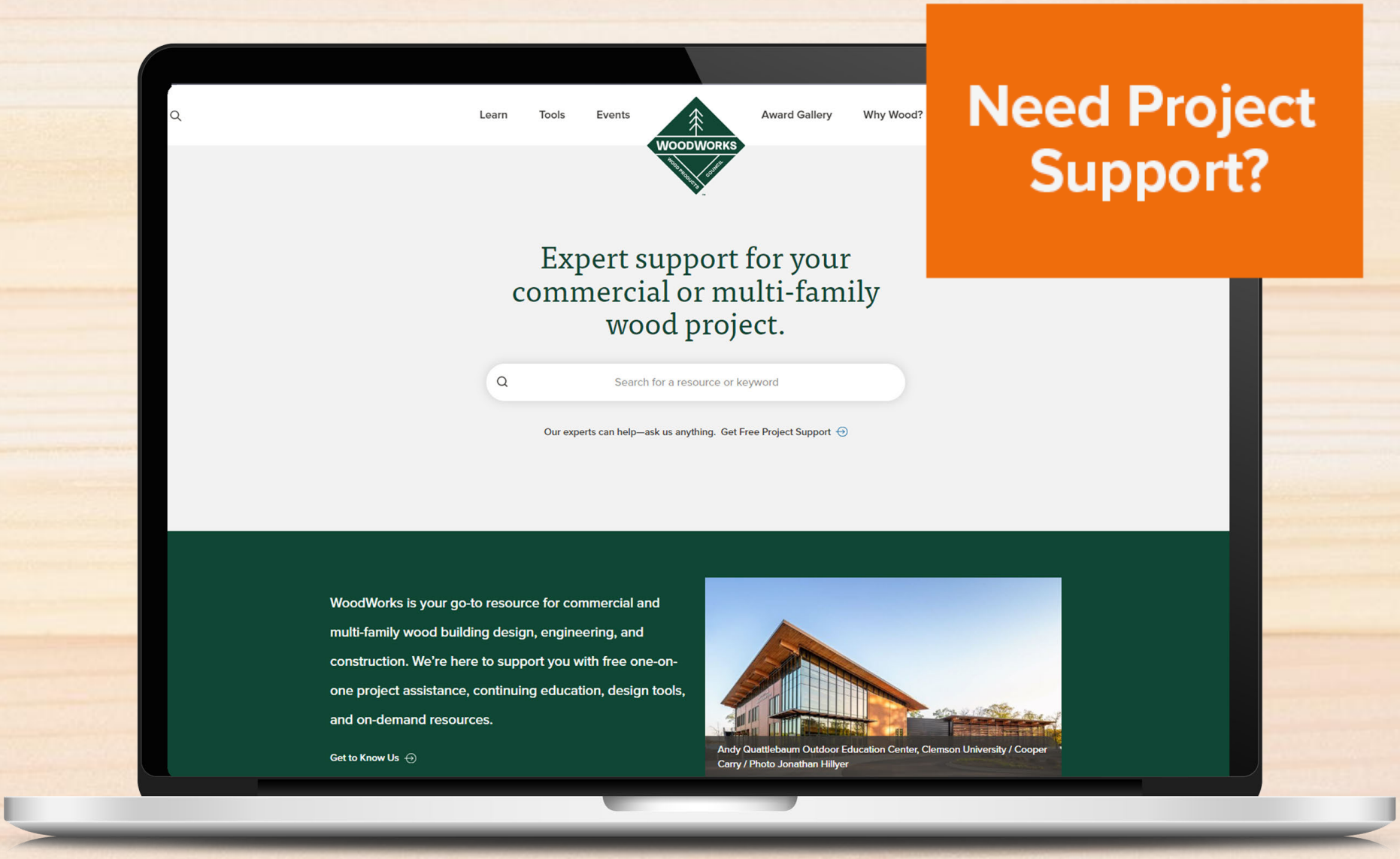

Building Systems

- Light-Frame
- Mass Timber / CLT
- Off-Site / Panelized Construction
- Hybrid

Building Types

- Multi-Family / Mixed Use
- Education
- Office
- Commercial Low-Rise
- Industrial
- Civic / Recreational
- Institutional / Healthcare

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WoodWorks is your go-to resource for commercial and multi-family wood building design, engineering, and construction. We're here to support you with free one-on-

Building Systems

- Mass Timber / CLT 24
- Light-Frame 9
- Panelized Construction 7
- Hybrid 5

Building Types

- Multi-Family / Mixed-Use 16
- Education 10
- Office 10
- Commercial Low-Rise 9
- Civic / Recreational 6
- Industrial 6
- Institutional / Healthcare 6

Project Roles

- Architect 14
- Developer/Owner 11
- Structural Engineer 10
- Contractor/Installer 6

Resource Types

- Expert Tips 10
- Solution Papers 2
- Calculators 1
- Guides, Manuals & Inventories 1

Regions

- National 20
- Midwest 5
- South 4
- West 4

acoustics

Acoustics and Mass Timber: Room-to-Room Noise Control

This paper covers key aspects of mass timber acoustical design, including rules of thumb for optimal design, common assemblies, detailing strategies, and flanking paths. Companion to the Inventory of Mass Timber Acoustic Assemblies.

Solution Papers

Designing Mass Timber Floor Assemblies for Acoustics

The growing availability and code acceptance of mass timber for construction has given designers a low-carbon alternative.

Expert Tips

Impact of Wall Stud Size and Spacing on Fire and Acoustic Performance

Interior wall partitions in a wood-frame building—such as unit demising and corridor walls in a multi-family project—must meet several design objectives simultaneously. Two primary functions are fire resistance and acoustical separation. Having to cite two tested wall assemblies, one for fire-resistance endurance results and another for acoustic results, is common.

Expert Tips

Firehouse 12

The continuous plywood shell that creates varying acoustic conditions within the performance space forms the exterior of the auditorium.

Award Winner

Acoustical Considerations for Mixed-Use Wood-Frame Buildings

This paper will help you understand the effects of acoustics in the context of other performance areas, enabling you to more easily navigate the decisions and trade-offs required when evaluating assembly options.

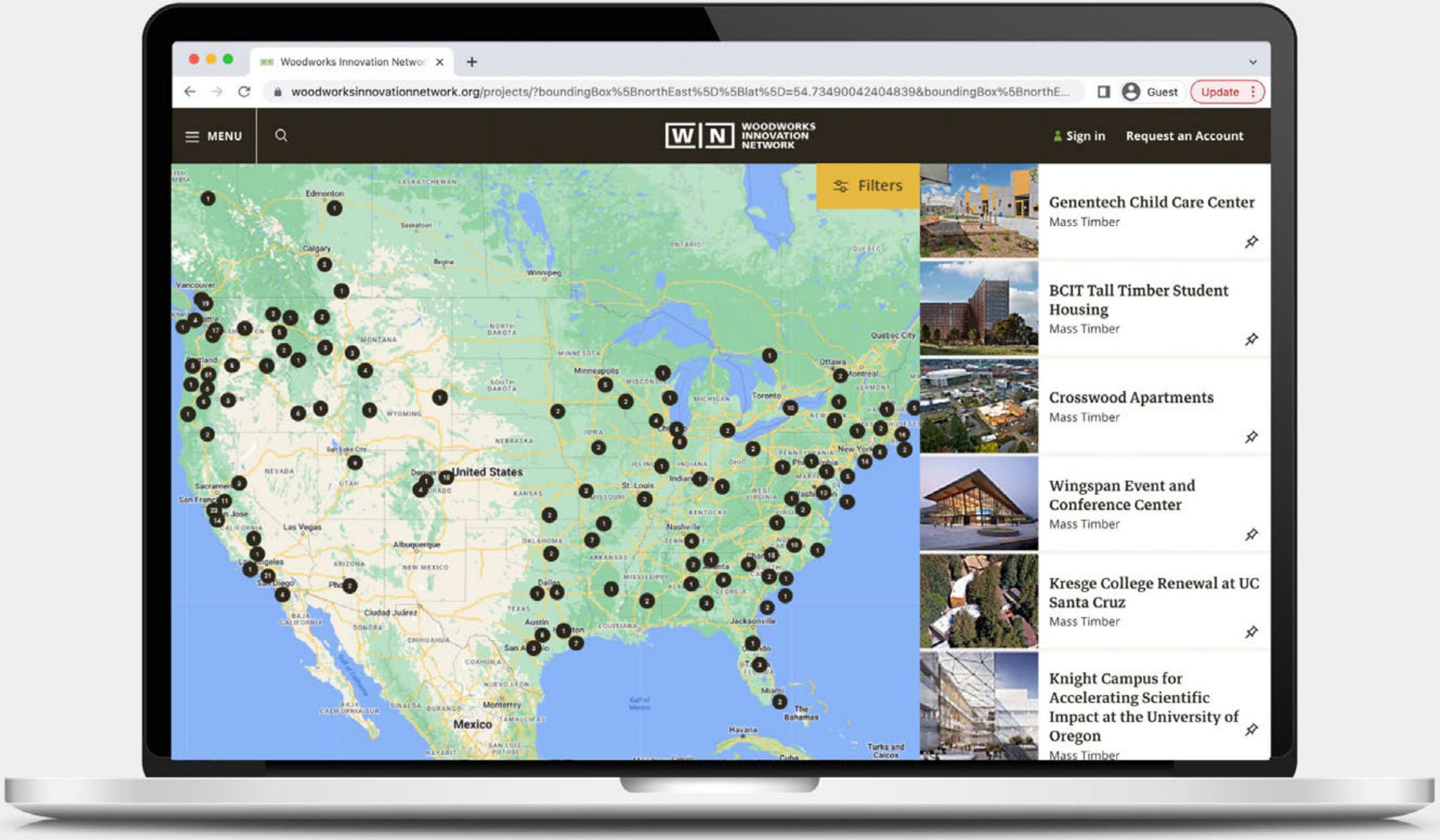
Solution Papers

Holes and Penetrations in Mass Timber Floor and Roof Panels

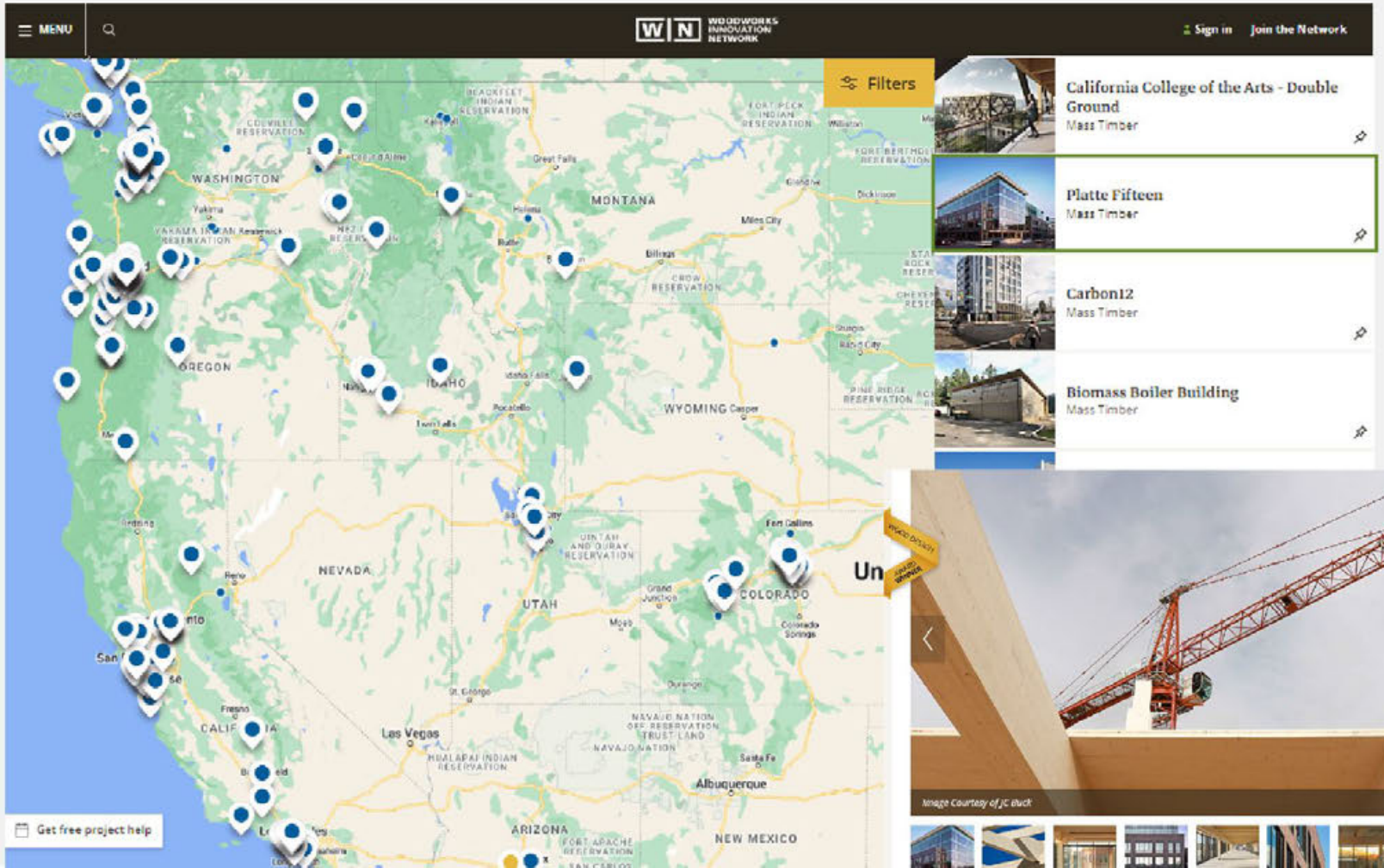
Guidance for the design of mass timber floor and roof panels with openings, including structural, fire resistance, and acoustic impacts, and tips for reinforcement.

Expert Tips

woodworksinnovationnetwork.org



See innovative wood projects + their design teams.



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HASSLACHER Group		14	View

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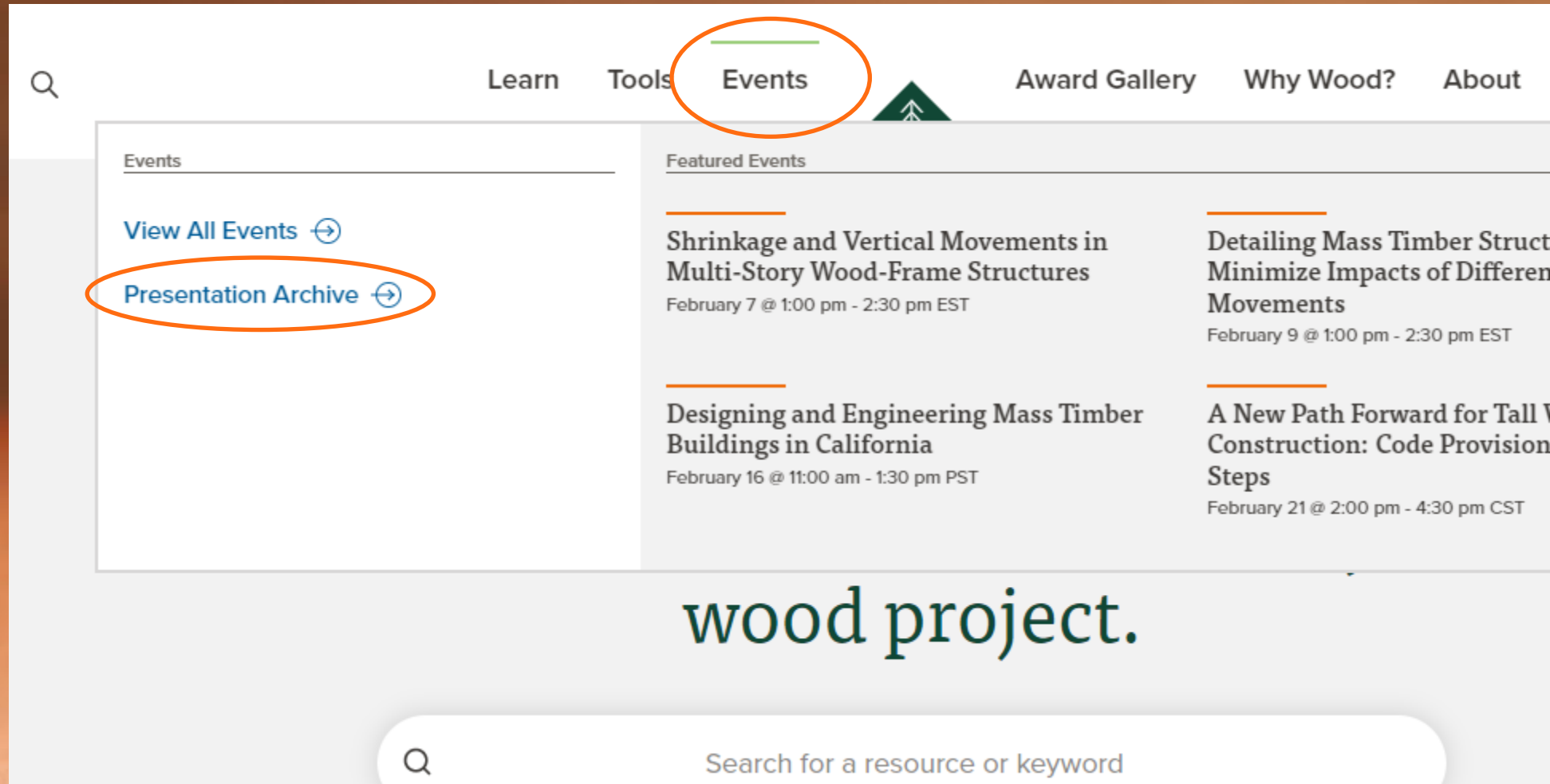
presentation slides in pdf:

woodworks.org/presentation-archive/



Agenda

Designing and Building with Mass Timber: Design, Planning and Performance

11:00 -11:05 pm	Welcome and Introductions, Jason Bahr
11:05 – 12:05 pm	Designing and Building with Mass Timber: Design, Planning and Performance, pt.1
12:05 - 12:10 pm	Break
12:10 - 1:10 pm	Designing and Building with Mass Timber: Design, Planning and Performance, pt.2
1:10 - 1:30 pm	Q&A (optional)

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This course 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.

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

AIA Approved Continuing Education

Course Description

How can architects, engineers and contractors collaborate to meet the growing demand for mass timber buildings? While developers across the country are pursuing mass timber projects, knowledge among AEC professionals is not yet widespread. Firms have varying degrees of familiarity with both the products and practicalities of designing, sourcing, and building a modern mass timber structure, and early adopters continue to play a significant role in educating the rest of the community. This presentation seeks to build on this openness and environment of shared learning, providing an overview of mass timber products, planning, design and implementation to maximize the benefits these buildings can deliver. We'll also discuss why some mass timber projects face resistance, and how to overcome misconceptions to achieve success. Topics will also include preconstruction coordination and interactions between the manufacturer and design/construction teams, case-based approaches to costing and scheduling, project delivery methods, how to achieve the highest level of efficiency for costs, schedule, and performance, and additional education and training opportunities.

Learning Objectives

1. Identify project planning, coordination and design topics that translate into successful buildings for both the design and construction team.
2. Explore best practices for interaction between manufacturer, design team and preconstruction manager that can lead to cost efficiency and safety on site.
3. Discuss potential construction schedule savings and construction fire safety practices realized through the use of prefabricated mass timber elements.
4. Discuss benefits of using mass timber products, including structural versatility, prefabrication, lighter carbon footprint, and reduced labor costs.

