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

May 5, 2026

Presented by:

Laura Cullen, PE
WoodWorks

Image: 619 Ponce / Jamestown / Handel Architects / StructureCraft / Raftermem Photography, courtesy of GFA

PRESENTATION OUTLINE

MASS TIMBER DESIGN

Products
Structural Solution & Connections
Projects and Code Considerations

MASS TIMBER CONSTRUCTION

Planning for Construction
Performing Construction
Workforce Development

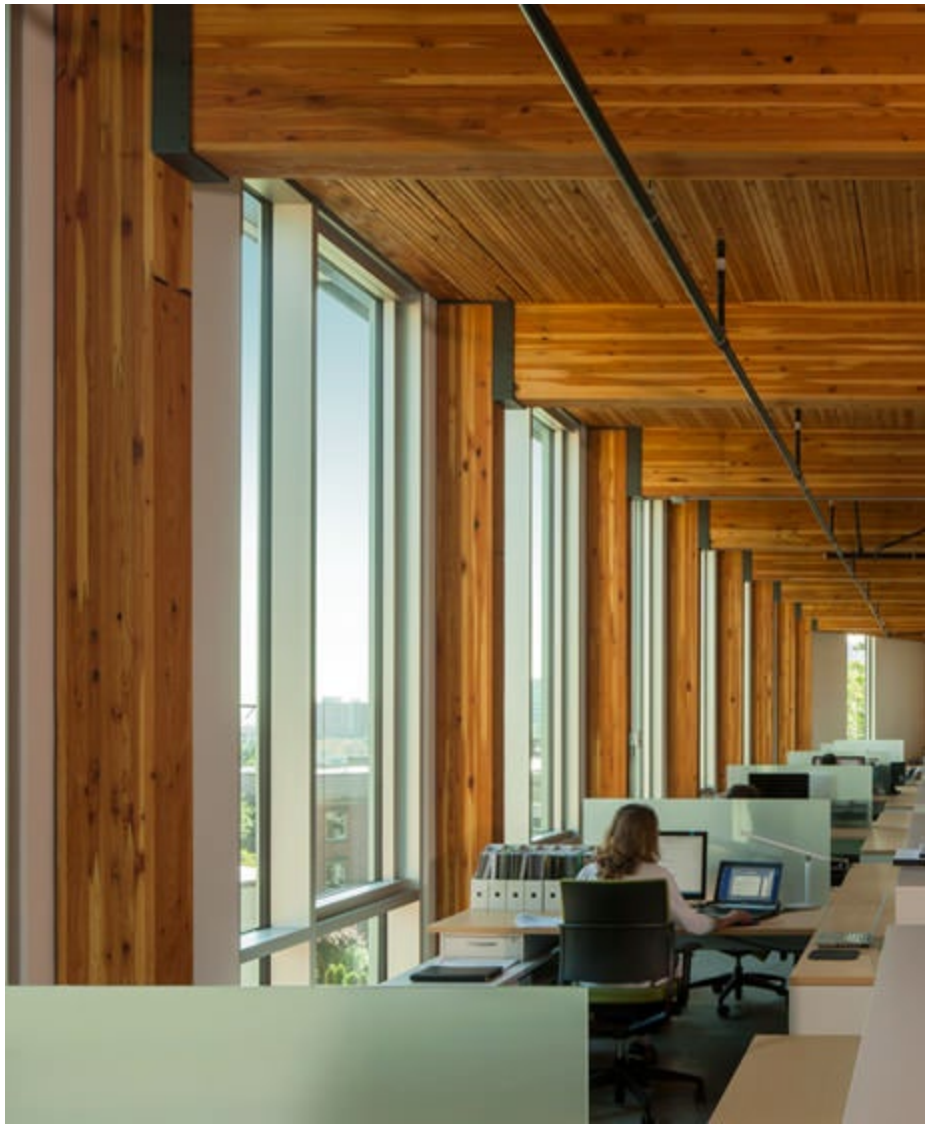