PRESENTATION OUTLINE

MASS TIMBER DESIGN

Products
Structural Solution & Connections
Projects and Code Considerations

MASS TIMBER CONSTRUCTION

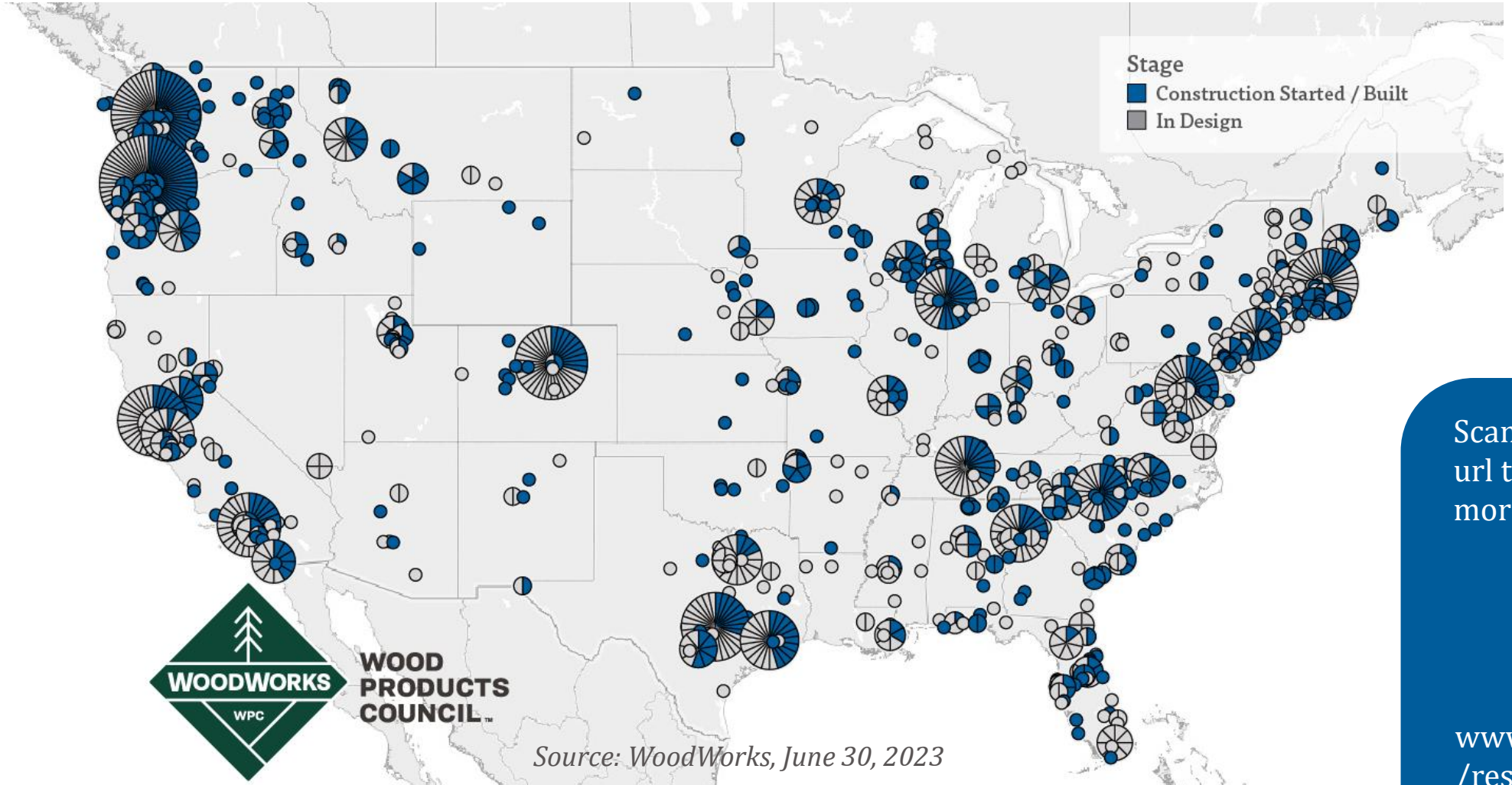
Planning for Construction
Performing Construction
Workforce Development

MASS TIMBER OVERVIEW

Photo: PCL Construction

Current State of Mass Timber Projects

As of June 2023, in the US, **1,860** multi-family, commercial, or institutional projects have been constructed with, or are in design with, mass timber.



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Source: WoodWorks, June 30, 2023

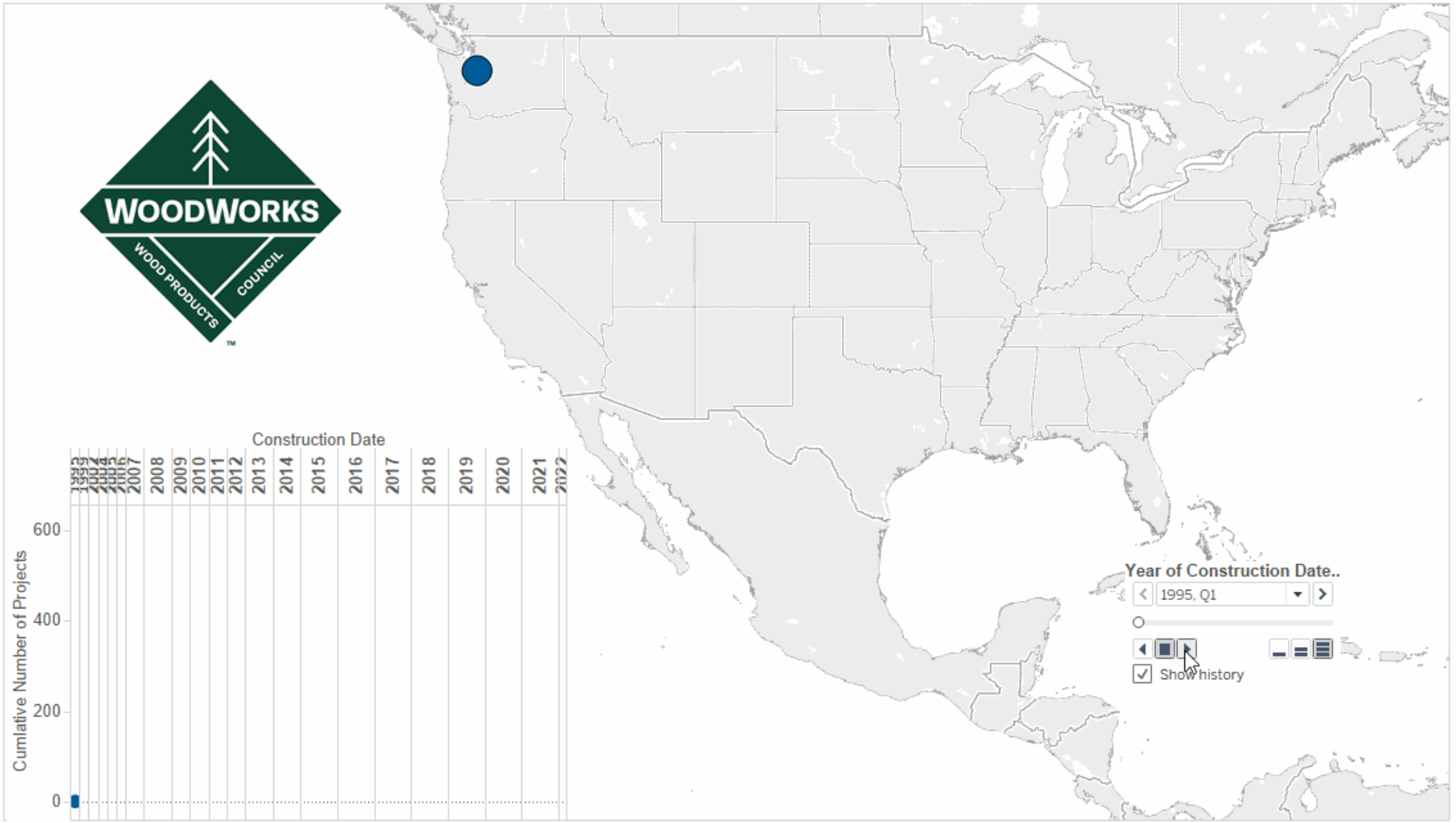
* *This total includes modern mass timber and post-and-beam structures built since 2013*

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

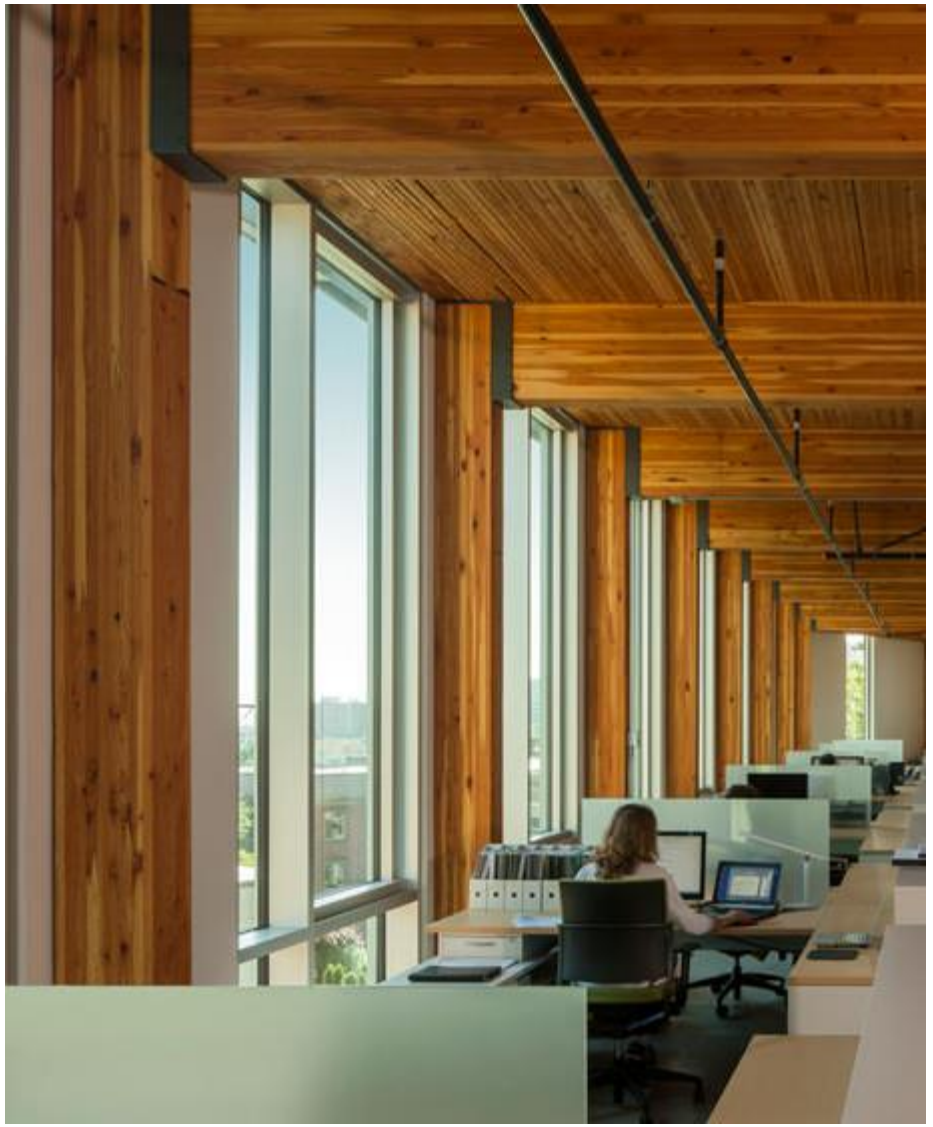
As of March 2022, in the US, **1,384** multi-family, commercial, or institutional projects have been constructed with, or are in design with, mass timber.



OVERVIEW | TIMBER METHODOLOGIES

Light Wood-Frame
Photo: WoodWorks

Heavy Timber
Photo: Benjamin Benschneider



Mass Timber
Photo: John Stamets

MASS TIMBER PRODUCTS

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

Dowel-Laminated Timber (DLT)

Photo: StructureCraft

Nail-Laminated Timber (NLT)

Photo: Think Wood

Glue-Laminated Timber (GLT)

Plank orientation

Photo: StructureCraft

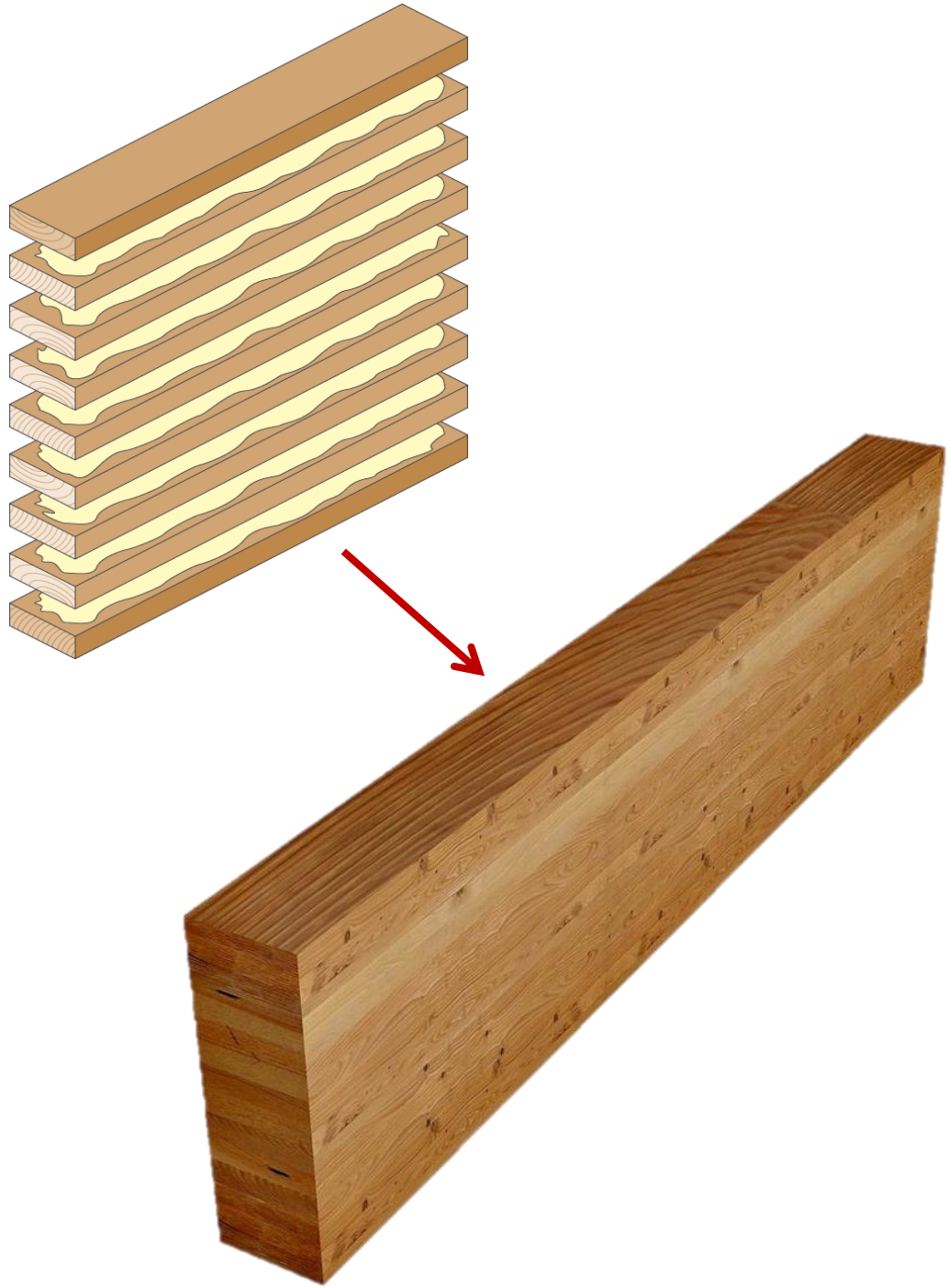
Photo: StructureCraft

Photo: Ema Peter

Photo: Manasc Isaac Architects/Fast + Epp

Glue Laminated Timber (GLT)

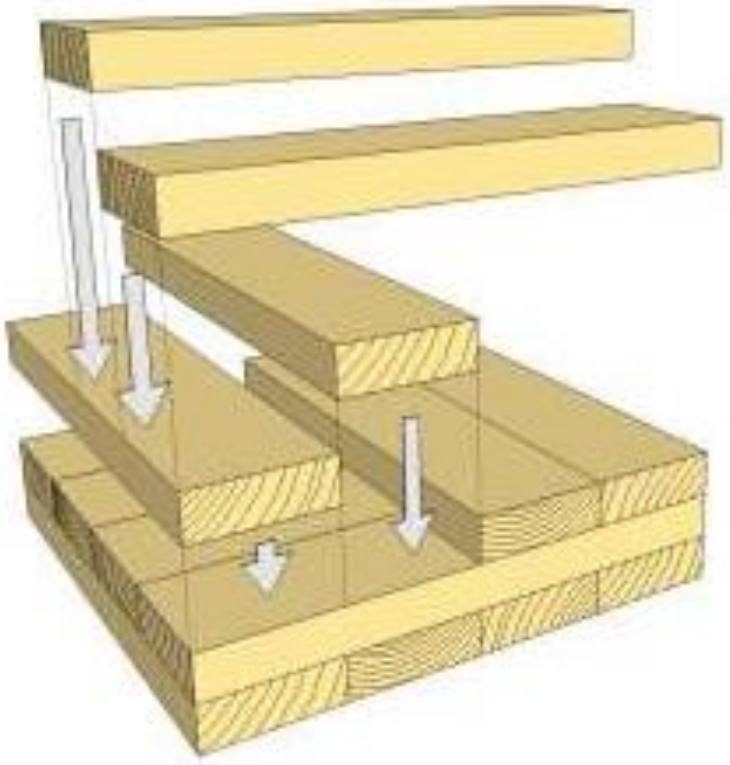
Photo: Manasc Isaac Architects/Fast + Epp

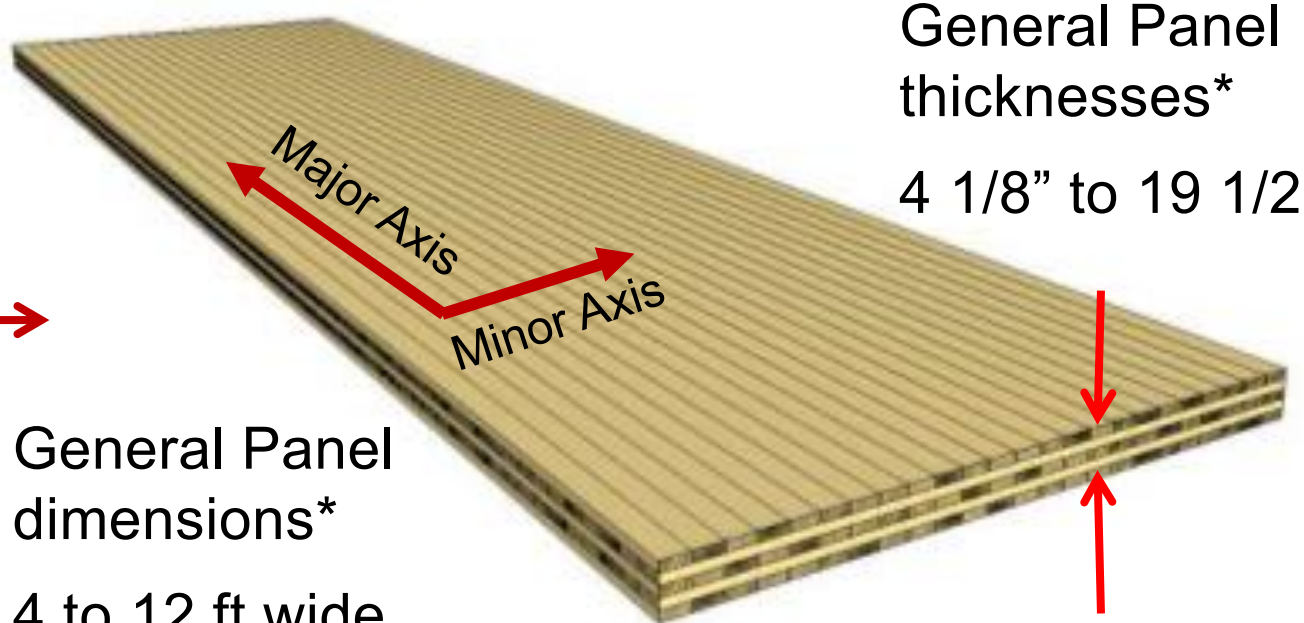


Cross-Laminated Timber (CLT)

Cross-Laminated Timber (CLT)

With solid sawn laminations





General Panel thicknesses*

4 1/8” to 19 1/2”

General Panel dimensions*

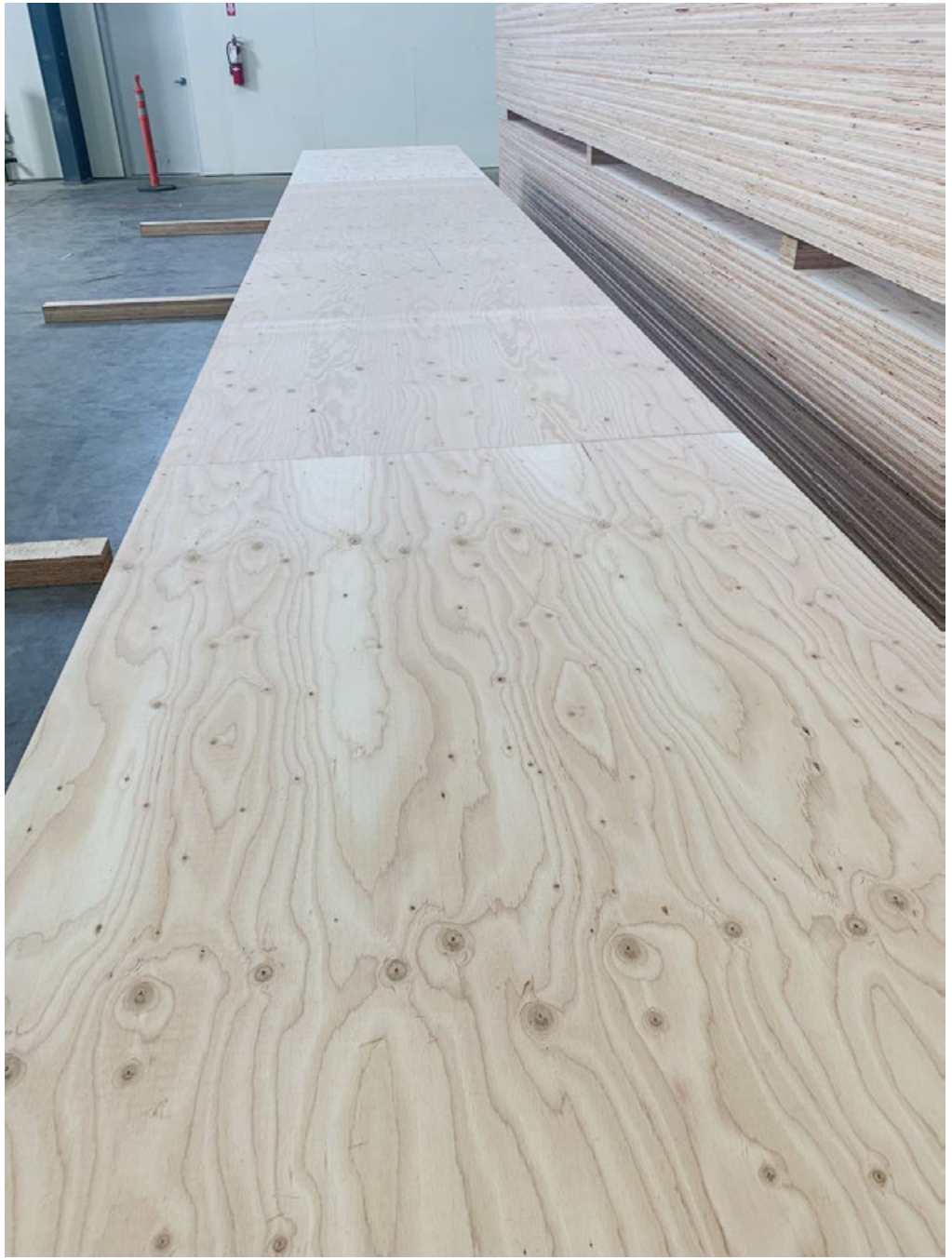
4 to 12 ft wide

24 to 64 ft long

*Consult with manufacturers for available panel sizes

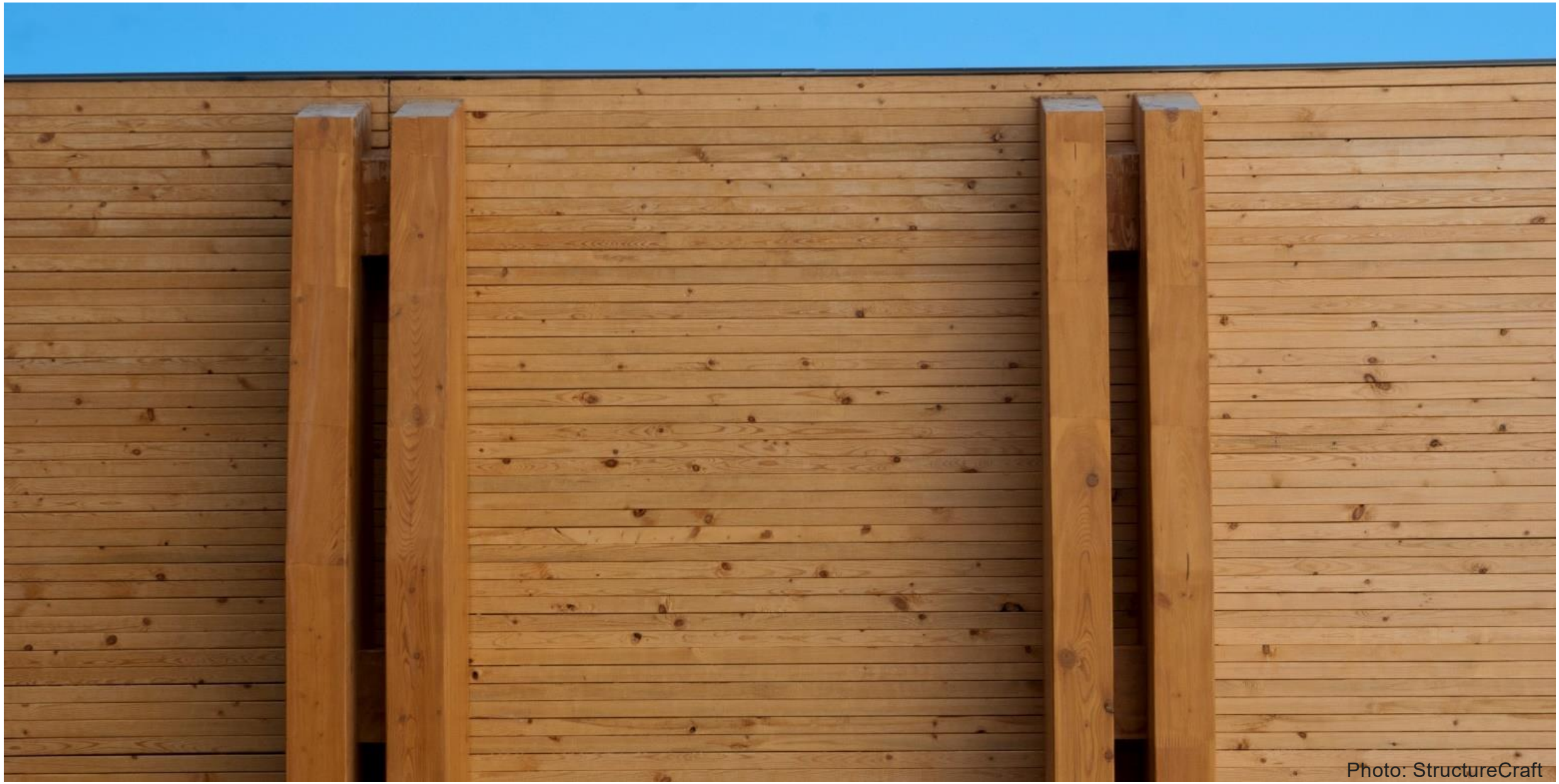
Cross-Laminated Timber (CLT)

With SCL laminations



Photos: Freres Lumber

Nail-Laminated Timber (NLT)



Nail-Laminated Timber (NLT)

Photo: StructureCraft

Photo: Think Wood

Dowel-Laminated Timber (DLT)

Photo: StructureCraft

Other Mass Timber Product Options

Glue Laminated Timber
GLT

Laminated Veneer Lumber
LVL

Parallel Strand Lumber
PSL

Laminated Strand Lumber
LSL

Timber-Concrete Composite
TCC

Decking

Photos: StructureCraft

Photo: Ema Peter

STRUCTURAL SOLUTIONS | POST, BEAM + PLATE

Photo: Seagate Structures

STRUCTURAL SOLUTIONS | POST + PLATE

Photo: Lendlease

STRUCTURAL SOLUTIONS | HYBRID LIGHT-FRAME + MASS TIMBER

Photo: TimberLab

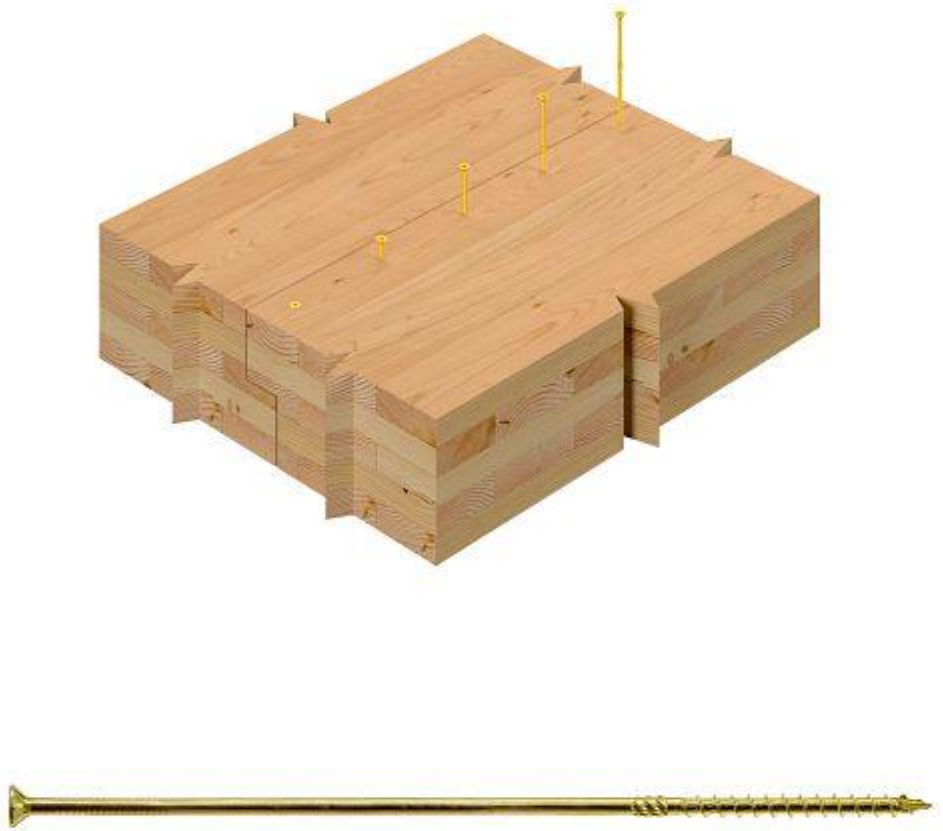
STRUCTURAL SOLUTIONS | HYBRID STEEL + MASS TIMBER

LEVER Architecture, photo Jeremy Bittermann

STRUCTURAL SOLUTIONS | HYBRID CONCRETE + MASS TIMBER

Concealed Connectors

Photo Marcus Kauffman



Self Tapping Screws

Photo Simpson Strong Tie

Beam to Column

Photo: StructureCraft

Photo: Structurlam

Column to Foundation

Photo: Alex Schreyer

Panel to Panel & Supports

Photo: Charles Judd

Photo: Marcus Kauffman

Photos: Michael Elkan | Naturally Wood | UBC

PRECEDENT PROJECTS | BROCK COMMONS

INTRO, CLEVELAND

9 Stories | 115 ft

8 Timber Over 1 Podium

512,000 SF

297 Apartments, Mixed-Use

Photo: Harbor Bay Real Estate Advisors, Purple Film | Architect: Hartshorne Plunkard Architecture

INTRO, CLEVELAND

Type IV-B
Variance to expose ~50% ceilings

Photo: Harbor Bay Real Estate Advisors, Image Fiction | Architect: Hartshorne Plunkard Architecture

ASCENT, MILWAUKEE

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

493,000 SF

259 APARTMENTS, MIXED-USE

ASCENT, MILWAUKEE

Tallest Mass Timber Building in the World

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

80 M ST, WASHINGTON, DC

3 STORY VERTICAL ADDITION
7 STORY EXISTING BUILDING

Photo: WoodWorks | Architect: Hickok Cole

80 M ST, WASHINGTON, DC

100,000 SF

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

APEX PLAZA
CHARLOTTESVILLE, VA

187,000 SF

Photo: WoodWorks | Architect: William McDonough + Partners

APEX PLAZA
CHARLOTTESVILLE, VA

8 STORIES
6 TIMBER OVER 2 PODIUM, 100 FT

PRIMARILY OFFICE SPACE

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

11 E LENOX, BOSTON, MA

7 STORIES

70 FT

Passive House

Multi-Family

Credit: H + O Structural Engineering

Credit: Monte French Design Studio

11 E LENOX, BOSTON, MA

Credit: H + O Structural Engineering

Photos: StructureCraft

Photo: Hartshorne Plunkard Architecture

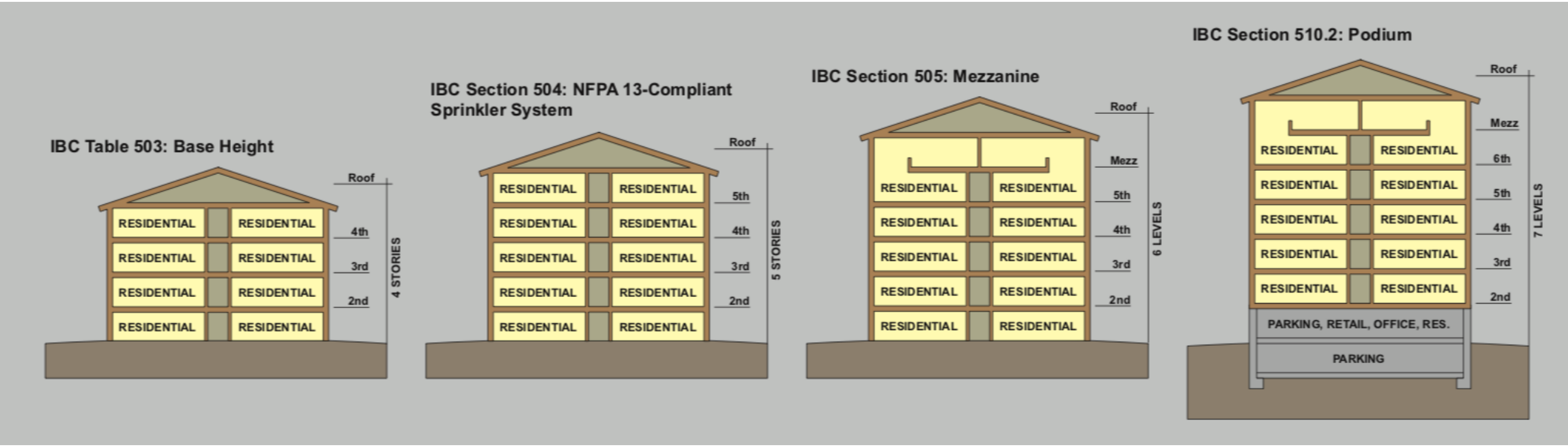
MASS TIMBER PROJECT CONSIDERATIONS

Photo: Hacker Architects

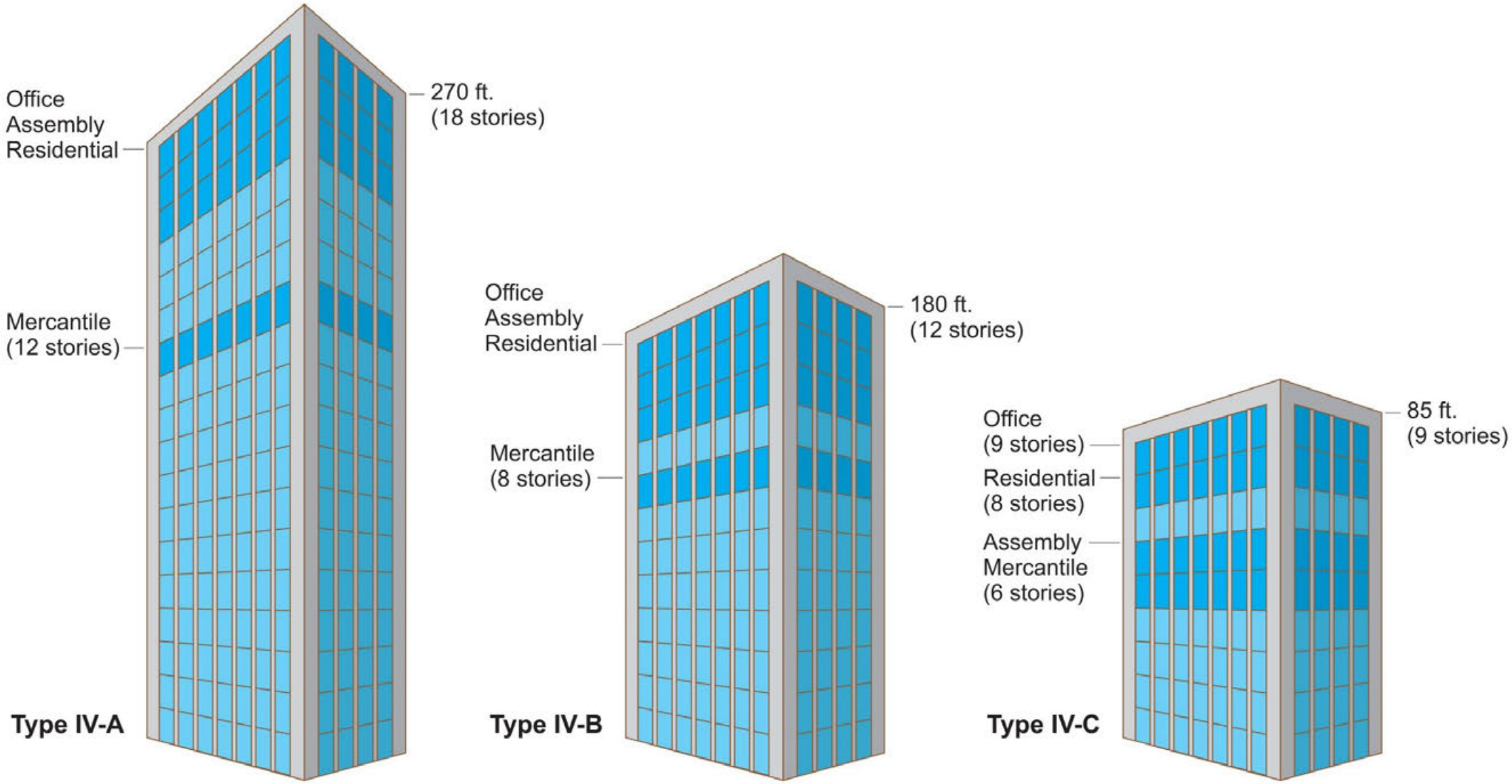
MASS TIMBER IN THE CODE

Photo: Freres Lumber

Mass Timber in Low- to Mid-Rise: 1-6 Stories in Construction Types III, IV or V



Tall Mass Timber: Up to 18 Stories in Construction Types IV-A, IV-B or IV-C

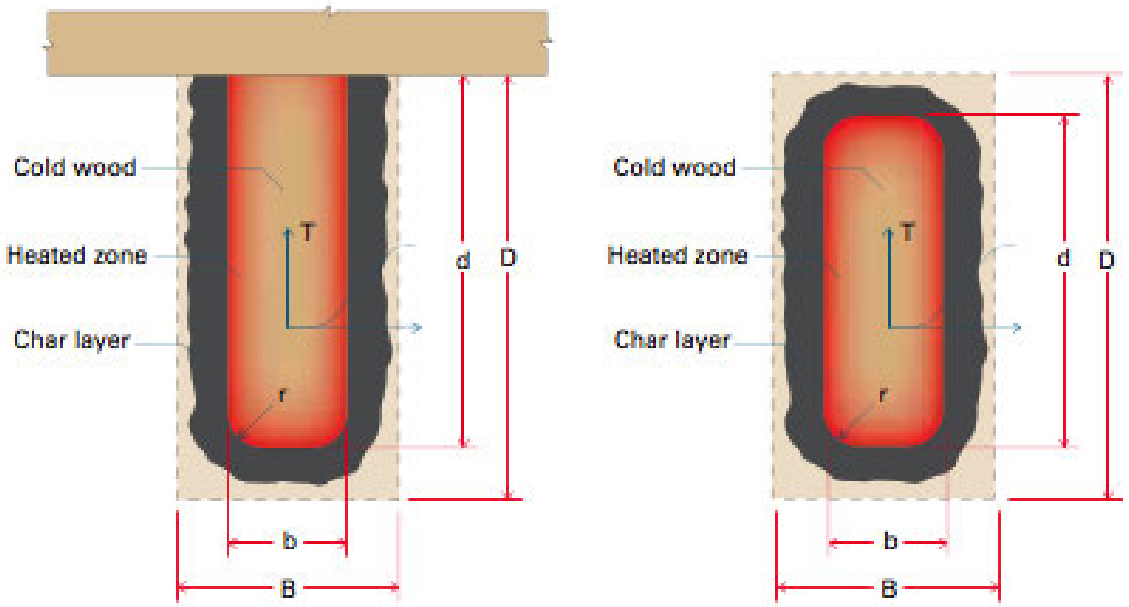


Mass Timber's Fire-Resistive Performance is Well-Tested, Documented and Recognized via Code Acceptance