MASS TIMBER OVERVIEW

Photo: PCL Construction

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

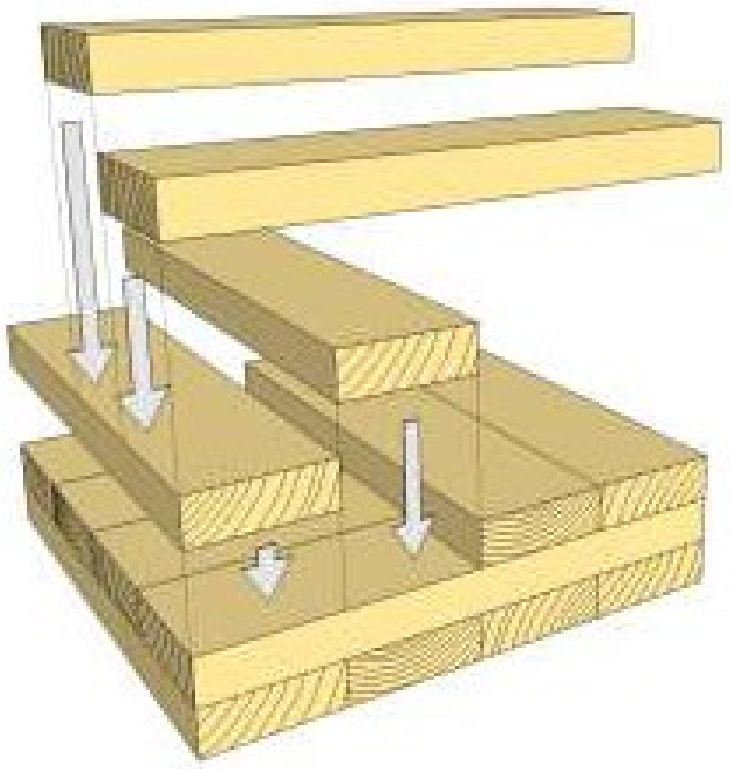
Photo: Ema Peter

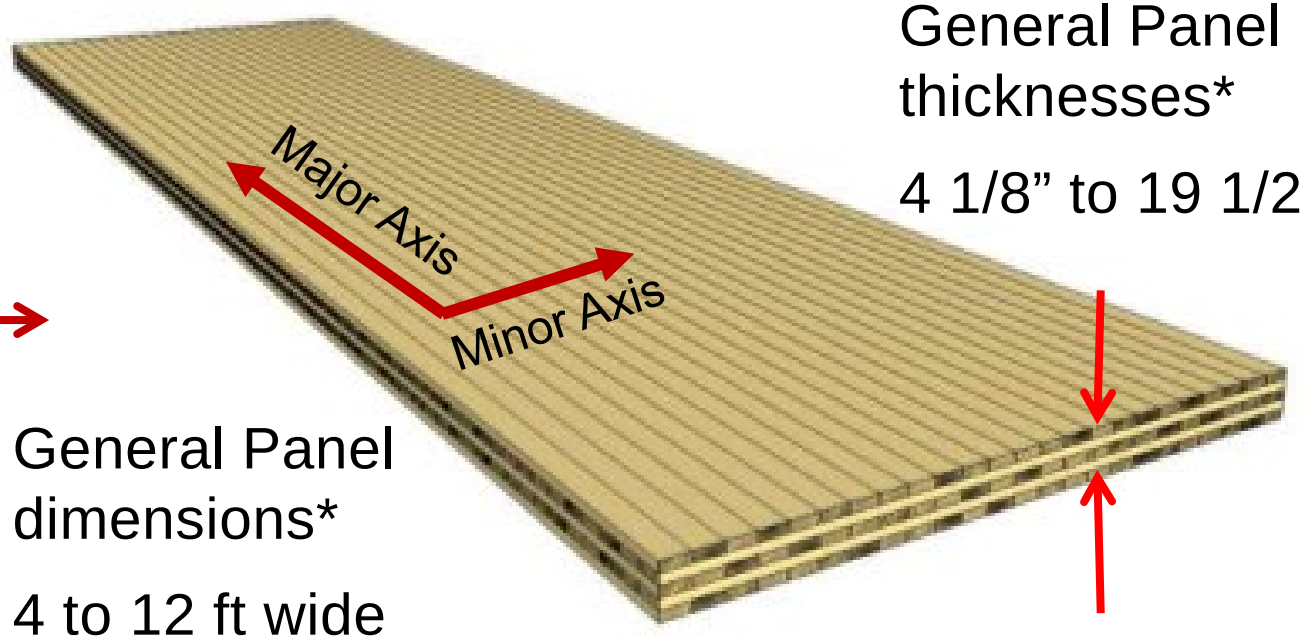
Photo: Manasc Isaac Architects/Fast + Epp

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*

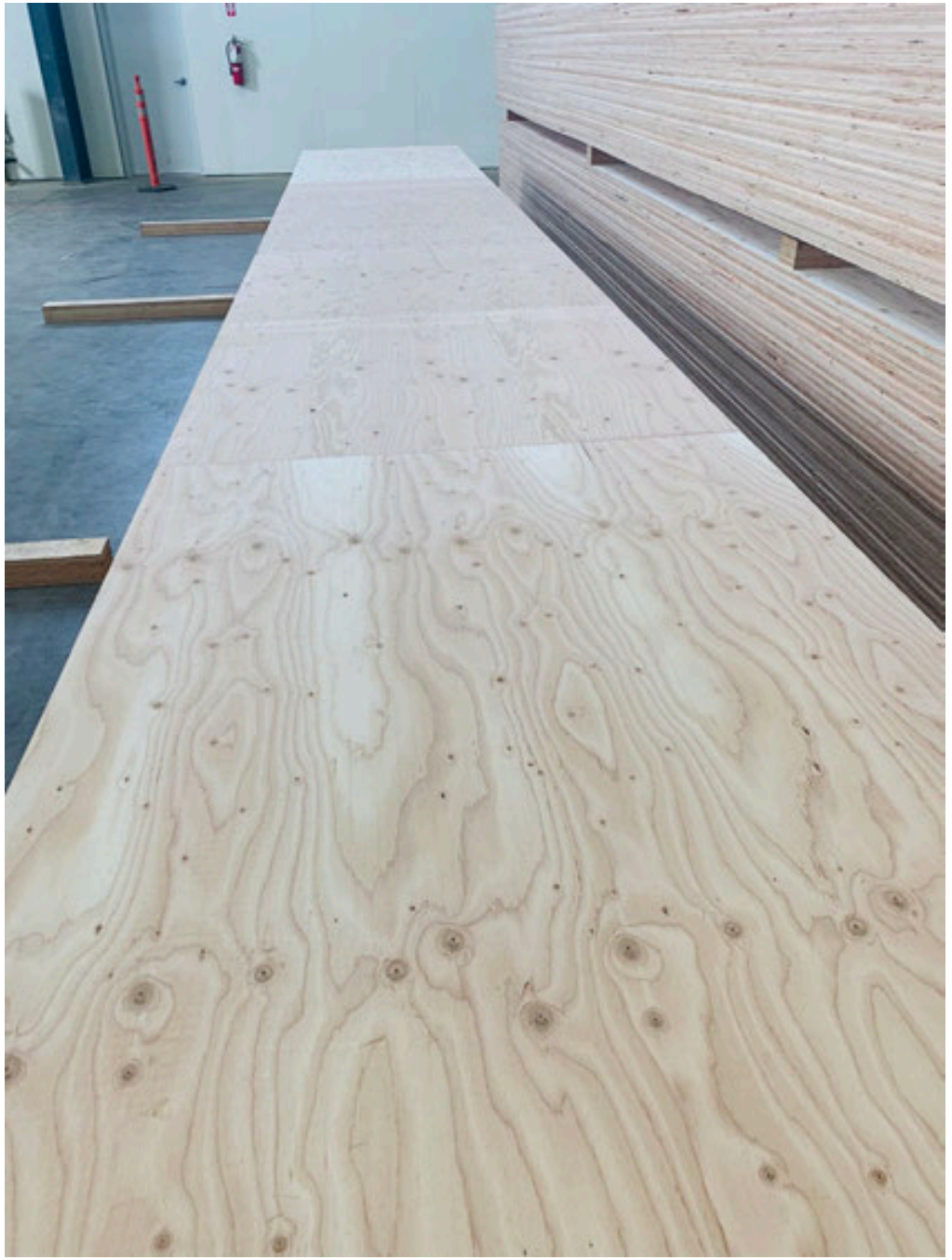
4 to 12 ft wide

24 to 64 ft long

*Consult with manufacturers for available panel sizes

Cross-Laminated Timber (CLT)

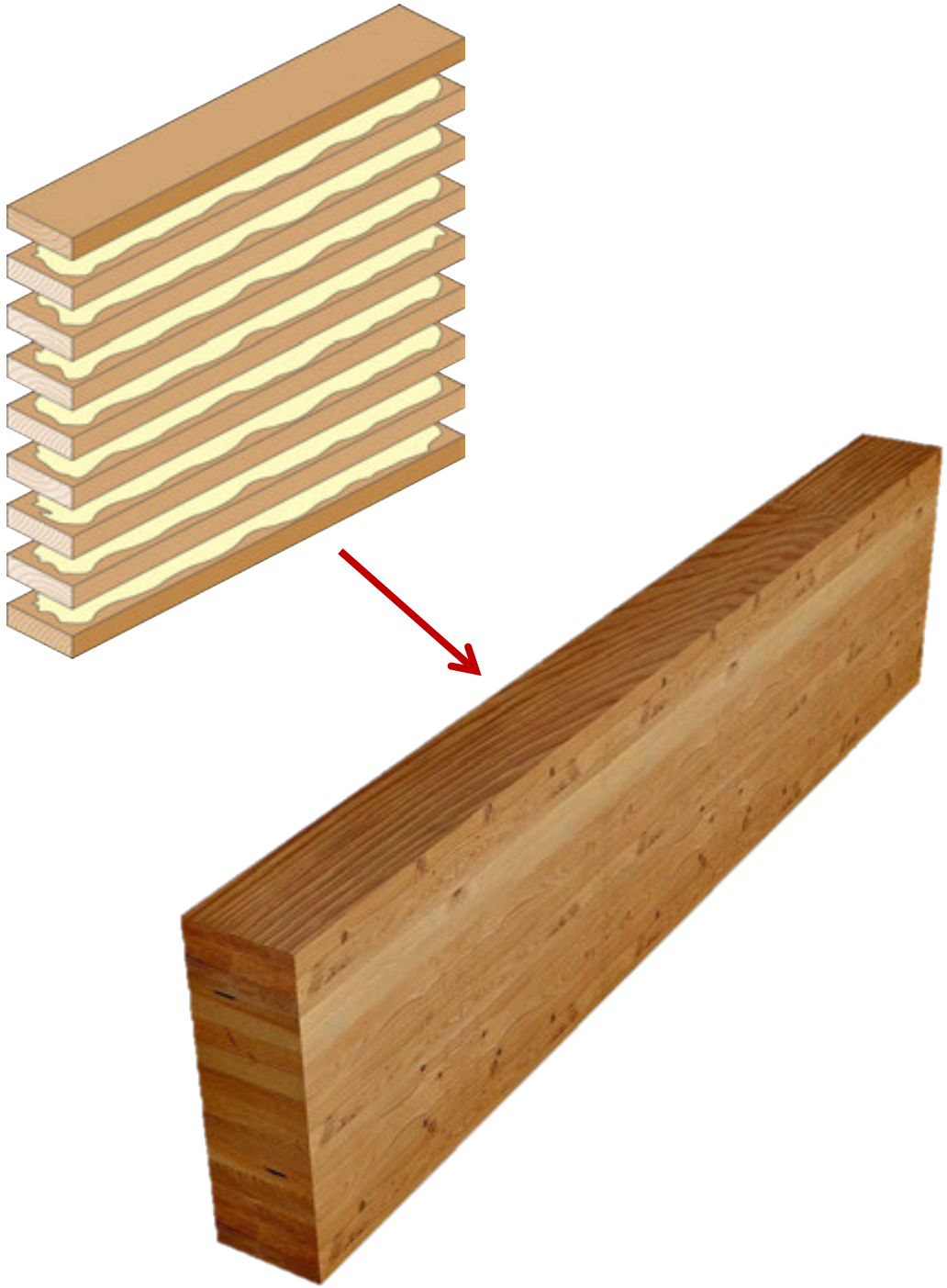
With SCL laminations



Photos: Freres Lumber

Glue Laminated Timber (GLT)

Photo: Manasc Isaac Architects/Fast + Epp



Nail-Laminated Timber (NLT)