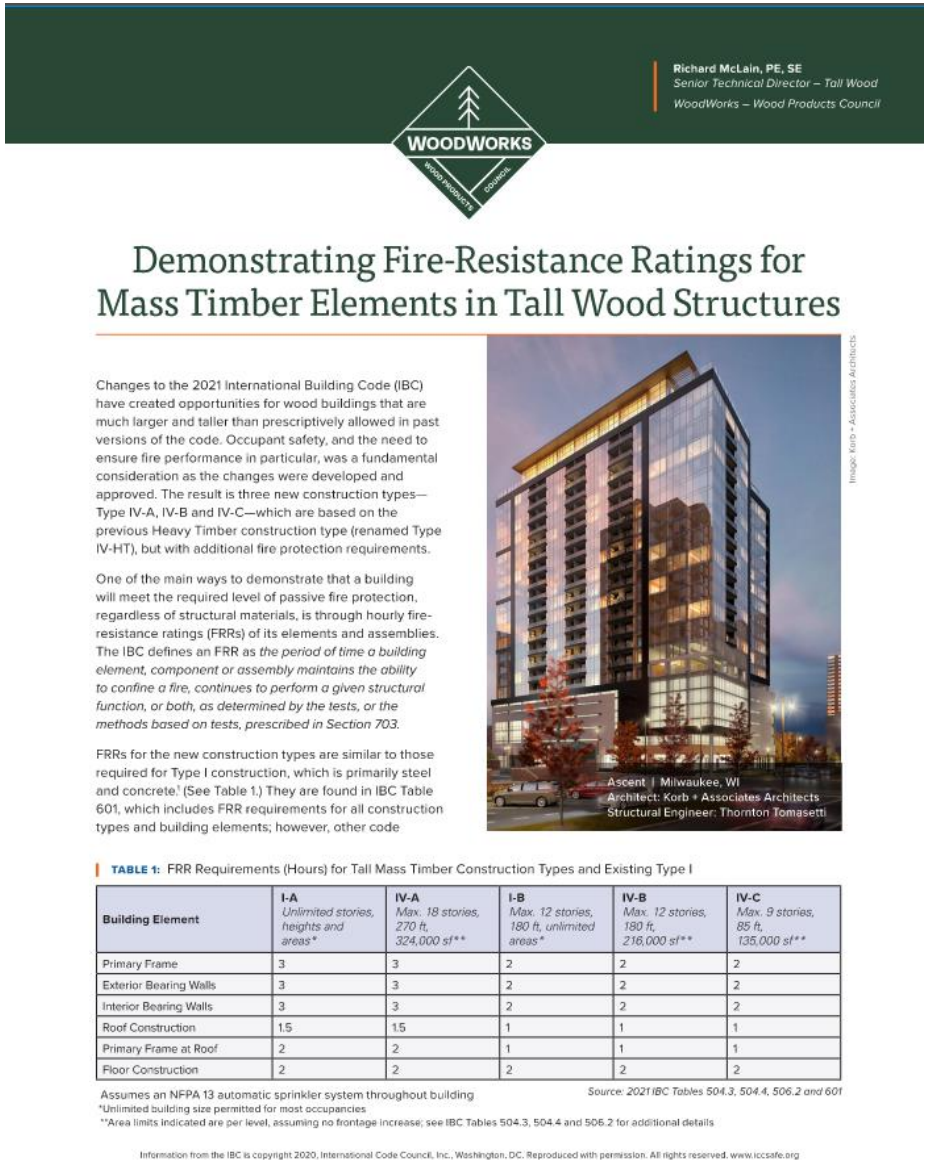
Table 16.2.1A Char Depth and Effective Char Depth (for β_n = 1.5 in./hr.)

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

Source: AWC's NDS



Source: AWC's TR 10



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

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

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

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

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

Image: Korb + Associates Architects

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

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

Building Element	I-A *Unlimited stories, heights and areas**	IV-A *Max. 18 stories, 270 ft, 324,000 sf***	I-B *Max. 12 stories, 180 ft, unlimited areas**	IV-B *Max. 12 stories, 180 ft, 216,000 sf***	IV-C *Max. 9 stories, 85 ft, 135,000 sf***
Primary Frame	3	3	2	2	2
Exterior Bearing Walls	3	3	2	2	2
Interior Bearing Walls	3	3	2	2	2
Roof Construction	1.5	1.5	1	1	1
Primary Frame at Roof	2	2	1	1	1
Floor Construction	2	2	2	2	2

Assumes an NFPA 13 automatic sprinkler system throughout building

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

*Unlimited building size permitted for most occupancies

**Area limits indicated are per level, assuming no frontage increase; see IBC Tables 504.3, 504.4 and 506.2 for additional details

Mass Timber Fire Design Resource

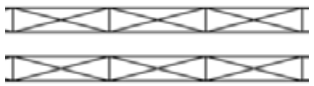
- Code compliance options for demonstrating FRR
- Updated as new tests are completed
- Free download at woodworks.org

Cost: Construction Type

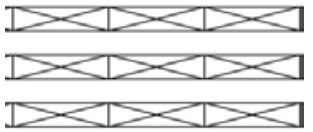
TABLE 601
Fire Resistance Rating Requirements for Building Elements (Hours)

Building Element	I-A	I-B	III-A	III-B	IV-A	IV-B	IV-C	IV-HT	V-A	V-B
Primary Structural Frame	3*	2*	1	0	3*	2	2	HT	1	0
Ext. Bearing Walls	3*	2*	2	2	3*	2	2	2	1	0
Int. Bearing Walls	3*	2*	1	0	3*	2	2	1/HT	1	0
Floor Construction	2	2*	1	0	2	2	2	HT	1	0
Roof Construction	1.5*	1*	1	0	1.5	1	1	HT	1	0
Exposed Mass Timber Elements					None	20-40%	Most	All		

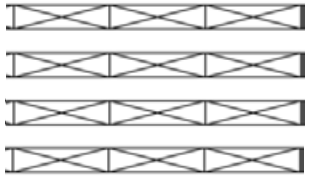
Baseline
0hr & HT



+$10/SF
1hr & maybe 2hr



+$12-15/SF
2hr FRR



Cost Source: Swinerton

*These values can be reduced based on certain conditions in IBC 403.2.1, which do not apply to Type IV buildings.

Cost Impacts of Construction Type

Construction Type Early Decision Example

3-story building on college campus

- Mostly Group B occupancy, some assembly (events) space
- NFPA 13 sprinklers throughout
- Floor plate = 7,700 SF
- Total Building Area = 23,100 SF

Impact of Assembly Occupancy Placement:

Owner originally desires events space on top (3rd) floor

- Requires Construction Type IIIA

If owner permits moving events space to 1st or 2nd floor

- Could use Type IIIB

Cost Impacts of Construction Type

Construction Type Early Decision Example

3-story building on college campus

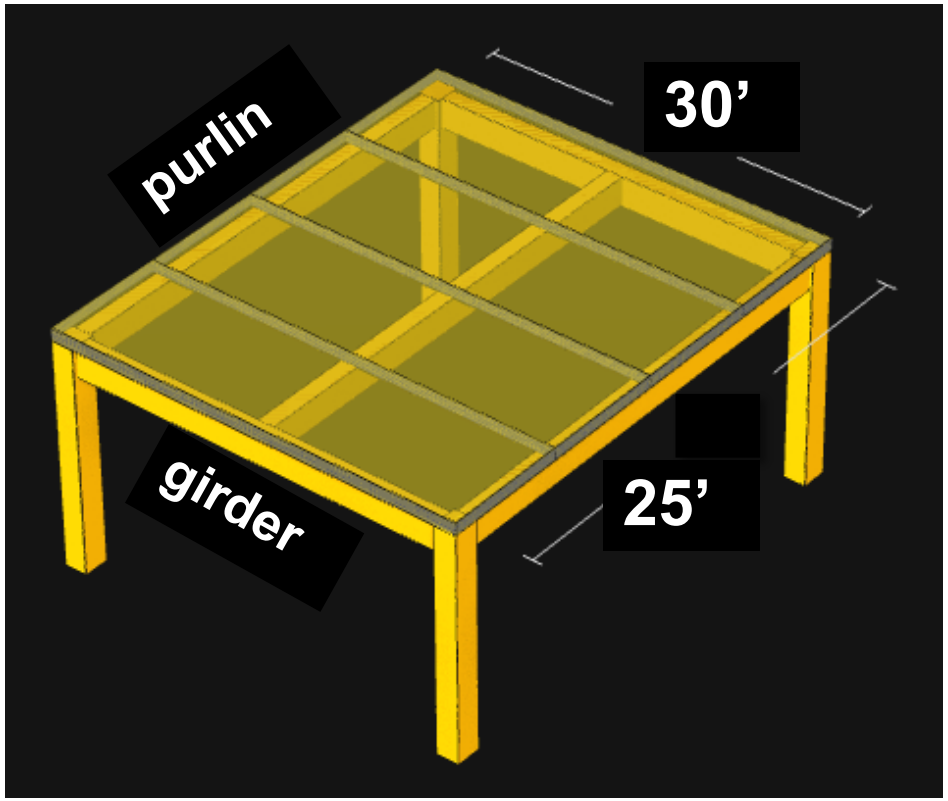
Cost Impact of Assembly Occupancy Placement:

Location of Event Space	3rd Floor	1st Floor
Construction Type	III-A	III-B
Assembly Group	A-3	A-3
Fire Resistive Rating	1-Hr	0-Hr
Connections	Concealed	Exposed
CLT Panel Thickness	5-Ply	3-Ply
Superstructure Cost/SF	**$65/SF**	**$53/SF**

Source: PCL Construction

Cost Implication of Design Choices

Panel volume usually 65-80% of MT package volume



Source: Fast + Epp, Timber Bay Design Tool

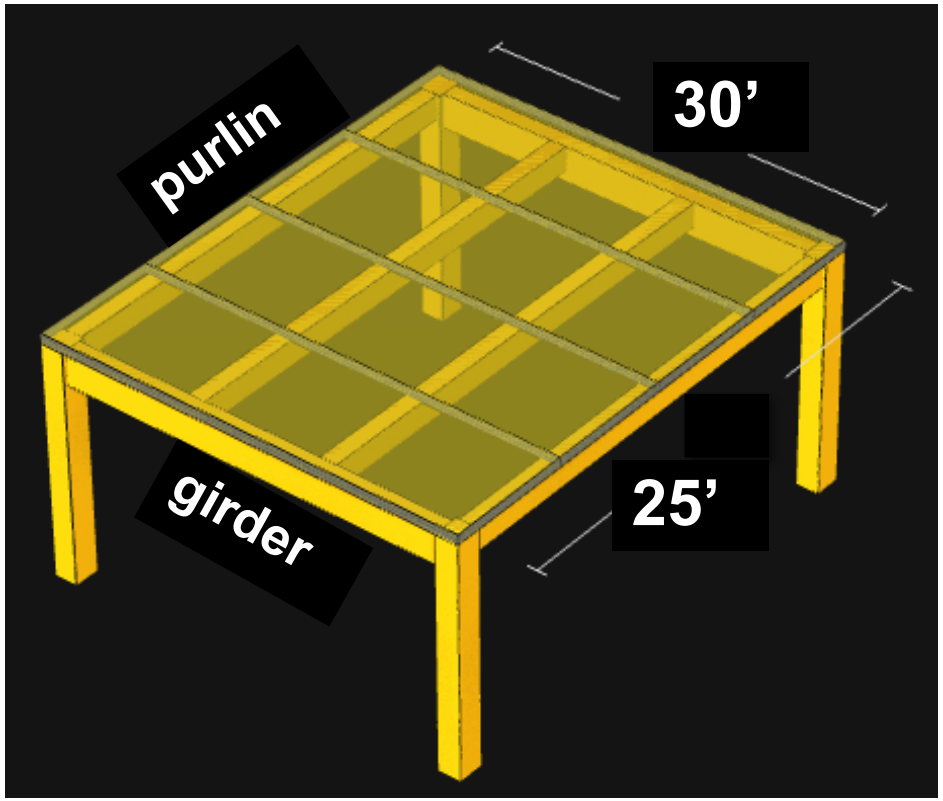
Type IIIA option 1

1-hr FRR
Purlin: 5.5”x28.5”
Girder: 8.75”x33”
Column: 10.5”x10.75”
Floor panel: 5-ply

Glulam volume = 118 CF (22% of MT)
CLT volume = 430 CF (78% of MT)
Total volume = 0.73 CF / SF

Cost Implication of Design Choices

Panel volume usually 65-80% of MT package volume



Source: Fast + Epp, Timber Bay Design Tool

Type IIIA option 2

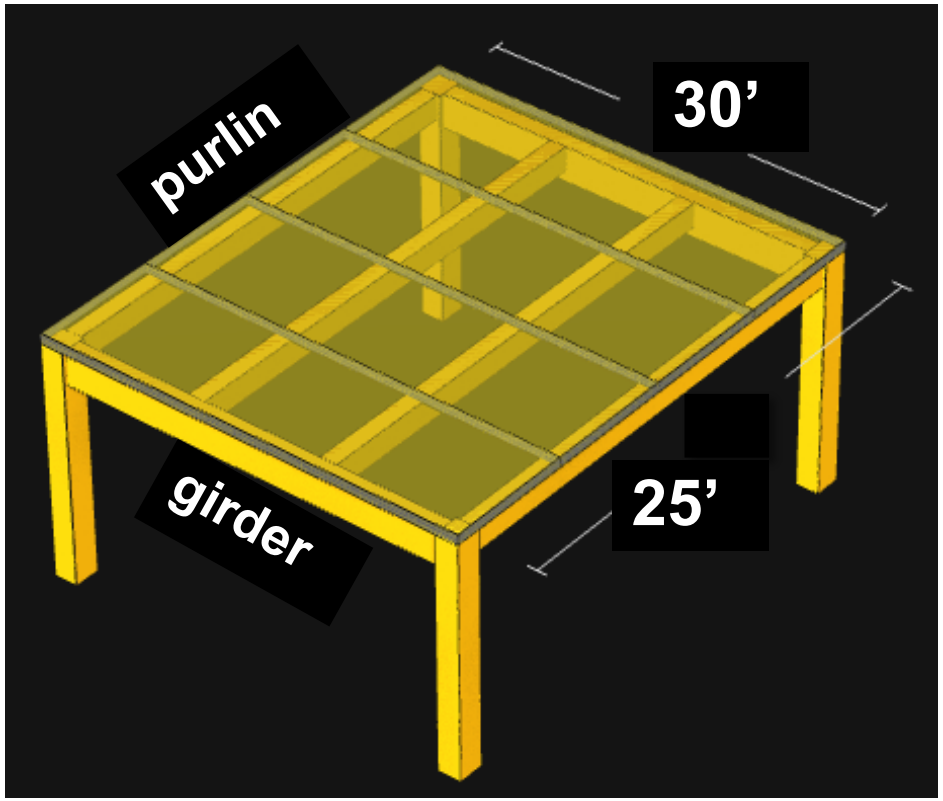
1-hr FRR
Purlin: 5.5”x24”
Girder: 8.75”x33”
Column: 10.5”x10.75”
Floor panel: 5-ply

Glulam volume = 123 CF (22% of MT)
CLT volume = 430 CF (78% of MT)
Total volume = 0.74 CF / SF

Cost considerations: One additional beam (one additional erection pick), 2 more connections

Cost Implication of Design Choices

Panel volume usually 65-80% of MT package volume



Source: Fast + Epp, Timber Bay Design Tool

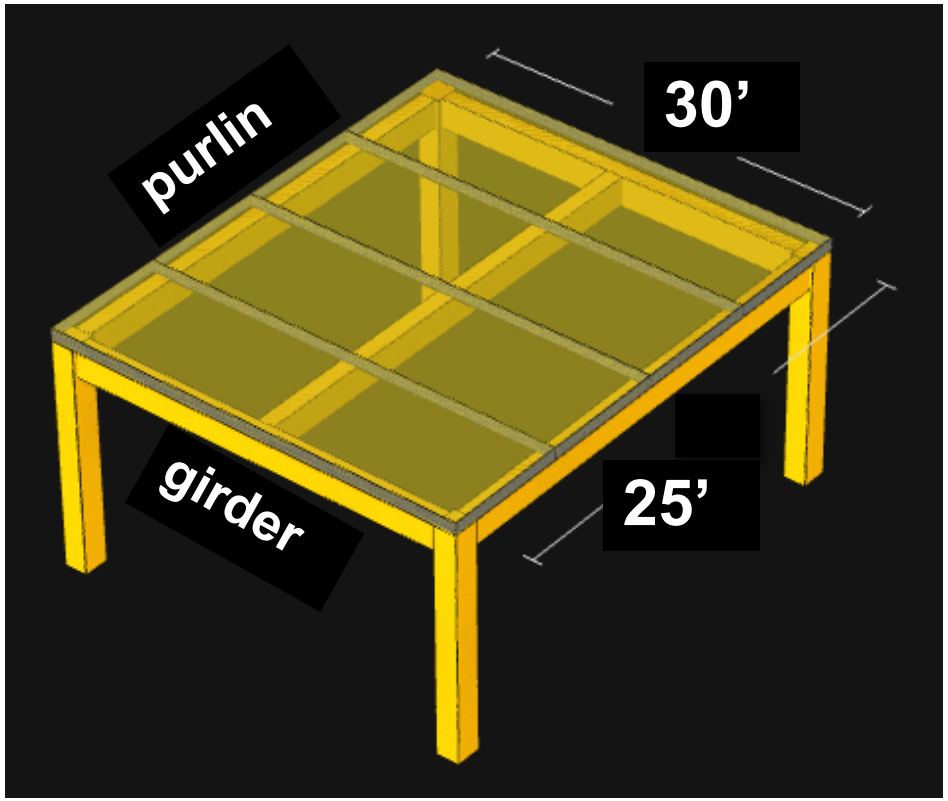
Type IV-HT

0-hr FRR (min sizes per IBC)
Purlin: 5.5”x24” (IBC min = 5”x10.5”)
Girder: 8.75”x33” (IBC min = 5”x10.5”)
Column: 10.5”x10.75” (IBC min = 6.75”x8.25”)
Floor panel: 3-ply (IBC min = 4” CLT)

Glulam volume = 120 CF (32% of MT)
CLT volume = 258 CF (68% of MT)
Total volume = 0.51 CF / SF

Cost Implication of Design Choices

Which is the most efficient option?



Source: Fast + Epp, Timber Bay Design Tool

	Timber Volume Ratio
IIIA – Option 1	0.73 CF / SF
IIIA – Option 2	0.74 CF / SF
IV-HT	0.51 CF / SF

A general rule of thumb for efficient mass timber fiber volume is no higher than 0.75 CF per SF for up to a 1 hour rated structure (higher if 2 hour exposed timber in tall mass timber). Ratios in the 0.85 to 1.0 CF / SF range tend to become cost prohibitive

Expert Tips

Key Design Considerations for Mass Timber Projects

Important considerations related to construction type, fire ratings, panel thickness, member size and occupancy.