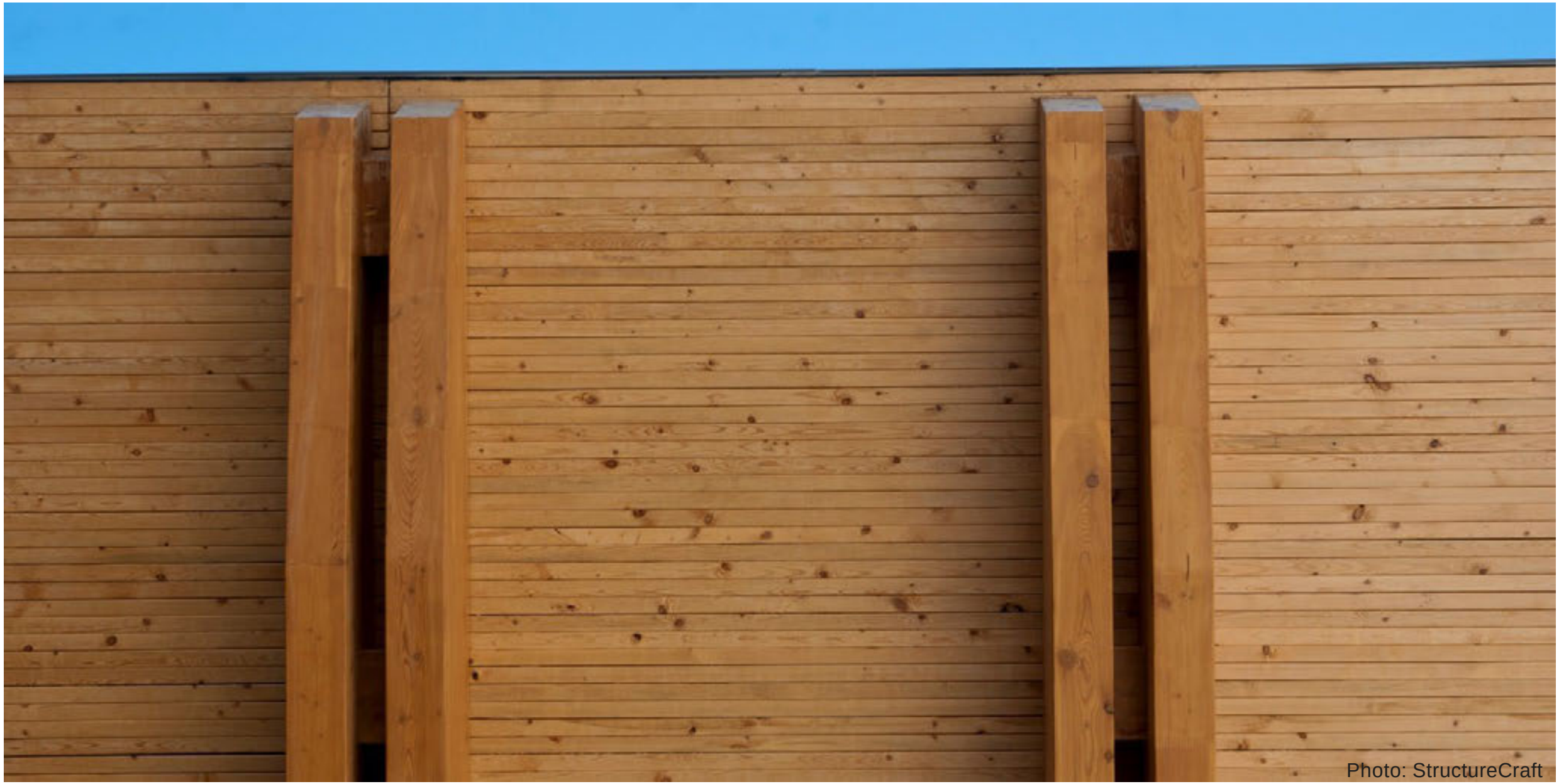


Photo: StructureCraft

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

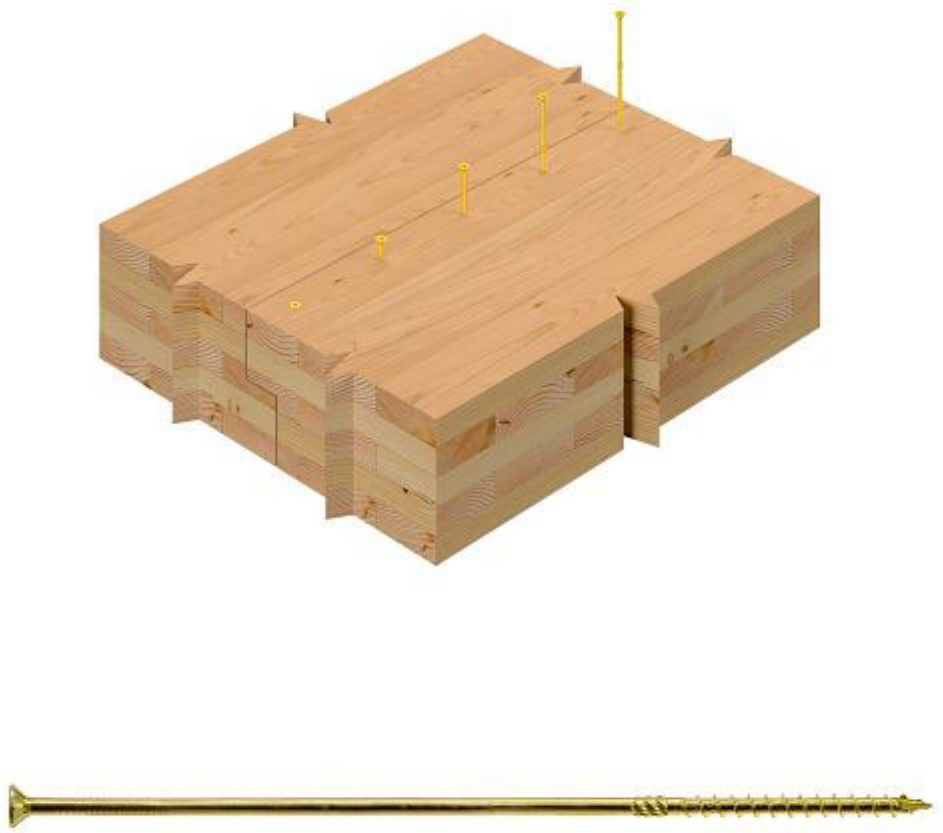
Photo: Lendlease

STRUCTURAL SOLUTIONS | HYBRID LIGHT-FRAME + MASS TIMBER

STRUCTURAL SOLUTIONS | HYBRID STEEL + 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

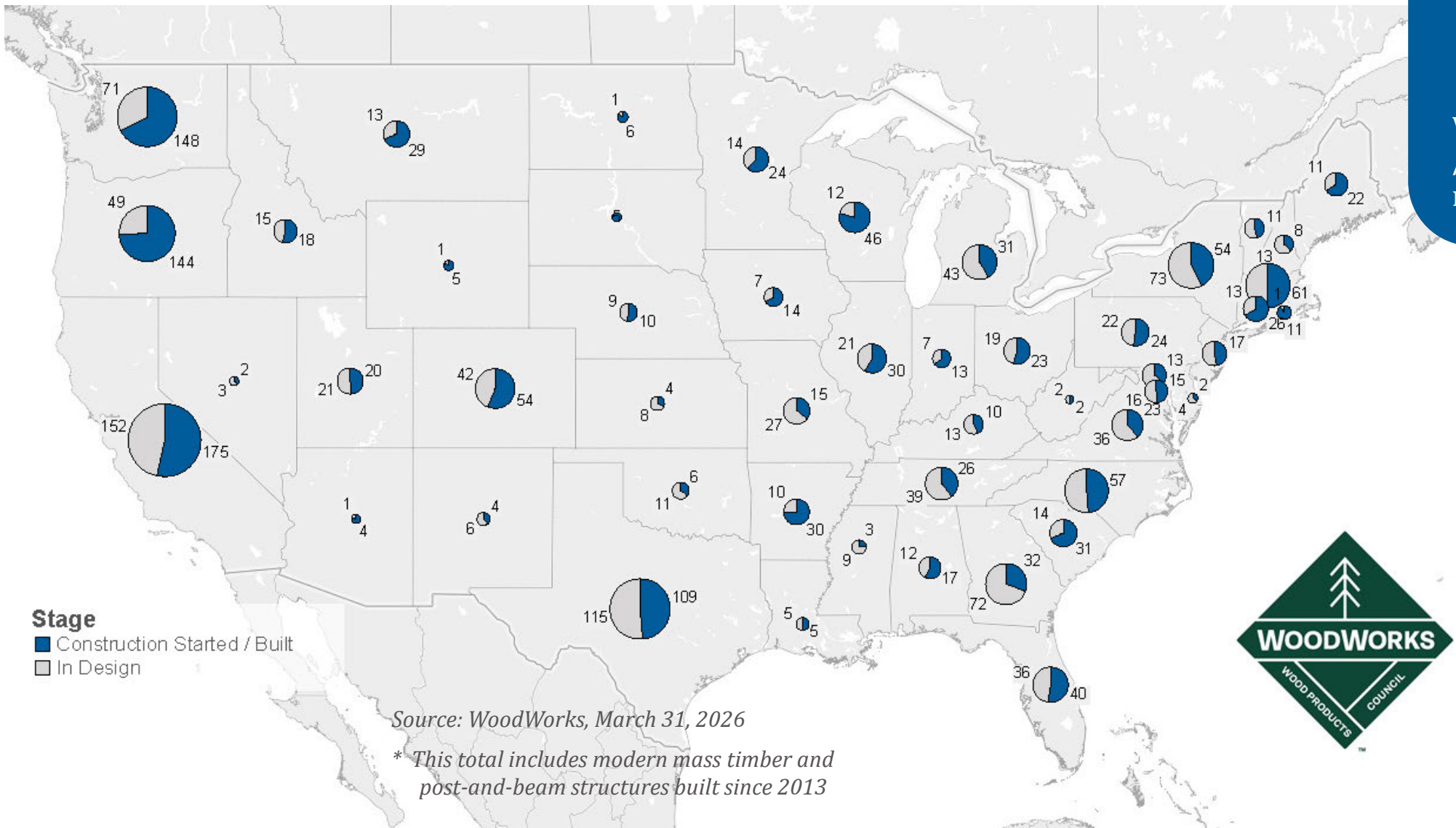
Photo: Marcus Kauffman

Current State of Mass Timber Projects

As of Q1 2026, in the US, **2,746** 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/



Stage

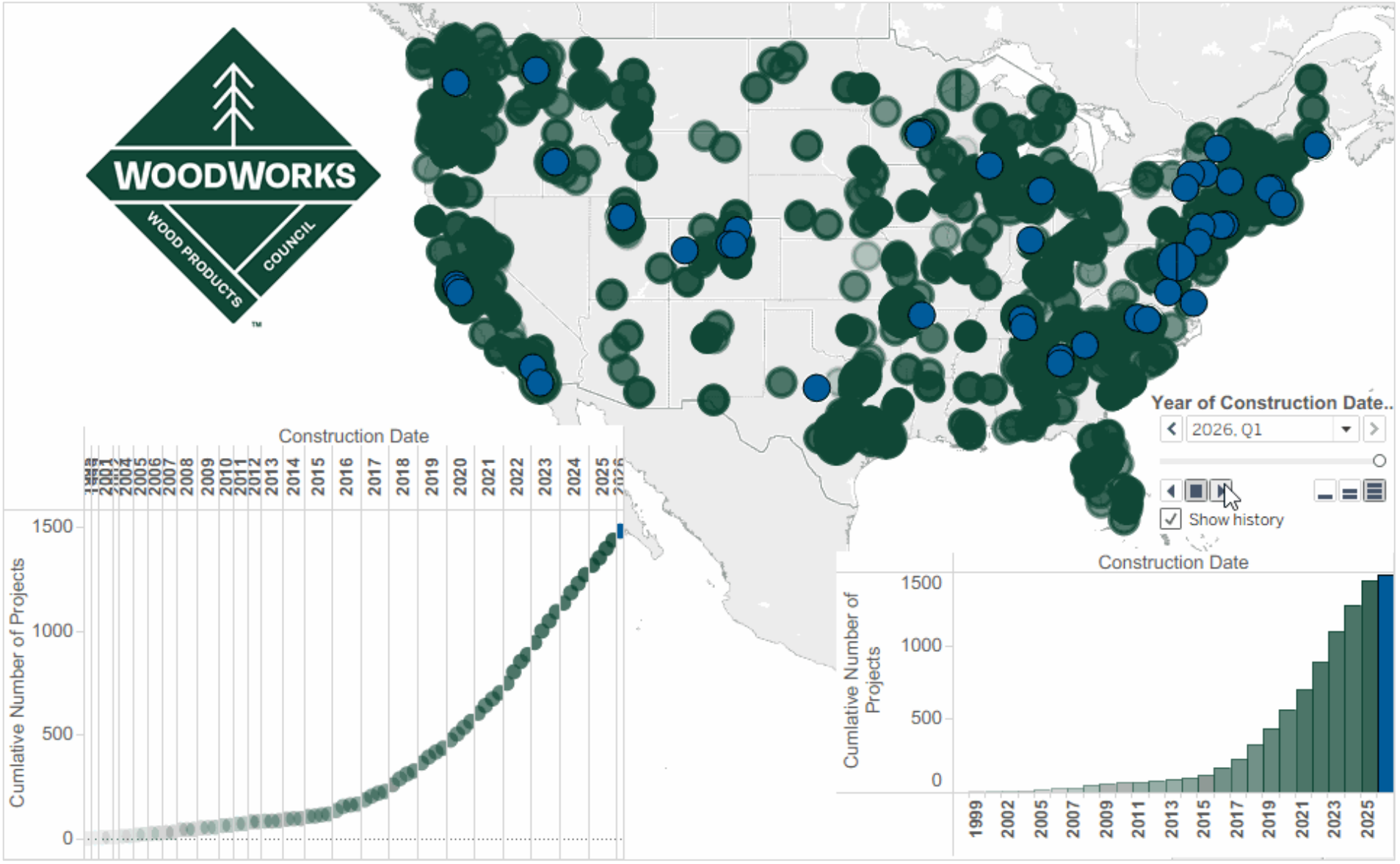
- Construction Started / Built
- In Design

Source: WoodWorks, March 31, 2026

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

Current State of Mass Timber Projects Over Time

US Market Q1 2026



Photos: Michael Elkan | Naturally Wood | UBC

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

Campus 244

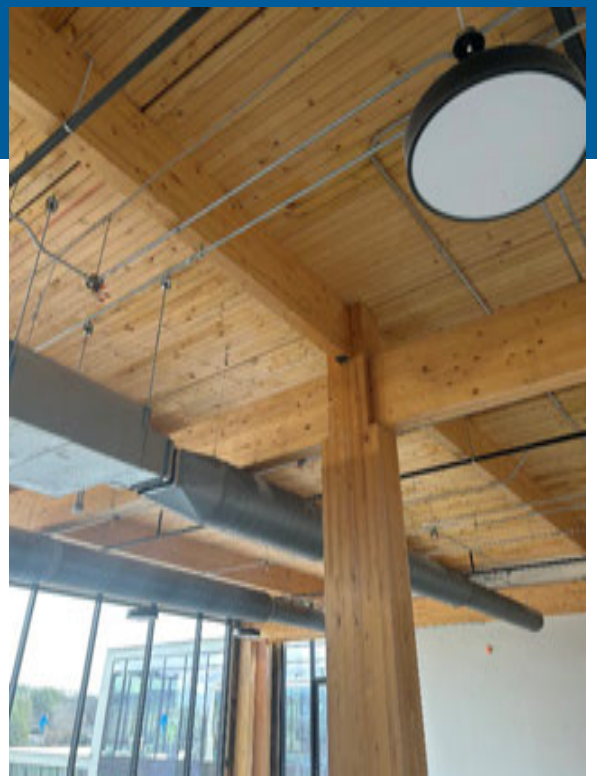
Dunwoody, GA

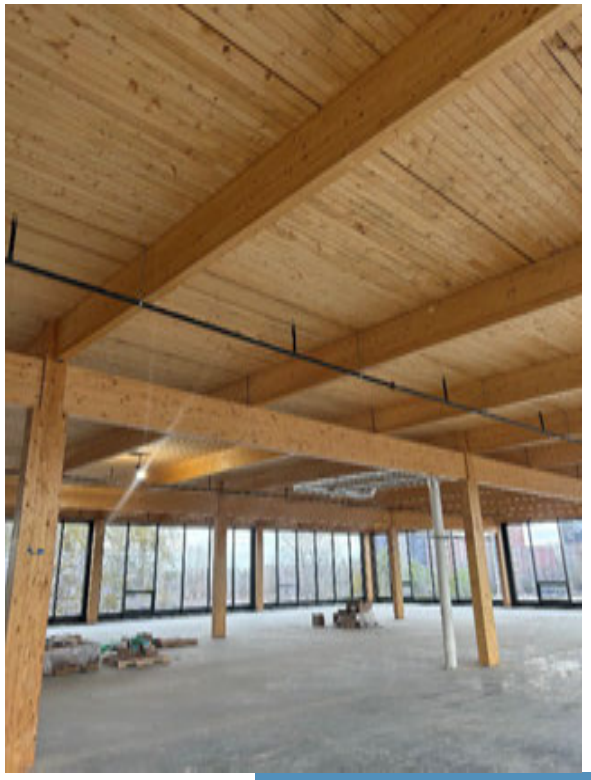
S9Architects
StructureCraft
Photo: Winter Construction

Campus 244

Dunwoody, GA

- 2-story mass timber overbuild on 3-story existing structure
- Existing foundations did not need to be underpinned