Share

Selecting a Construction Type

For mass timber projects, selection of construction type is one of the more significant design decisions. While it's common to choose construction type based on structural material—i.e., to assume that steel and concrete structures should be Type II, light-frame wood should be Type V, and exposed heavy/mass timber should be Type IV—this approach can lead to additional costs. While Type IV construction can be used for exposed

Expert Tips

Creating Efficient Structural Grids in Mass Timber Buildings

Although a mass timber solution may work economically on grids created for other materials, a few modifications can increase efficiencies related to member sizing and manufacturer capabilities.

Share

Mass timber products such as cross-laminated timber (CLT), nail-laminated timber (NLT) and glue-laminated timber (glulam) are at the core of a revolution that is shifting how designers think about construction. At no time has materials selection been such an integral aspect of the building designer's daily responsibilities. In addition to its sustainability and light carbon footprint, mass timber has benefits that include enhanced aesthetics, speed of construction and light weight, all of which can positively impact costs. However, to convince building owners and developers that a mass timber solution is viable, the structural design must also be cost competitive. This requires a full understanding of both material properties and

Value Analysis

$$Value = \frac{\uparrow Function \quad + \uparrow Aesthetics}{\downarrow Cost}$$

Cost Impacts of Finish/ Appearance Grade

Appearance vs. Industrial Grades

Aesthetic Expectations

- Appearance grade more $
- Industrial grade can save $
- Specification of appearance grade varies by product
- CLT, DLT, NLT: aesthetic expectations are agreed upon by building designer and manufacturer/ fabricator (ask for samples & outline in specs)
- Glulam: grades are standardized

Expert Tips

Specifying Appearance Grades for CLT, NLT and Glulam

Information for designers seeking to specify appearance grade for cross-laminated timber (CLT), nail-laminated timber (NLT), or glue-laminated timber (glulam).

Share

For mass timber, specification of appearance grade varies by product. Aesthetic expectations for cross-laminated timber (CLT) and nail-laminated timber (NLT) are agreed upon between the building designer and manufacturer/fabricator and described in the product specifications, whereas grades for glued-laminated timber (glulam) are standardized.

CLT Appearance Grades

Starting with the 2015 version of the International Building Code (IBC), CLT has been prescriptively

MASS TIMBER CONSTRUCTION MANAGEMENT

Planning

- Anatomy of a Mass Timber Package
- Procurement, Supply Chain, Schedule Drivers

Environmental Exposure

- Site Planning
- Moisture Planning and Mitigation
- UV Planning and Mitigation

Workforce Training

- Strategic Partnerships
- Training/Education
- Resources

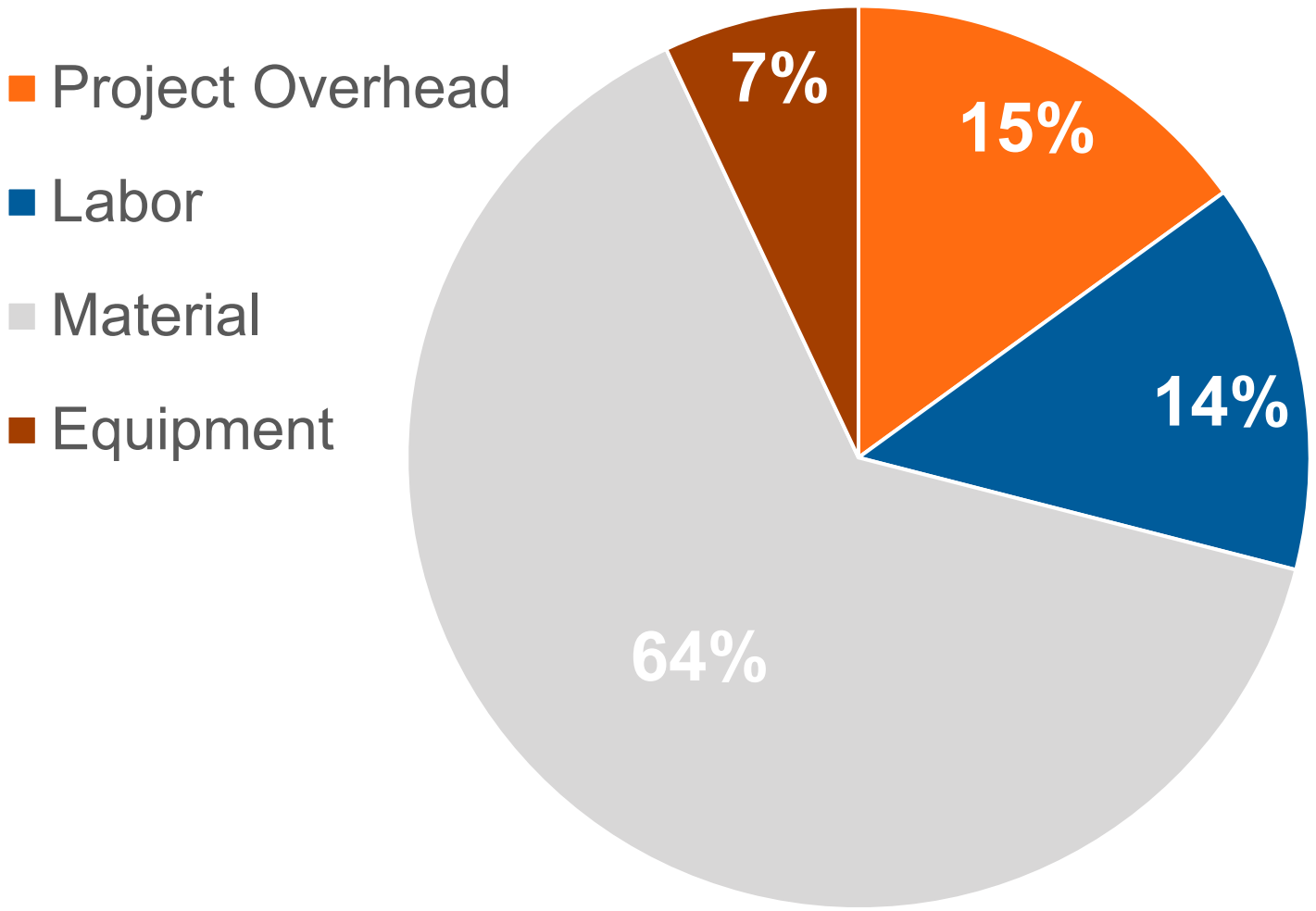
Holistic Costing

$/SF

$/SF

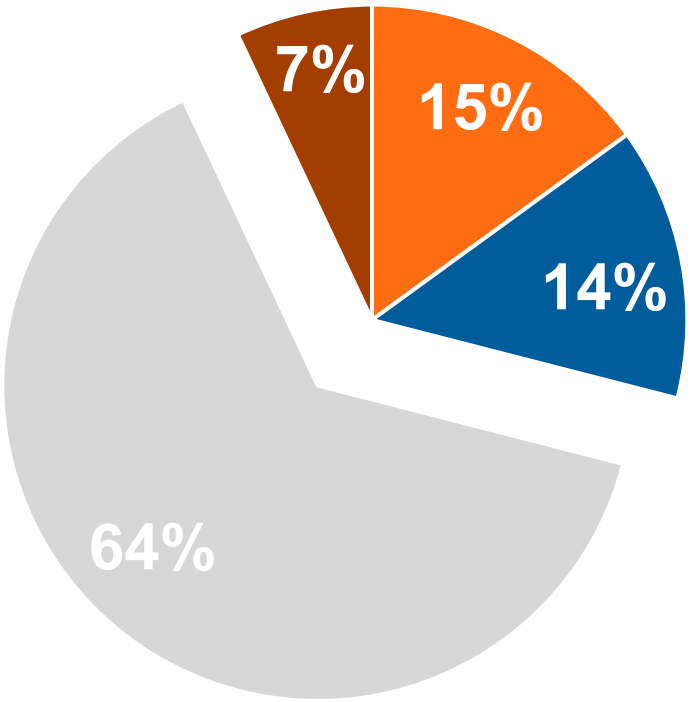
Image: GBD Architects

Anatomy of a Turnkey Mass Timber Package



Source: Swinerton

Material (Direct Cost)

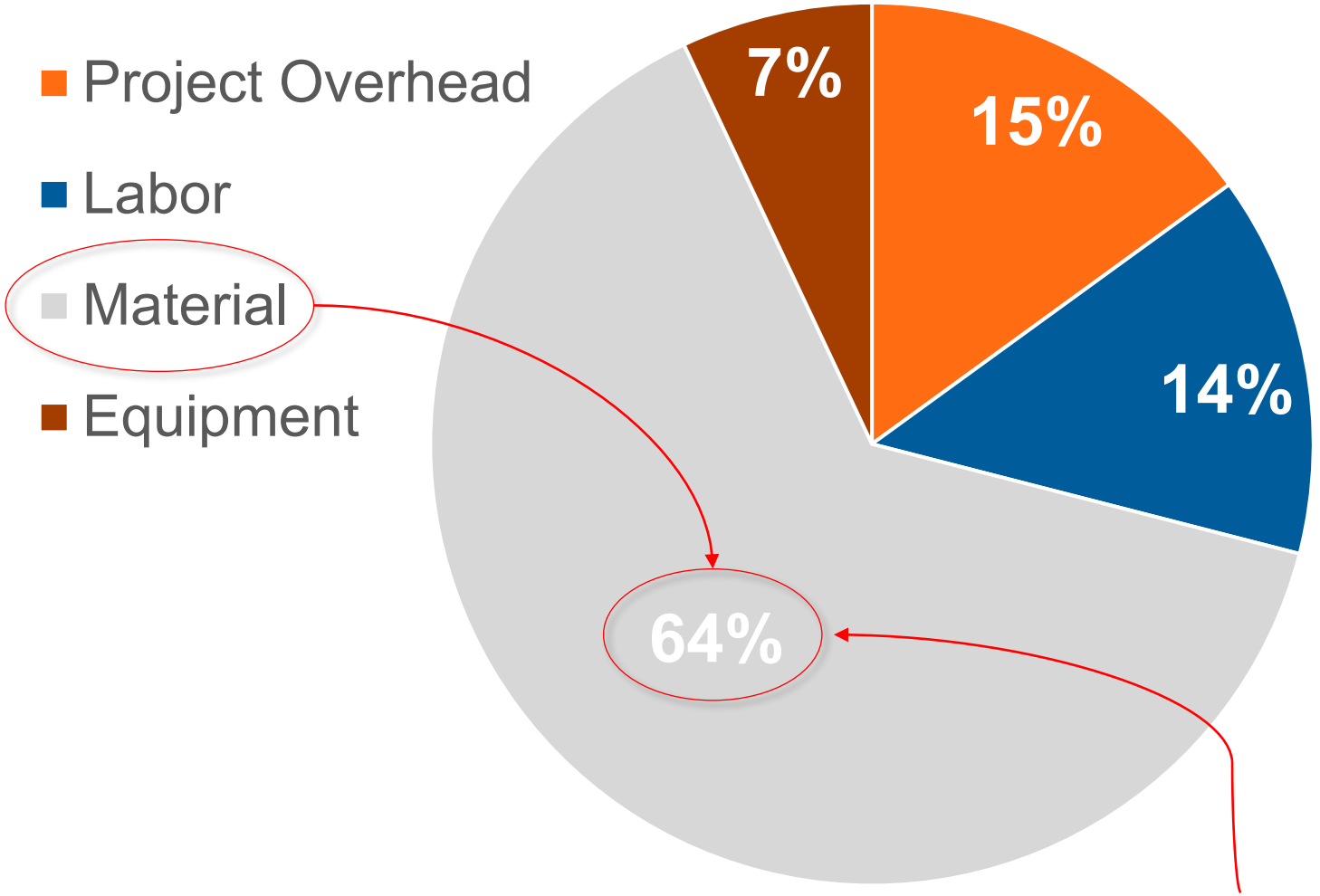


Turnkey Mass Timber Package

or

Source: Swinerton

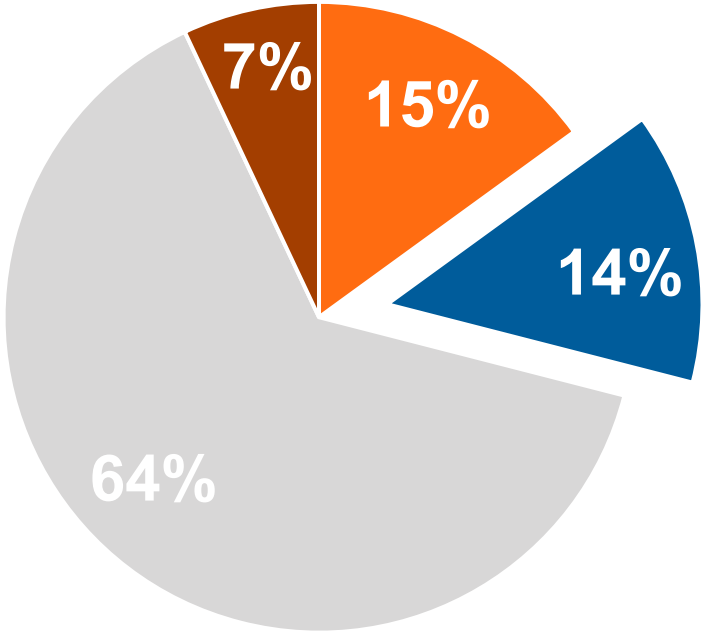
Mass Timber Package Costs



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

Source: Swinerton

Labor (Direct Cost)

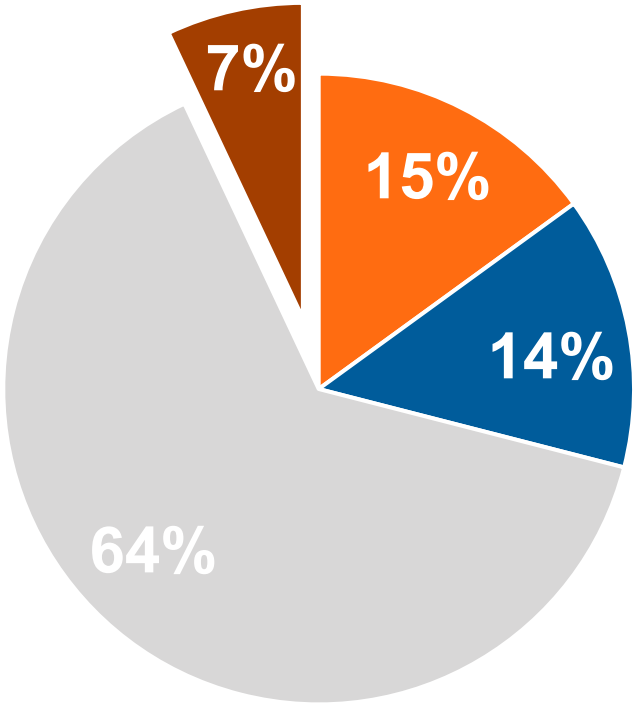


Turnkey Mass Timber Package

Photo: Swinerton

Source: Swinerton

Equipment (Direct Cost)



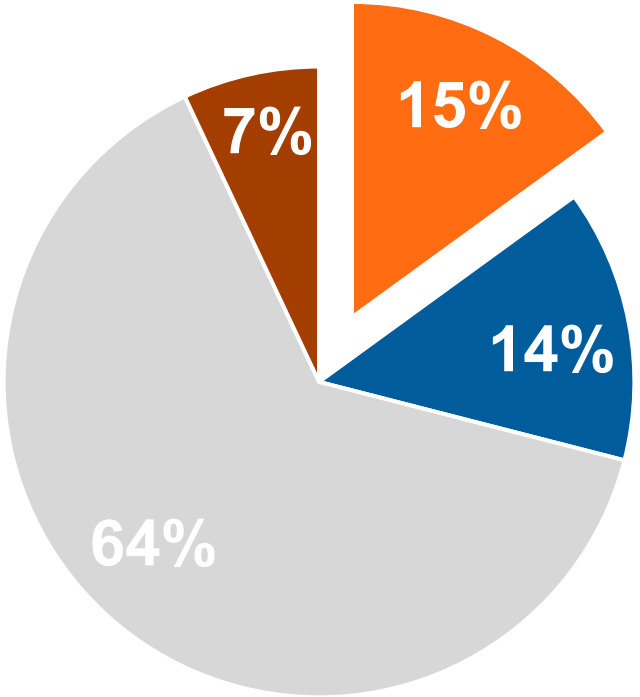
Turnkey Mass Timber Package

Photo: Swinerton

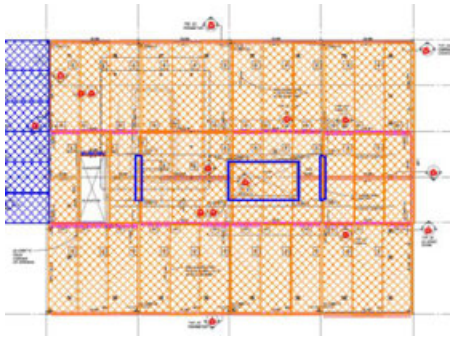
Photo: Alex Schreyer

Source: Swinerton

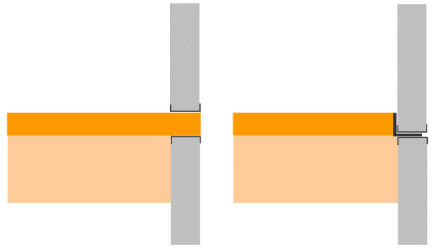
Project Overhead



Turnkey Mass Timber Package

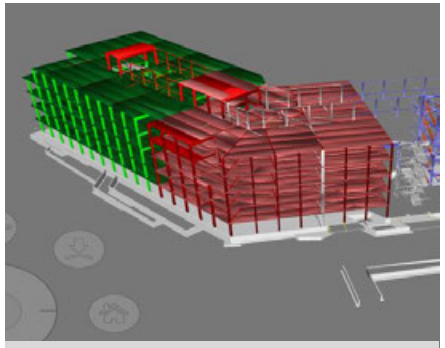


Cost Analysis

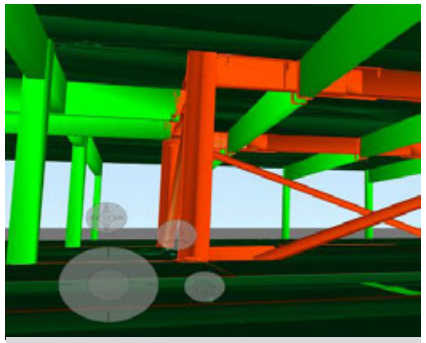


Design Refinement

System Integration



VD&C



Detail Optimization

Logistics Planning

Photos: Swinerton

Source: Swinerton

Total Project Cost Analysis

CONSIDERATIONS:

- Ceiling Treatment
- Floor Topping
- HVAC System & Route
- Foundation Size
- Material Savings
- Perimeter glazing
- Value of Time
- Completion Bonds/Insurance

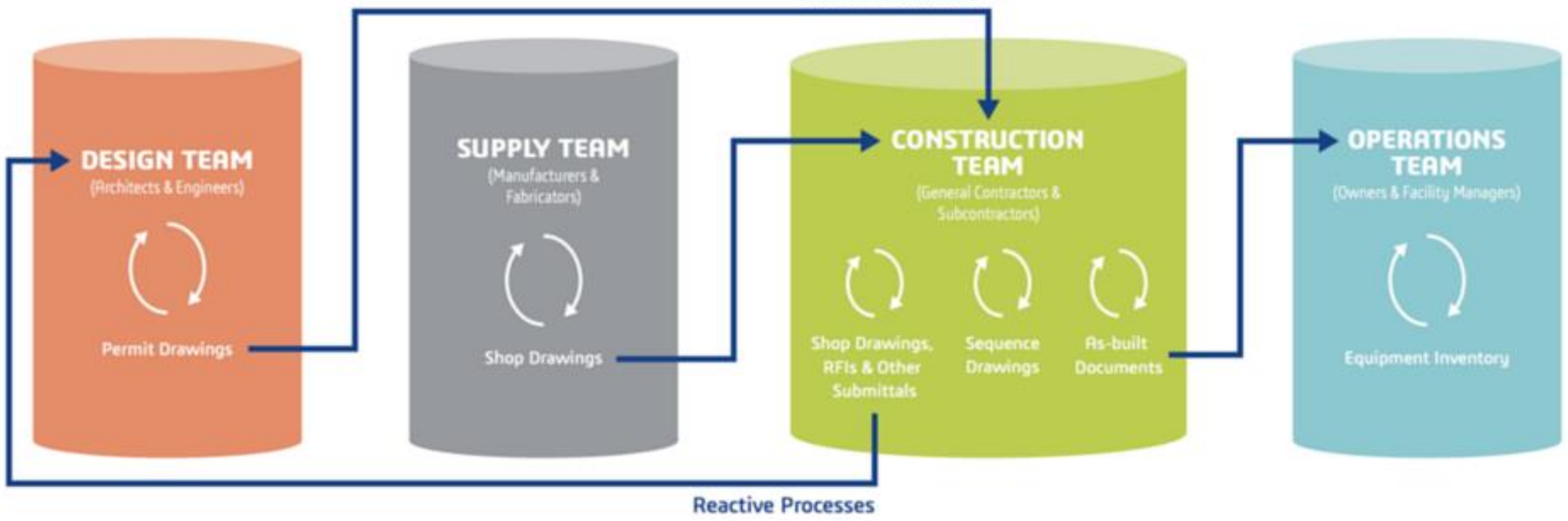
Credit: Hacker Architects

Sample Procurement Strategies

GC/CM Hires Turnkey Mass Timber Subcontractor	GC/CM Buys Material, Self-Performs Installation and Coordinates	GC/CM Buys Material, Subcontracts Labor and Coordinates
RISK SPECTRUM		
+ Hiring experience + Single point of responsibility	+ Hiring experience + Single point of responsibility + Financial security of strong GC/CM	+ Potential added mark-up
– Prequalify capacity of subs – Potential added mark-up	– Lack of familiarity with supply chain – Steep learning curve for coordination	– Multiple layers of coordination – Prequalify capacity of sub

Source: Timberlab

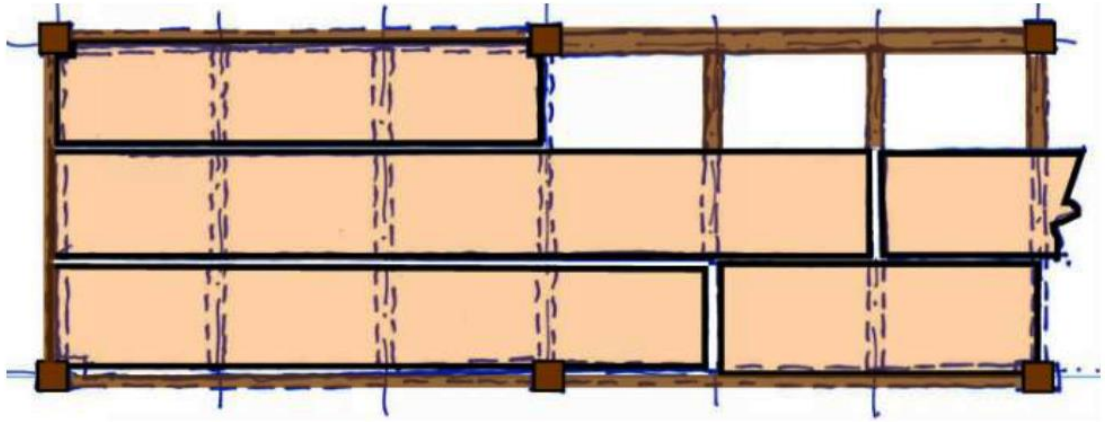
Potential Cost Impacts: Design-Bid-Build Procurement

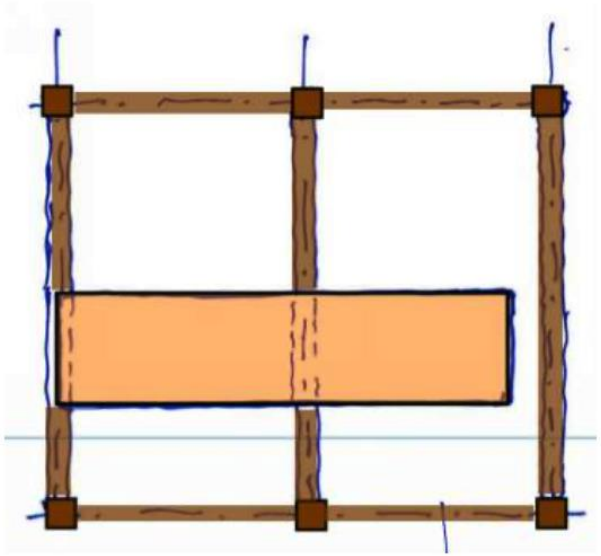


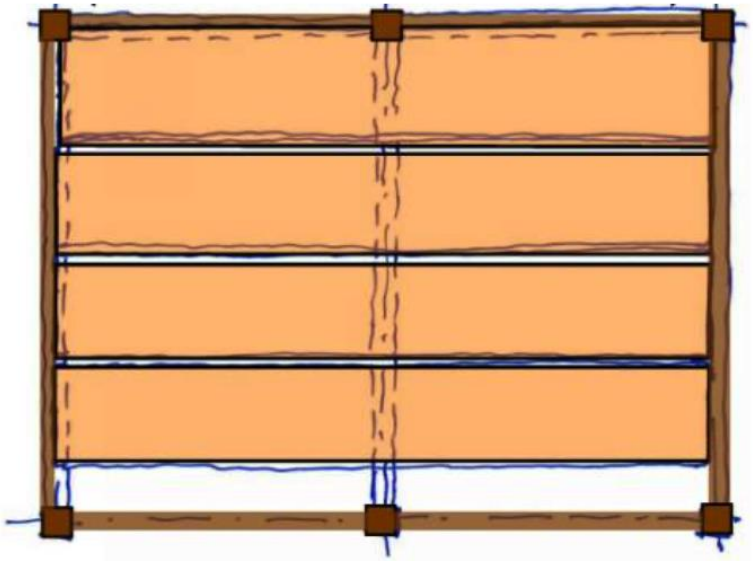
Alternate Procurement Option:
Trade Partner/Master Builder Approach

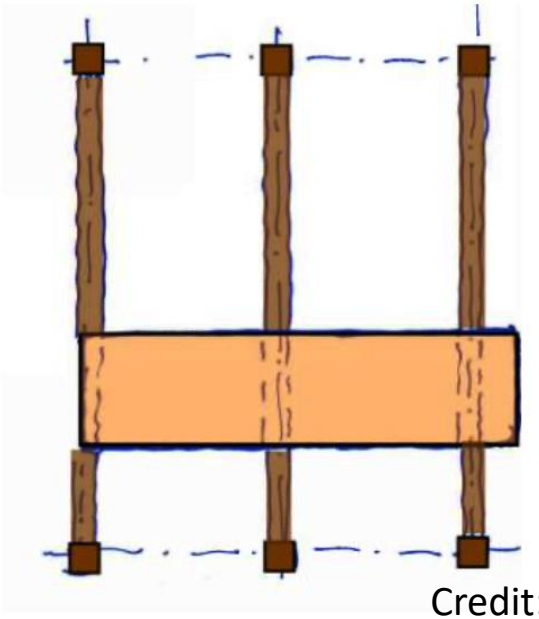
Understand the Supply Chain

Photo: Swinerton





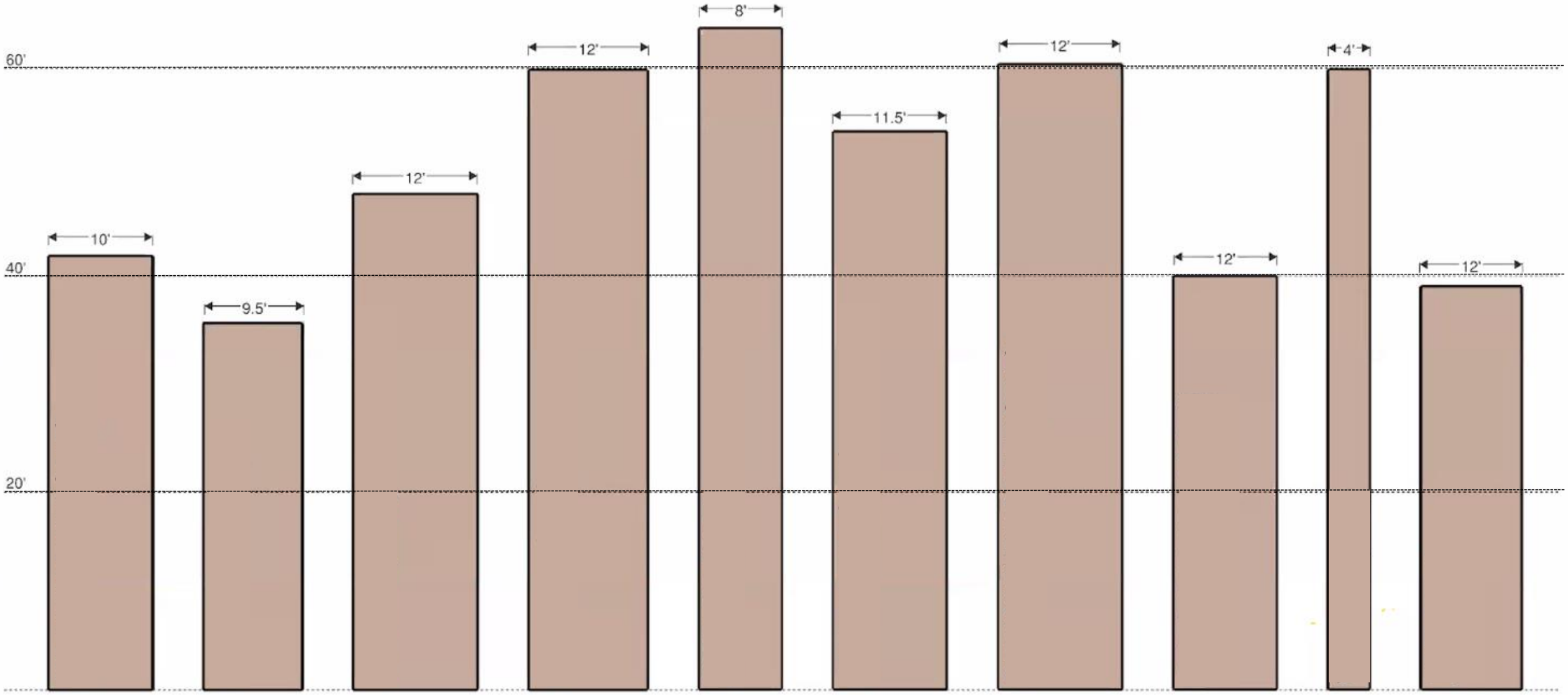




Credit: Tanya Luthi, Entuitive

Understand Manufacturer’s Capabilities

Understand Manufacturer's Capabilities

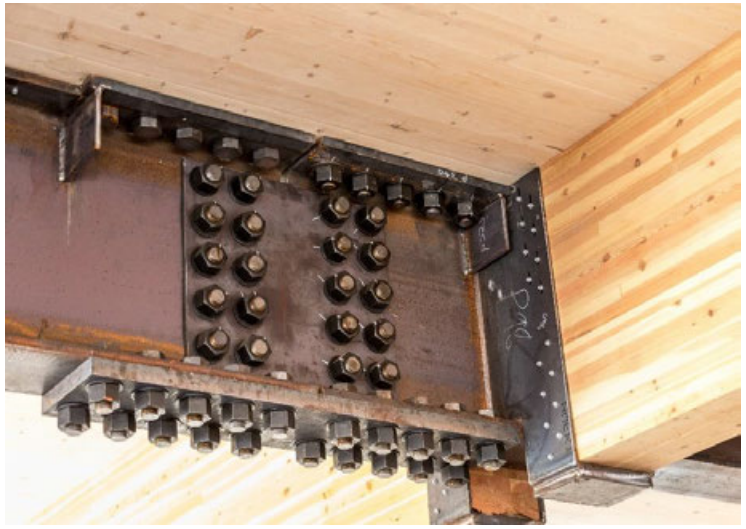


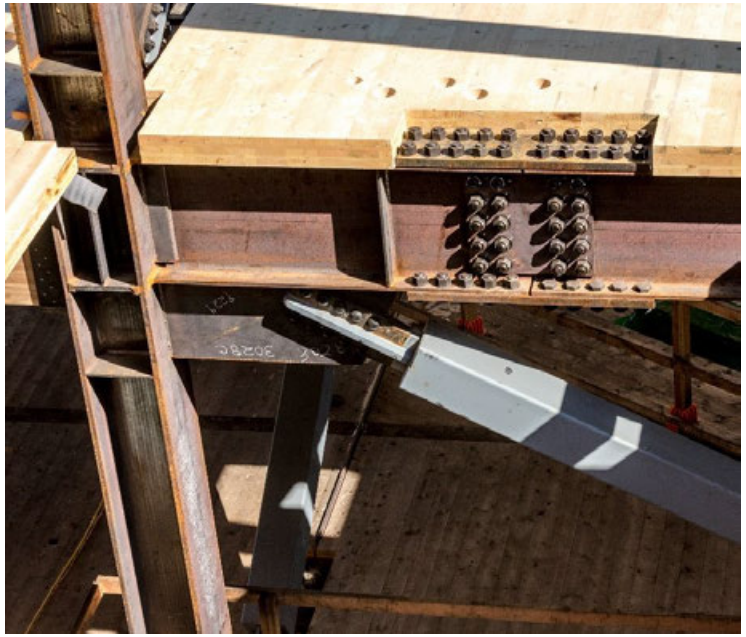
Credit: TimberLab

Embrace the Prefab Advantage

Photo: Swinerton

Tolerances: Interface with Other Structural Materials



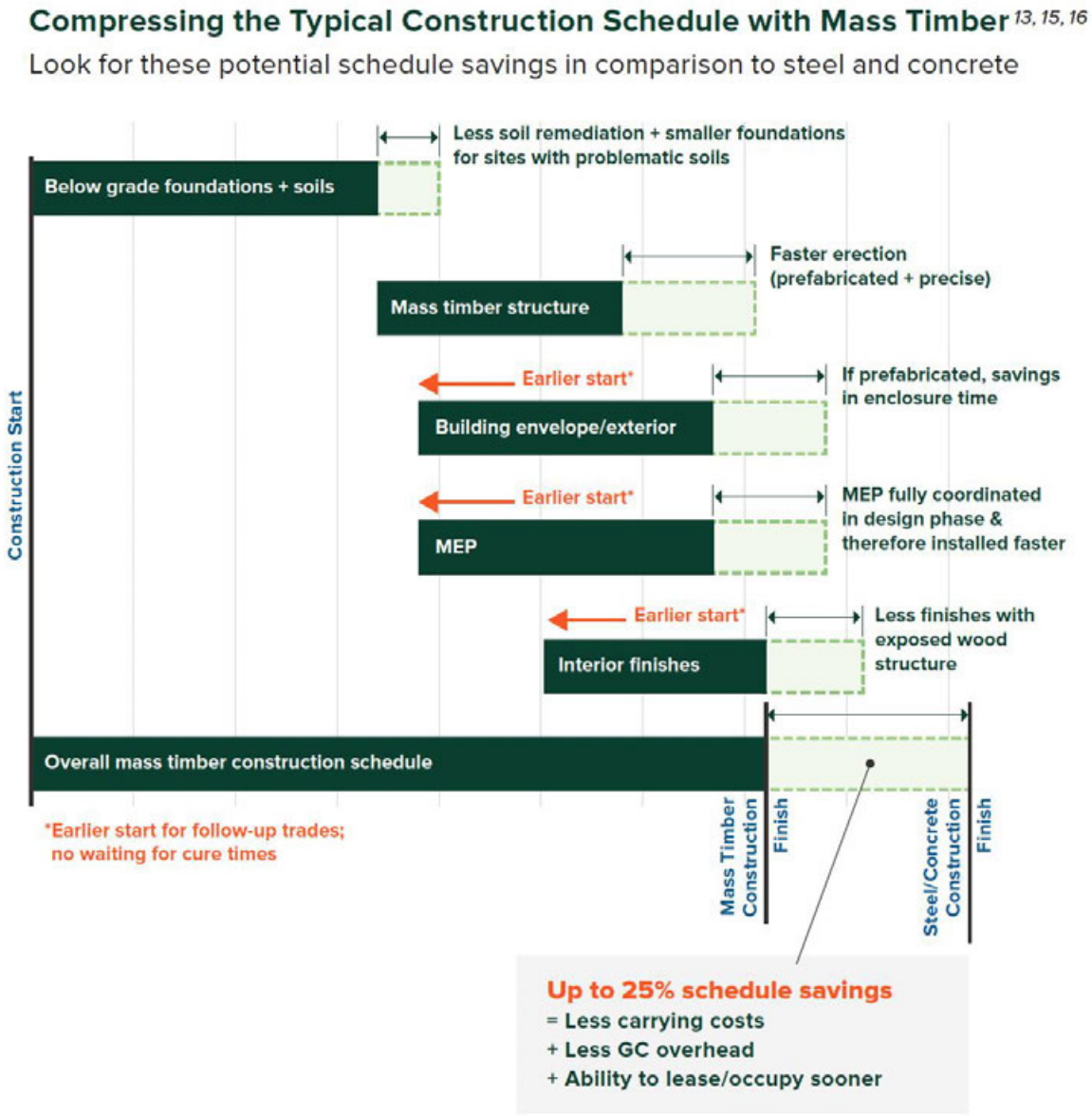


Photos: Swinerton

Schedule Drivers

Photo: Swinerton

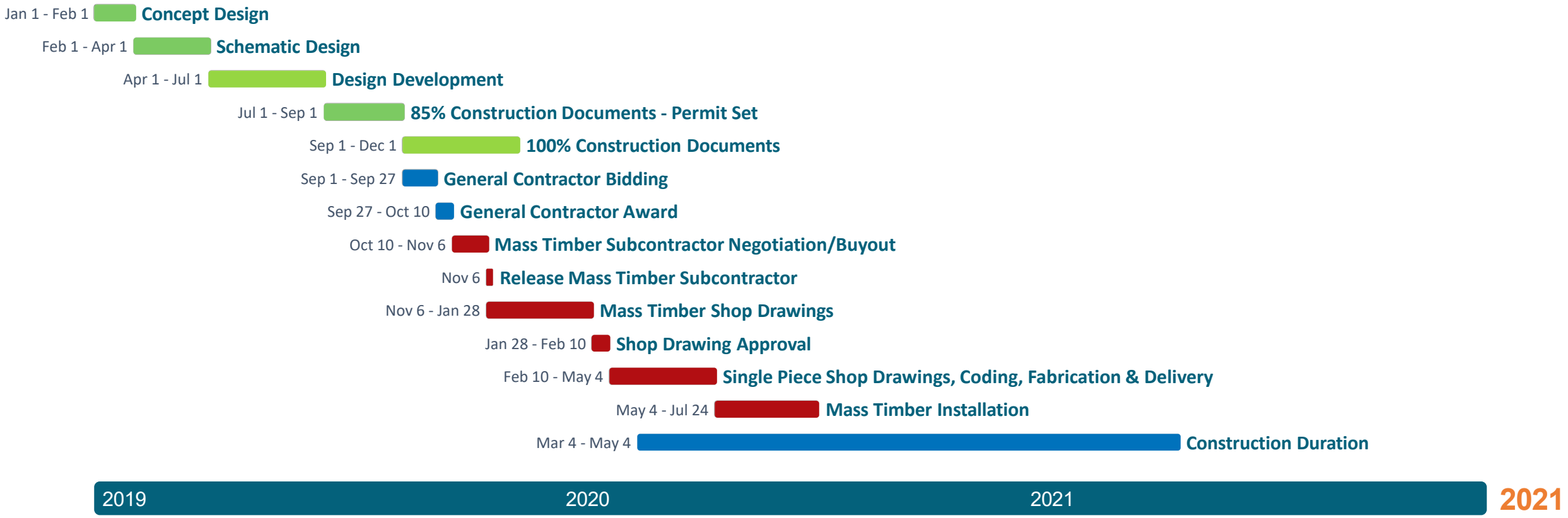
Procurement Approach Determines Schedule