Photos: Winter Construction

S9Architects
StructureCraft

619 Ponce

Atlanta, GA

Handel Architects
StructureCraft
Photo: Jamestown

619 Ponce

Atlanta, GA

120,000 sf, 4 stories

Type III-B

Office / Retail

Completed 2024

WoodWorks CASE STUDY

WN PROFILE

Handel Architects
StructureCraft
Photo: StructureCraft

Photos: StructureCraft

Photo: Hartshorne Plunkard Architecture

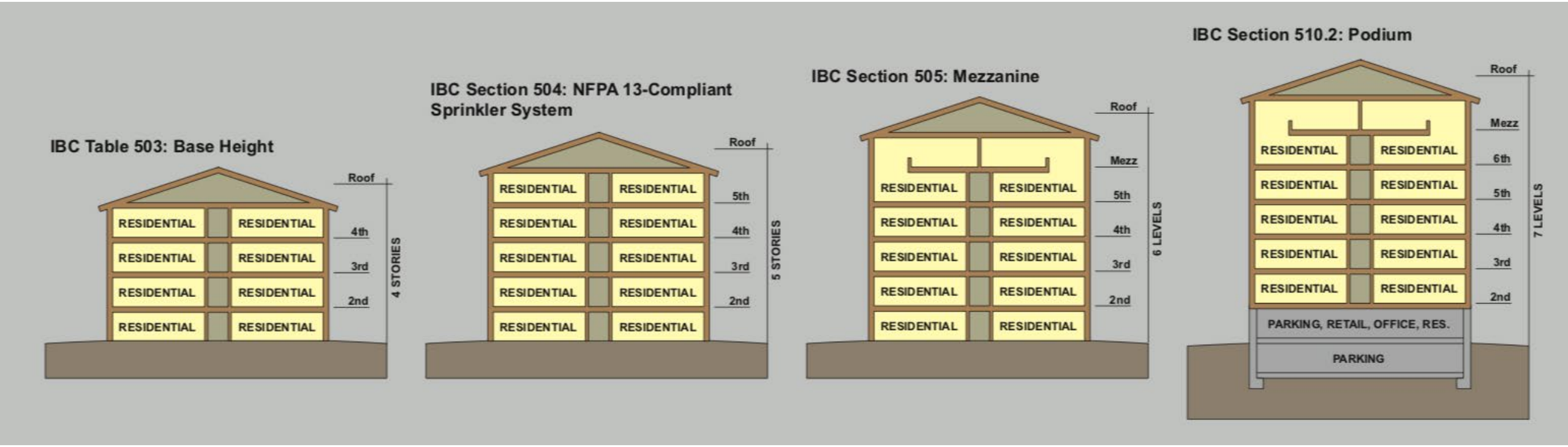
MASS TIMBER PROJECT CONSIDERATIONS

Photo: Hacker Architects

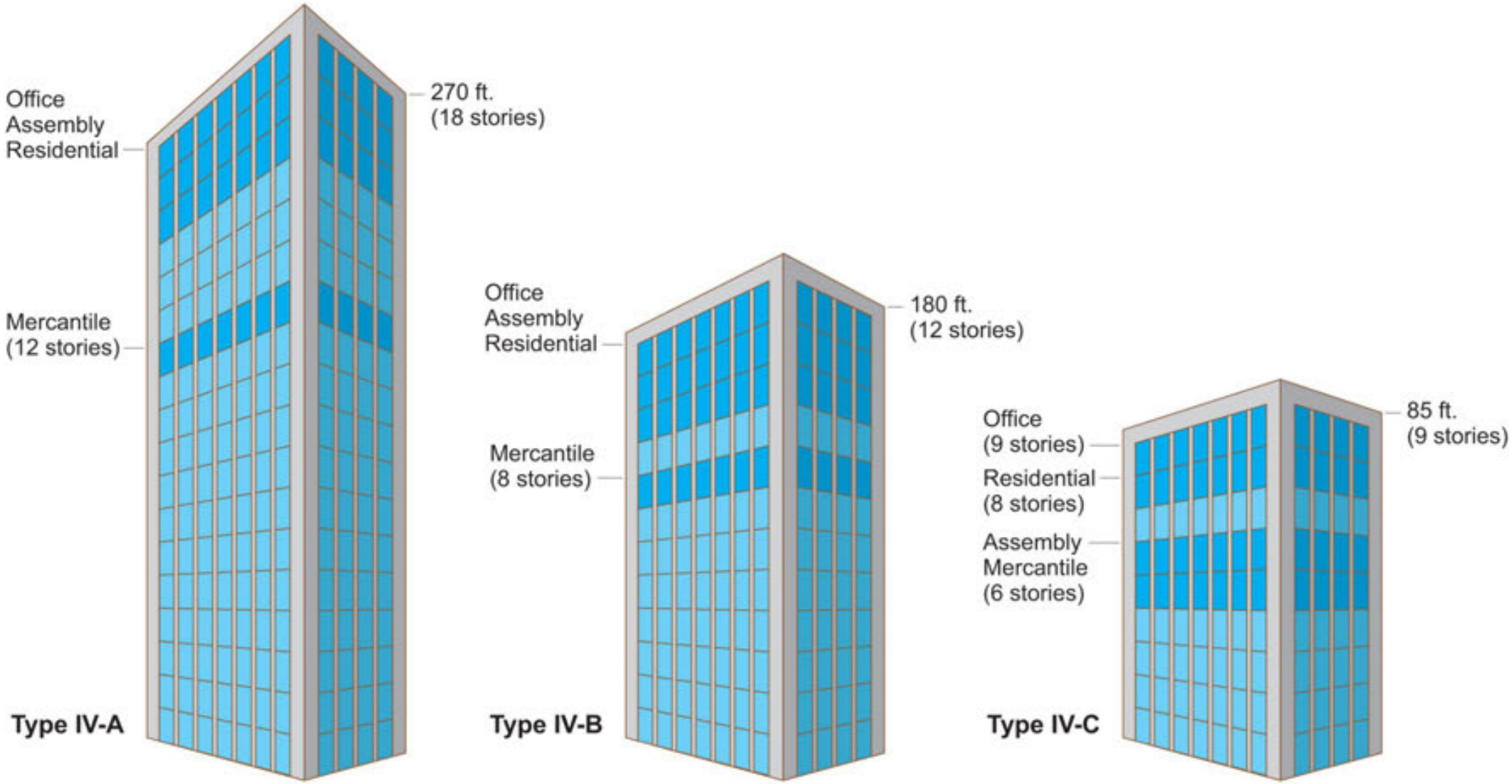
MASS TIMBER IN THE CODE

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

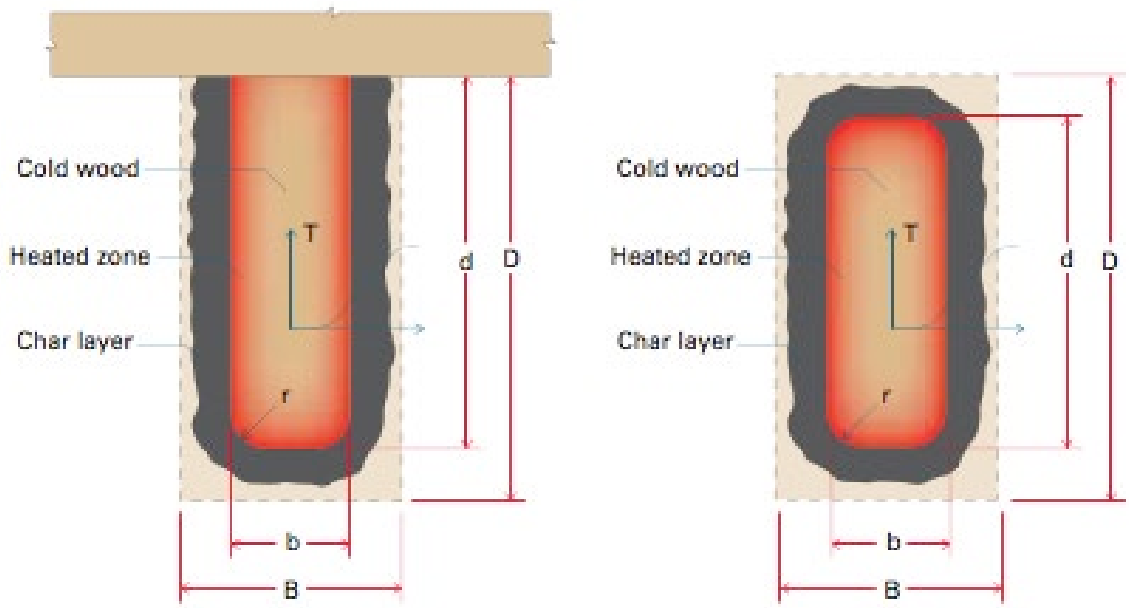


Mass Timber's Fire-Resistive Performance is Well-Tested, Documented and Recognized via Code Acceptance

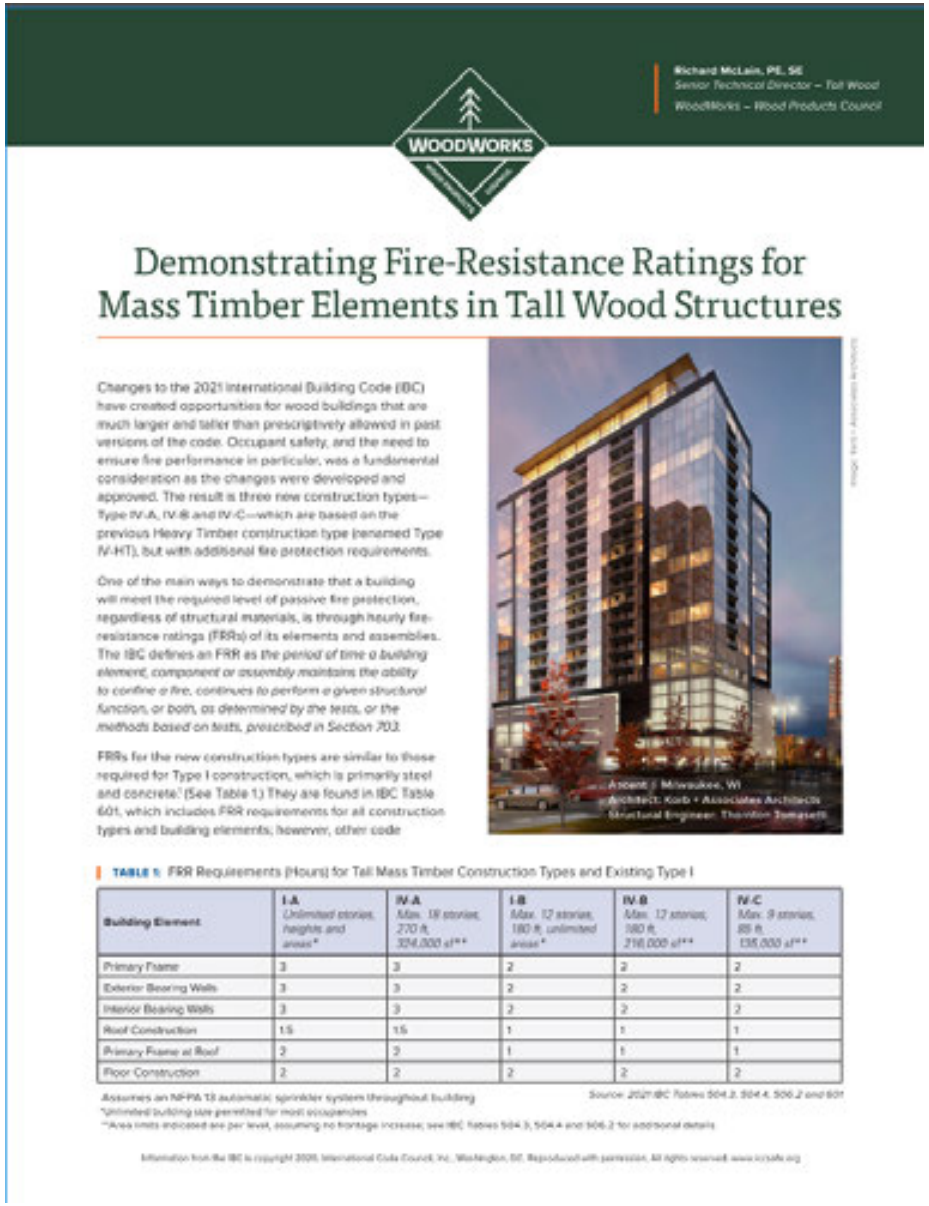
Table 16.2.1A Char Depth and Effective Char Depth (for β_n = 1.5 in./hr.)

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

WOODWORKS

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

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 504.2, 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

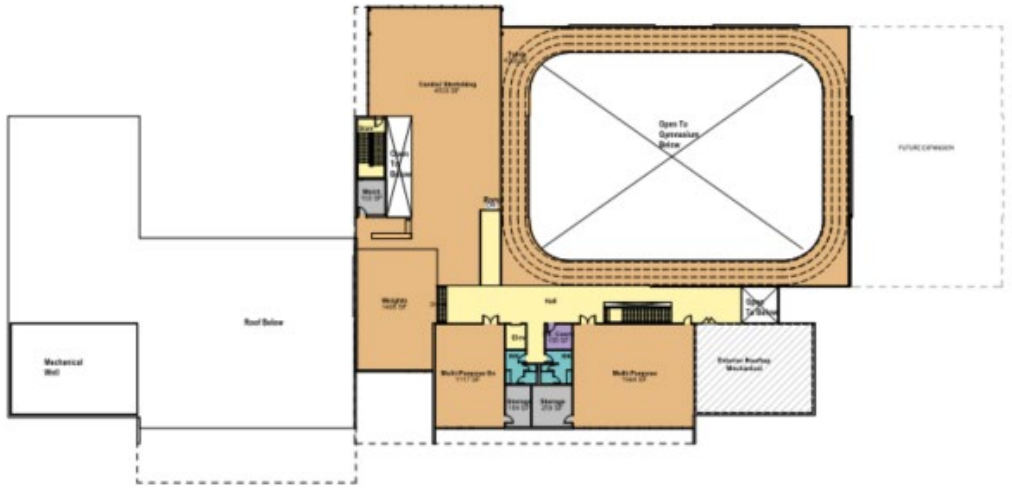
Mass Timber Fire Design Resource

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

Value: Program

Level 1

Level 2



Concept Plan

Hillsboro Community Center at 53rd Ave.