Source: WoodWorks

Procurement Approach Determines Schedule

Example 6 Story Type IIIA Project

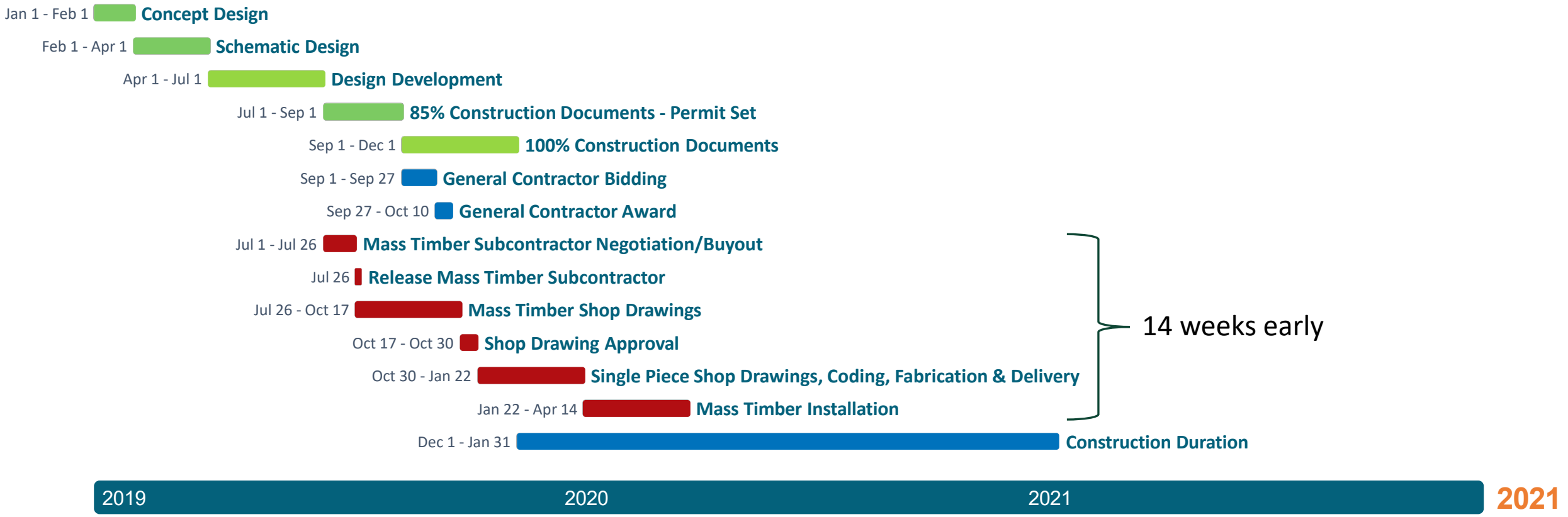


Source: Swinerton

Design-Bid-Build Procurement

Procurement Approach Determines Schedule

Example 6 Story Type IIIA Project



Source: Swinerton

Design-Build/Design-Assist Procurement

Schedule Comparison

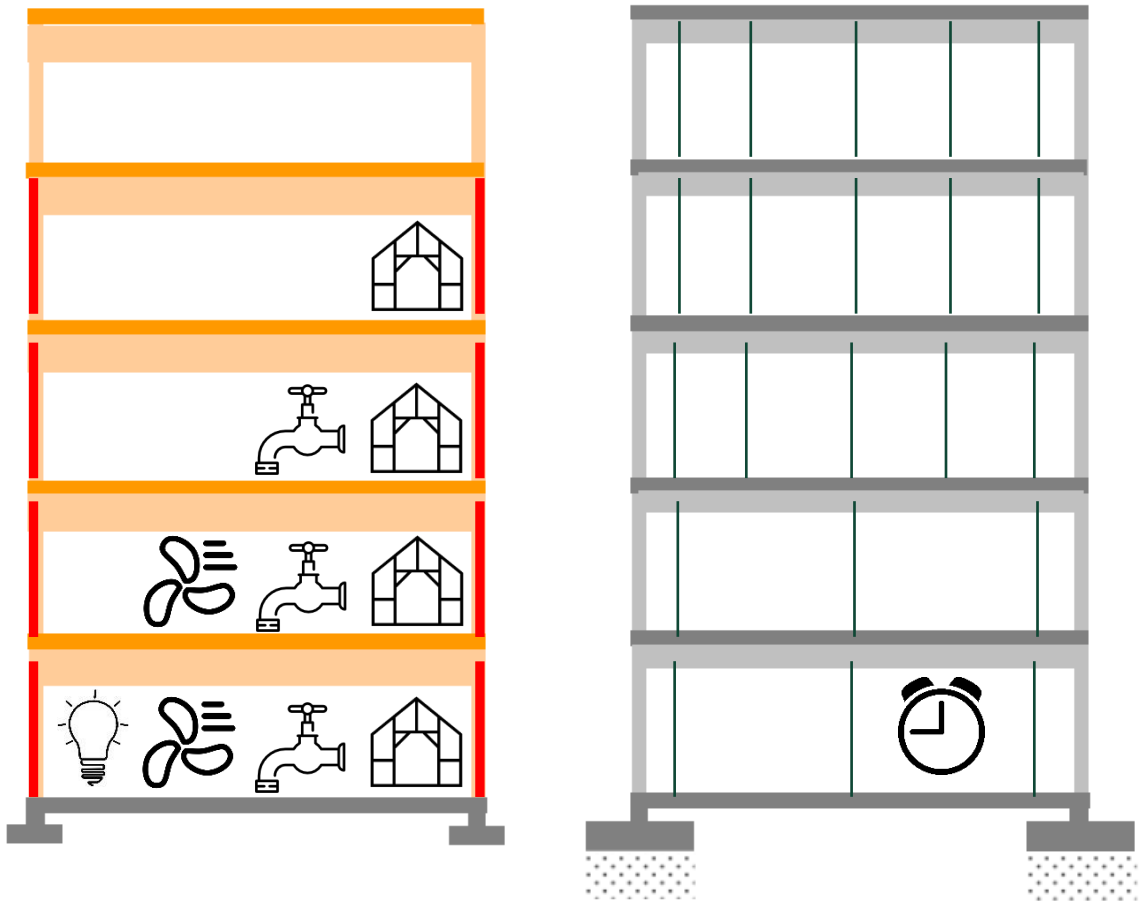
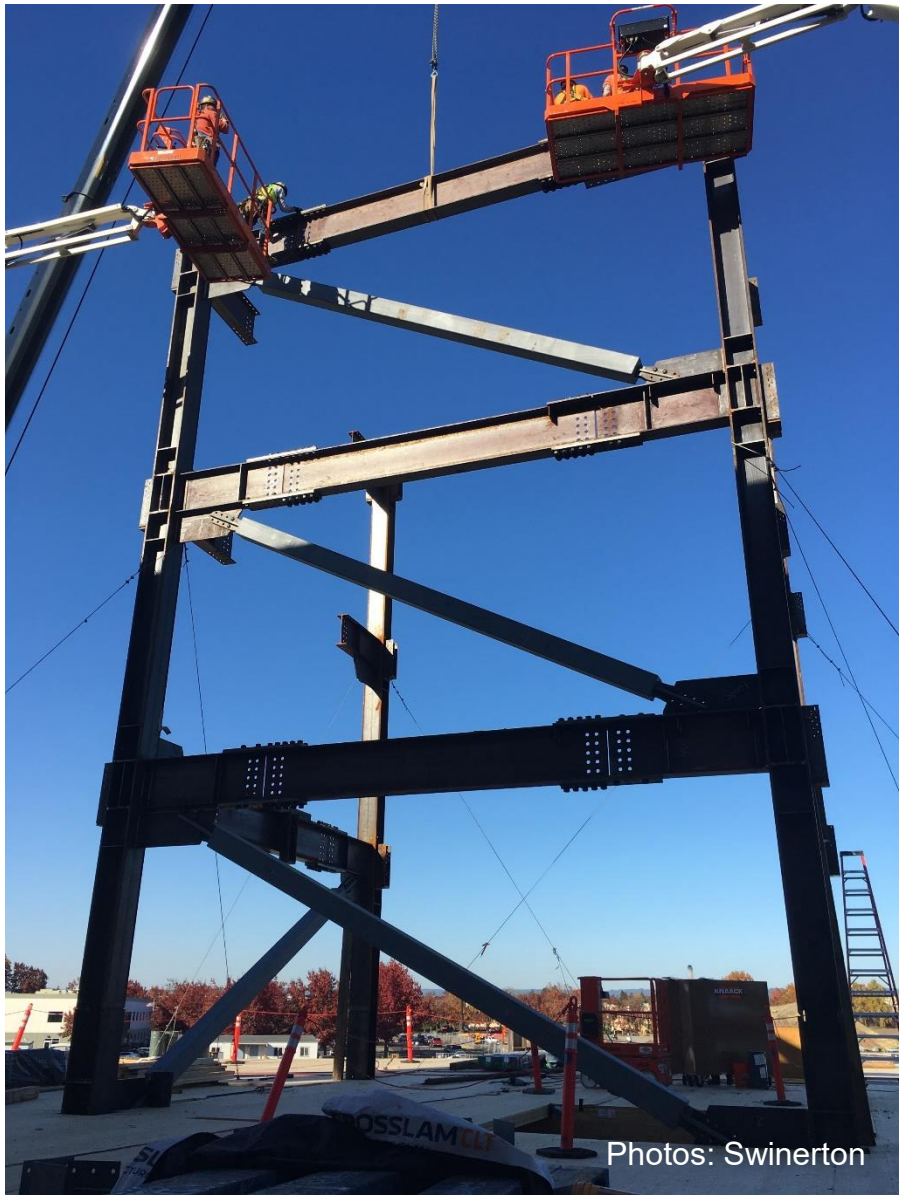


Image: Swinerton

Photo: WoodWorks

Schedule Impacts: Hybrid Structures

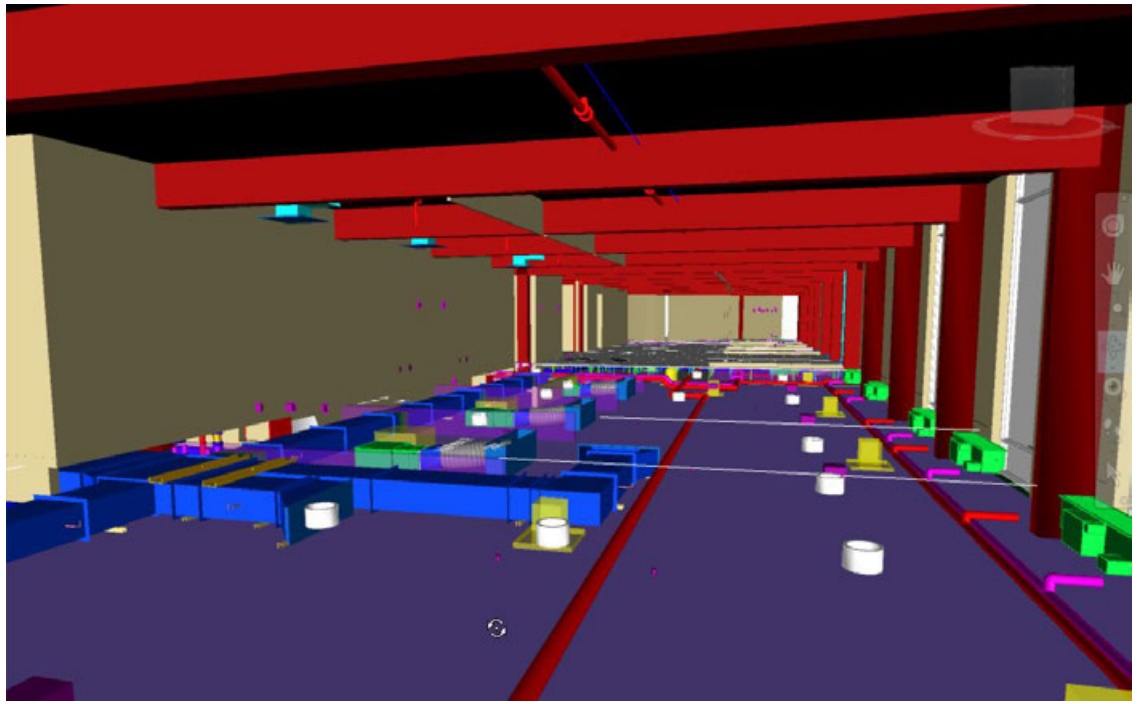


Photos: Swinerton

Early Move-In for Rough-In Trades.

Photos: Swinerton

Embracing BIM for Fabrication



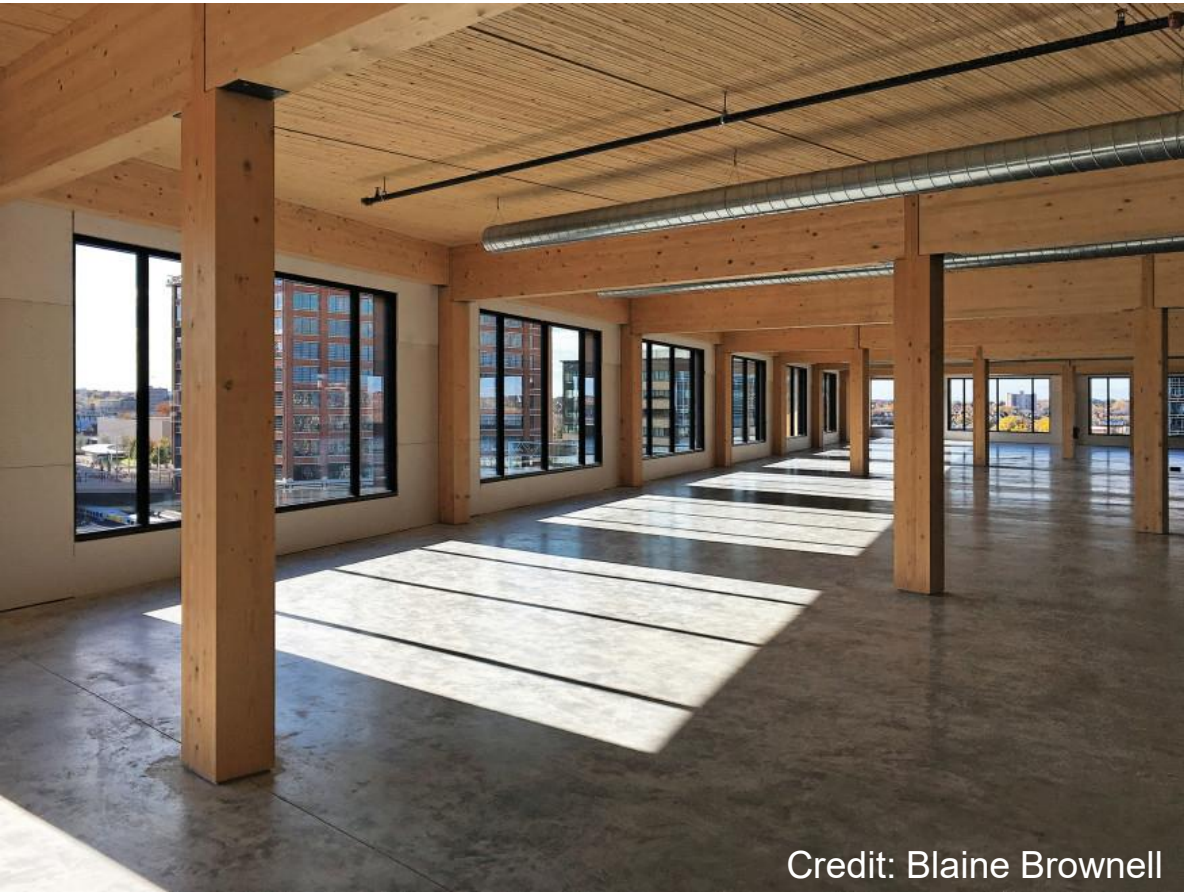
Photos: Swinerton

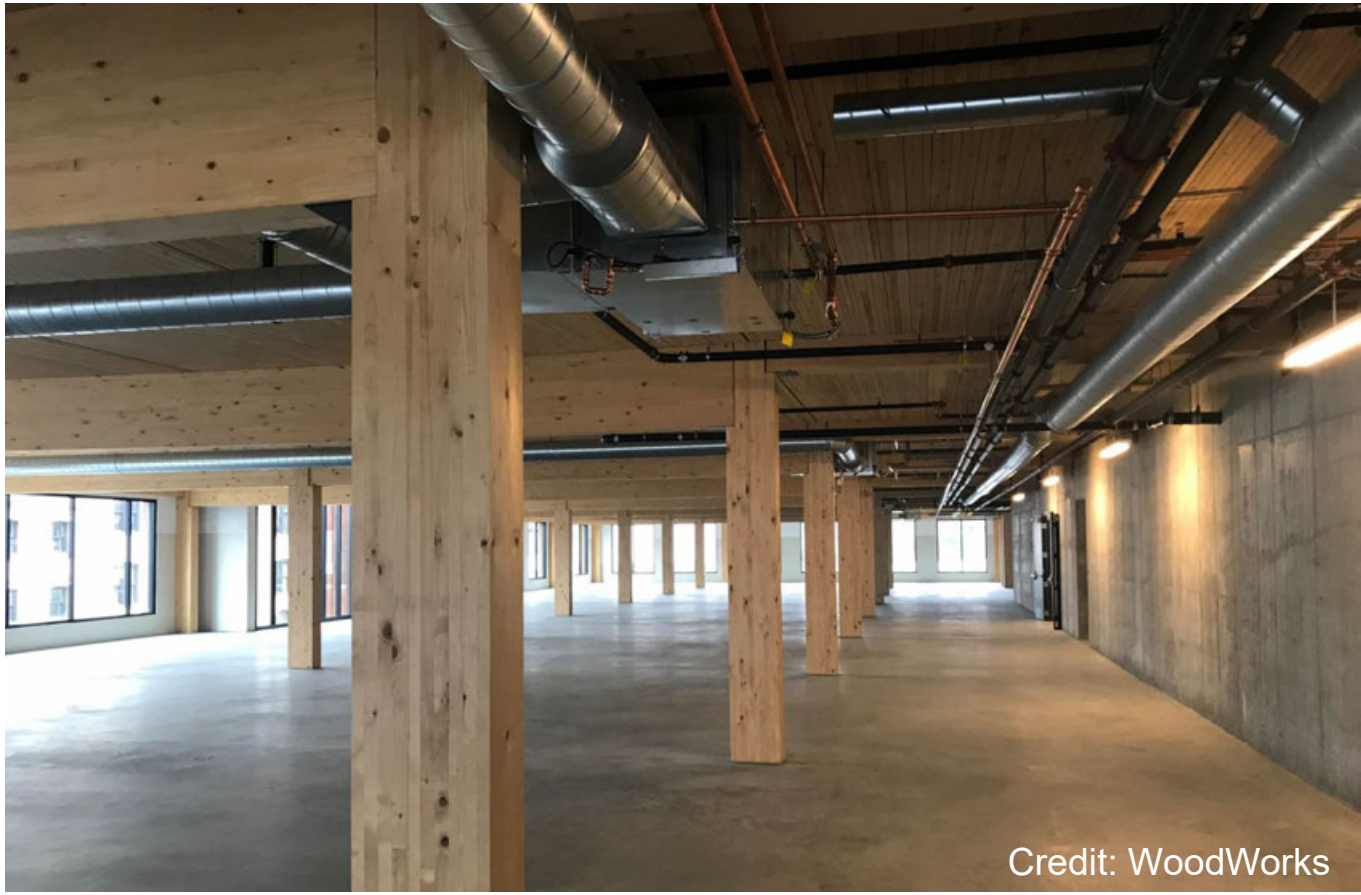
MEP Layout & Integration

MEP Layout & Integration

Smaller grid bays at central core (more head height)

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





MEP Layout & Integration

Dropped below MT framing

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

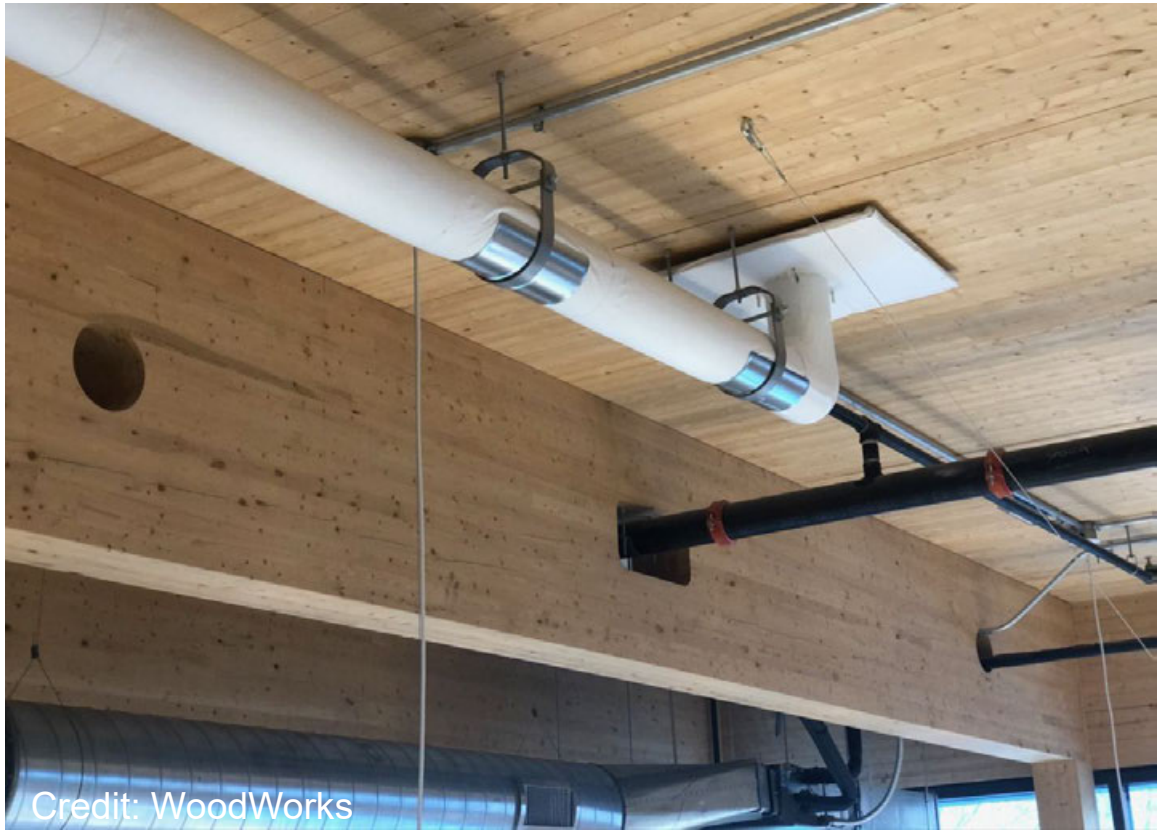

Credit: Alex Schreyer


Credit: WoodWorks

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

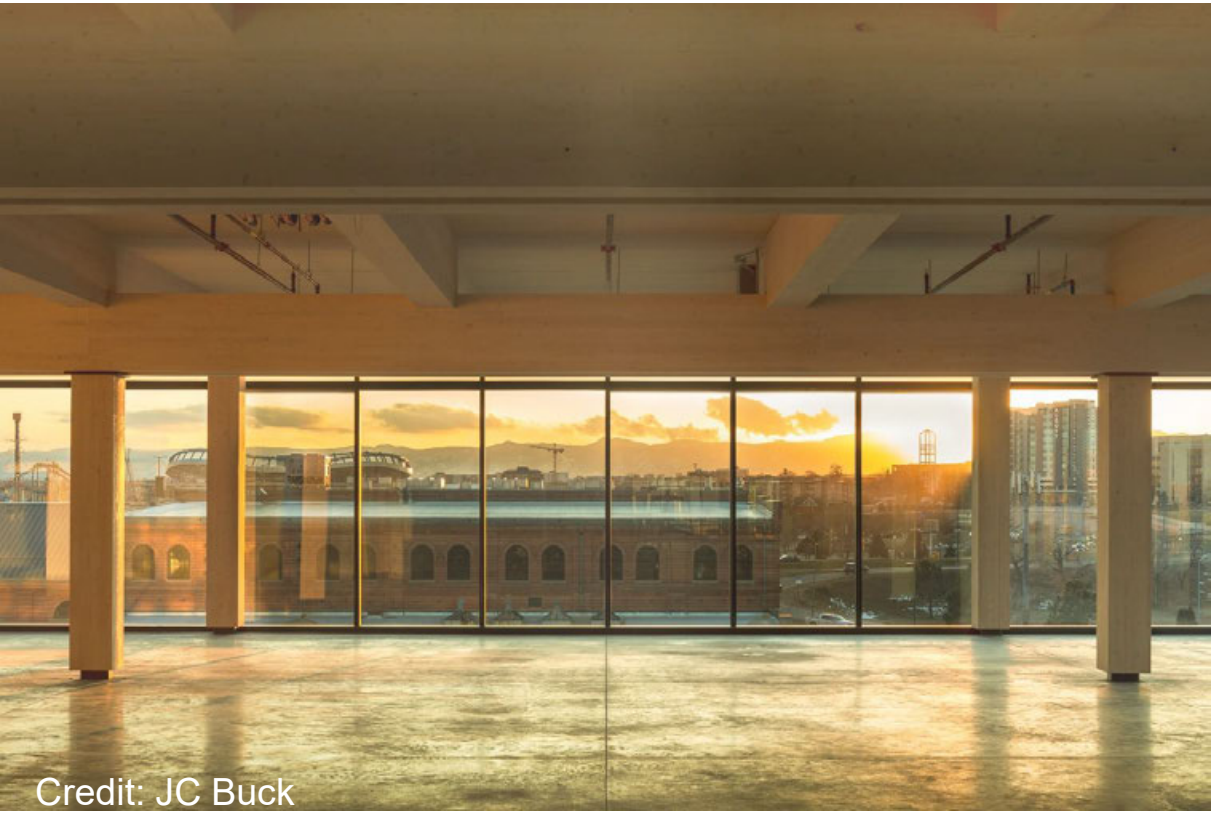

Credit: WoodWorks


Credit: WoodWorks

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

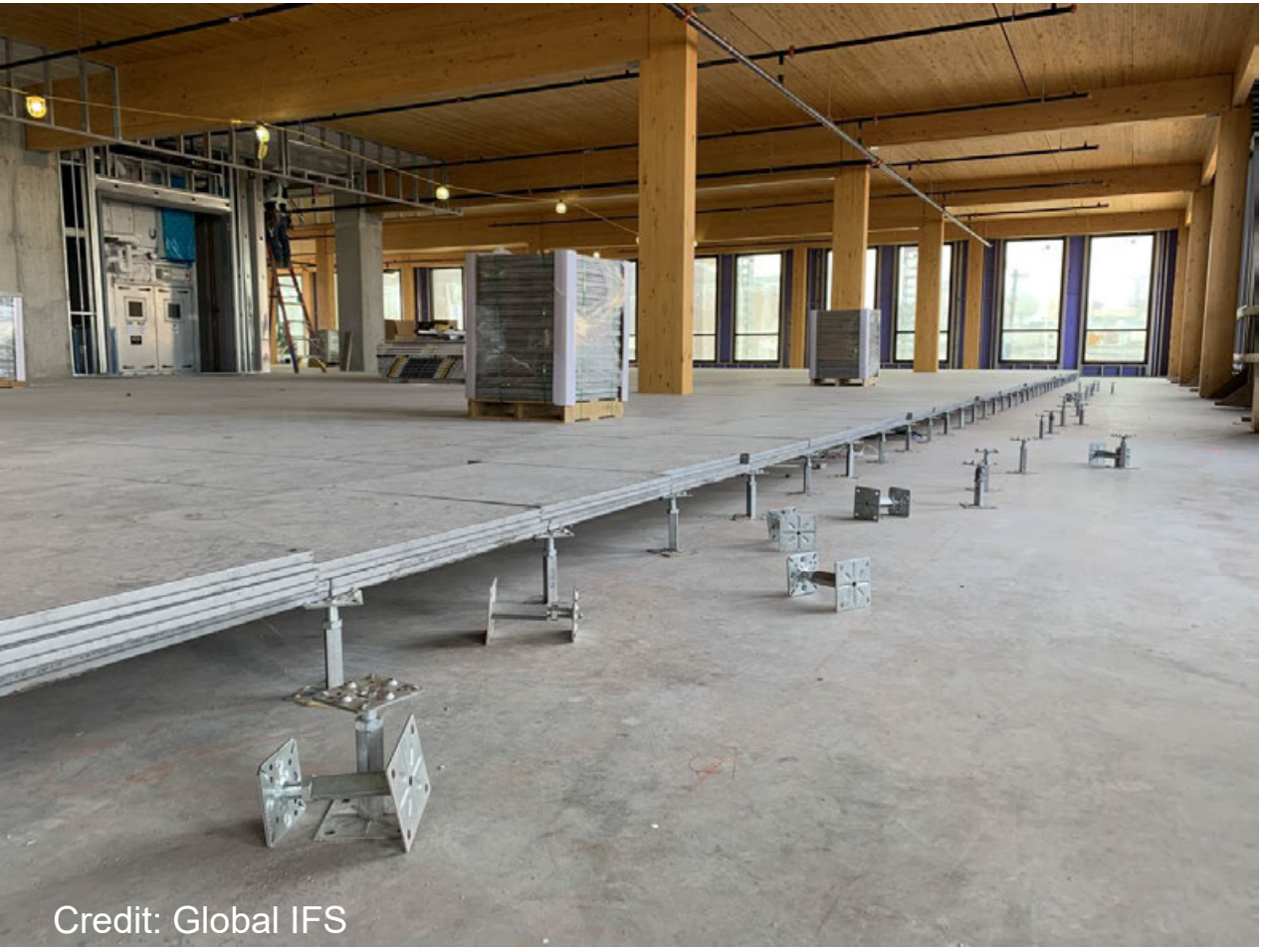
Credit: Ema Peter/MGA

Credit: Hacker Architects

MEP Layout & Integration

In 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

Credit: Alex Schreyer

SITE PLANNING

Photo: Swinerton

QA/QC

Photo: Swinerton

SITE INSPECTIONS

Photo: H+O Structural Engineering,,Kure Creative

Tall Mass Timber Special Inspections

TABLE 1705.5.3
REQUIRED SPECIAL INSPECTIONS OF MASS TIMBER CONSTRUCTION

Type	Continuous Special Inspection	Periodic Special Inspection
1. Inspection of anchorage and connections of mass timber construction to timber deep foundation systems.		X
2. Inspect erection of mass timber construction		X
3. Inspection of connections where installation methods are required to meet design loads		
3.1. Threaded fasteners		
3.1.1. Verify use of proper installation equipment.		X
3.1.2. Verify use of pre-drilled holes where required.		X
3.1.3. Inspect screws, including diameter, length, head type, spacing, installation angle, and depth.		X
3.2. Adhesive anchors installed in horizontal or upwardly inclined orientation to resist sustained tension loads	X	
3.3. Adhesive anchors not defined in 3.2.		X
3.4. Bolted connections		X
3.5. Concealed connections		X

Source: International Building Code

Table is only required for Type IV-A, IV-B, and IV-C

PICK PLAN

Photo: Swinerton

MATERIAL DELIVERY

Photo: Swinerton

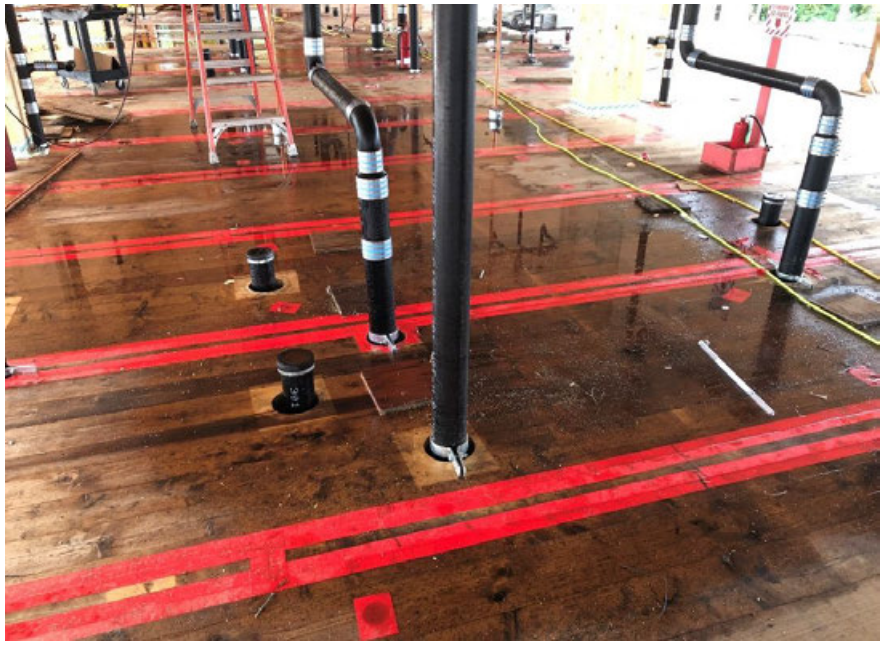
Photo: Swinerton

STAGING

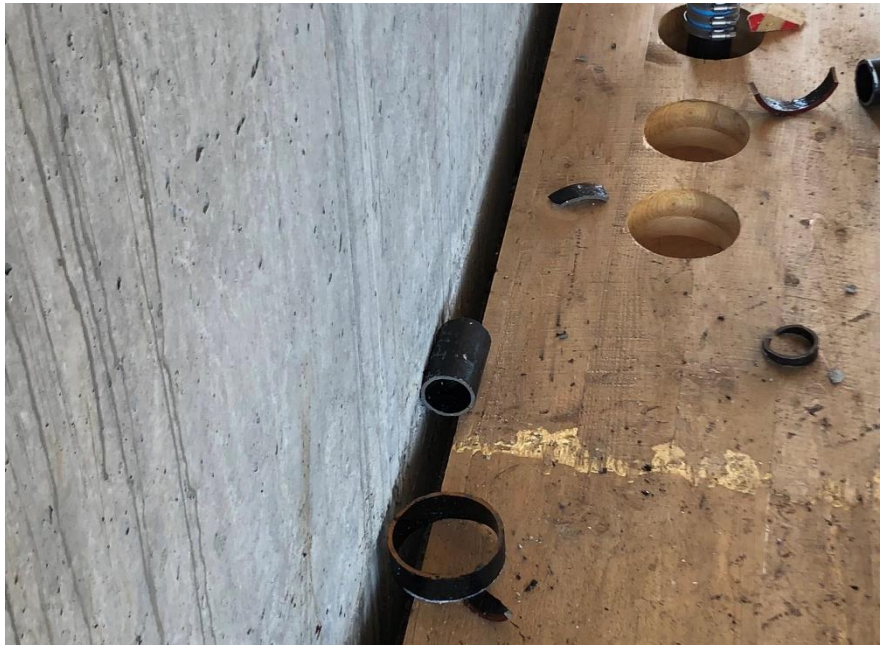
Planning for Environmental Exposures

- Plan Early
- Risk Evaluation
- Develop Construction
- Phase Plan
- Execute the Design and Moisture Management Plan
- Monitor

RDH Moisture Management Guide 1st Ed



Onsite Considerations



Other Materials

Workforce Development

Training is the key to efficiency
Training takes time and money

Training versus Education

Resources available to all

MT Construction Manual
Installer Curriculum
Other WW Resources
CM Workshops
Previous recorded versions
Learning Management System

Mass Timber Construction Management Program

MASS TIMBER CONSTRUCTION MANUAL

8- & 16-HOUR INSTALLER TRAINING PACKAGE AND TRAINING CENTERS

COMMUNITY COLLEGE AND UNIVERSITY CM PROGRAMS

VIRTUAL AND/OR IN-PERSON WORKSHOPS

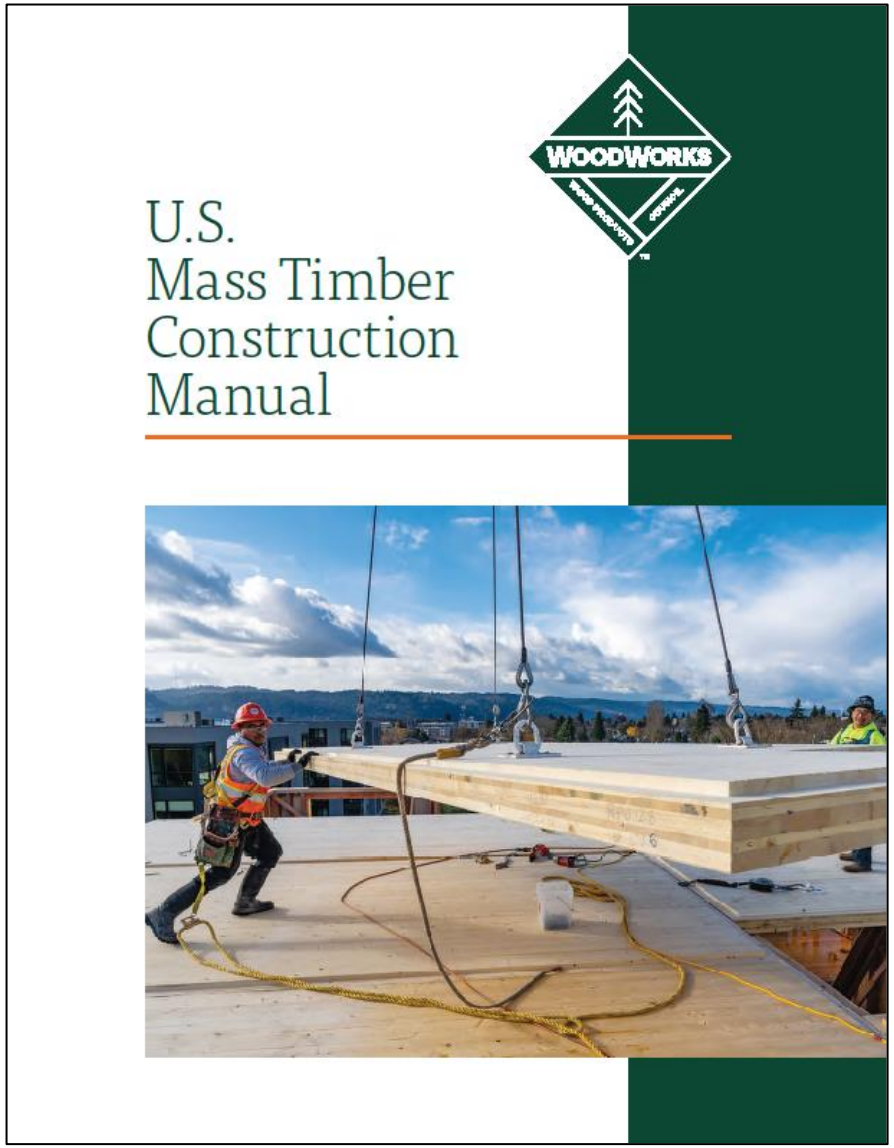
PARTNER WITH CONSTRUCTION ASSOCIATIONS

PROJECT TOURS

ENGAGE WITH GENERAL CONTRACTORS ACROSS THE US

Released on 20 October 2021

https://www.woodworks.org/mass-timber-construction-management-program/



The Loading Dock, OZ Architecture, KL&A, photo Joe Anastasi

MULTI-FAMILY/MIXED-USE | EDUCATION | OFFICE | RETAIL | INDUSTRIAL | CIVIC | INSTITUTIONAL

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Ask us anything.

FREE PROJECT SUPPORT / EDUCATION / RESOURCES

Nationwide support for the code-compliant design, engineering and construction of non-residential and multi-family wood buildings.

- Allowable Heights/Areas
- Construction Types
- Structural Detailing
- Wood-Framed & Hybrid Systems
- Fire/Acoustic Assemblies
- Lateral System Design
- Alternate Means of Compliance
- Energy-Efficient Detailing
- Building Systems & Technologies

John W. Olver Design Building at UMass Amherst
Leers Weinzapfel Associates, Equilibrium Consulting
photo © Albert Vecerka / Esto

woodworks.org/project-assistance | help@woodworks.org

Questions? Ask us anything.

Jason Bahr, PE
Regional Director | KS, AR, MO, OK
(913) 732-0075
jason.bahr@woodworks.org

Please take our survey!

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

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Funding provided in part by the Softwood Lumber Board