May 03, 2018

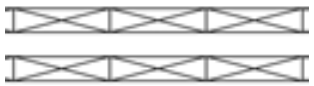
opsis

Cost: Construction Type

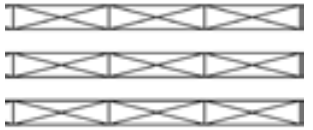
TABLE 601
Fire Resistance Rating Requirements for Building Elements (Hours)

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		

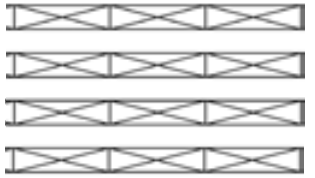
Baseline
0hr & HT



+$10/SF
1hr & maybe 2hr



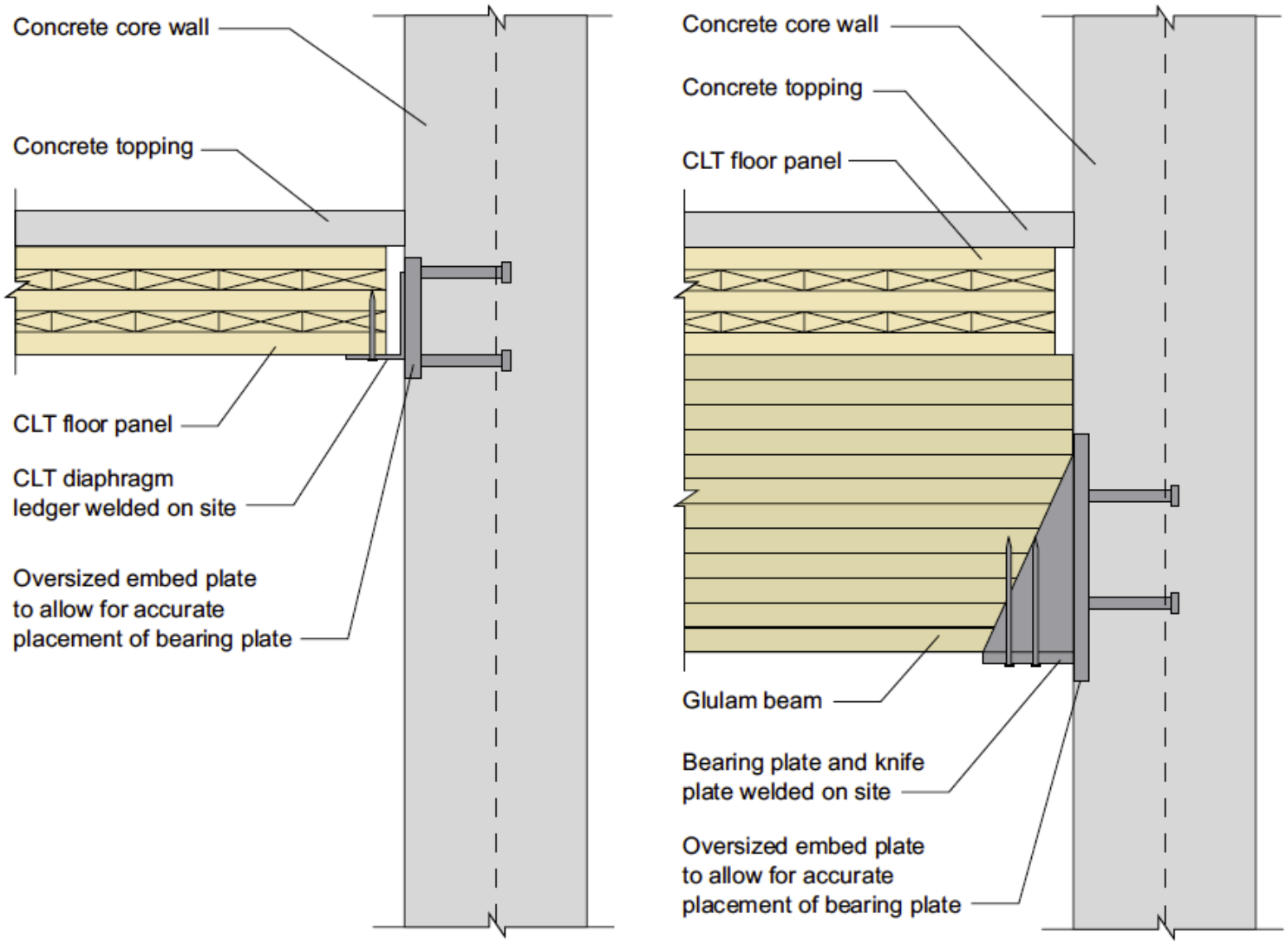
+$12-15/SF
2hr FRR



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.

Options for accommodating differential movement



Cost Impacts of Construction Type

Construction Type Early Decision Example

4-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 (4th) floor

- Requires Construction Type IIIA

If owner permits moving events space to 1st, 2nd or 3rd floor

- Could use Type IIIB

Cost Impacts of Construction Type

Construction Type Early Decision Example

4-story building on college campus

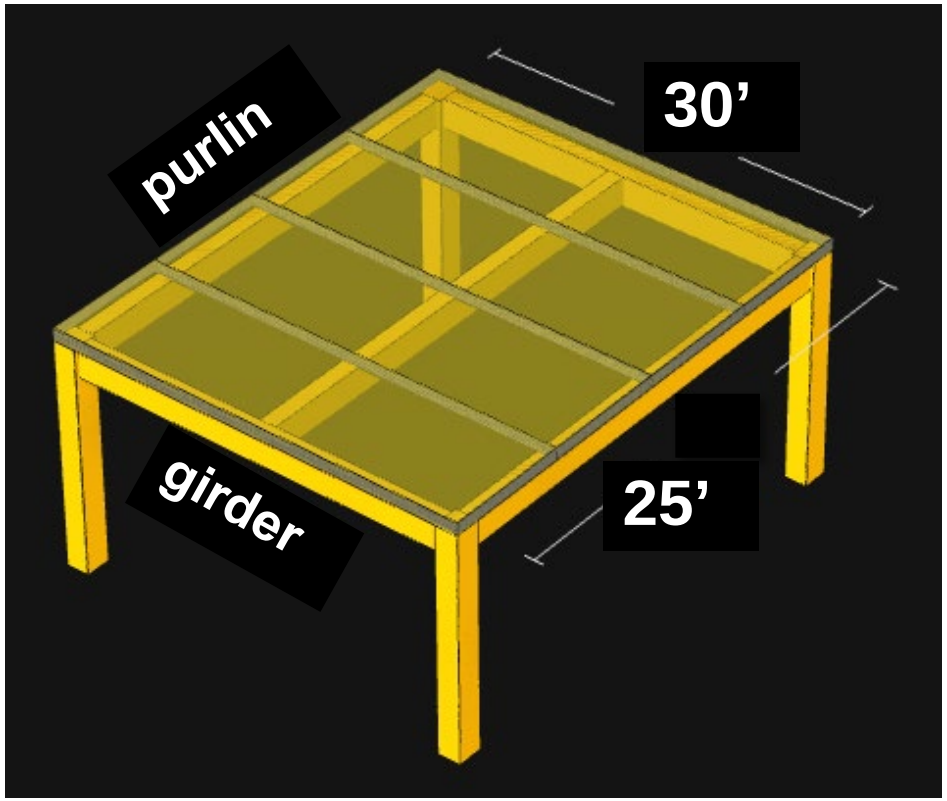
Cost Impact of Assembly Occupancy Placement:

Location of Event Space	4th 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

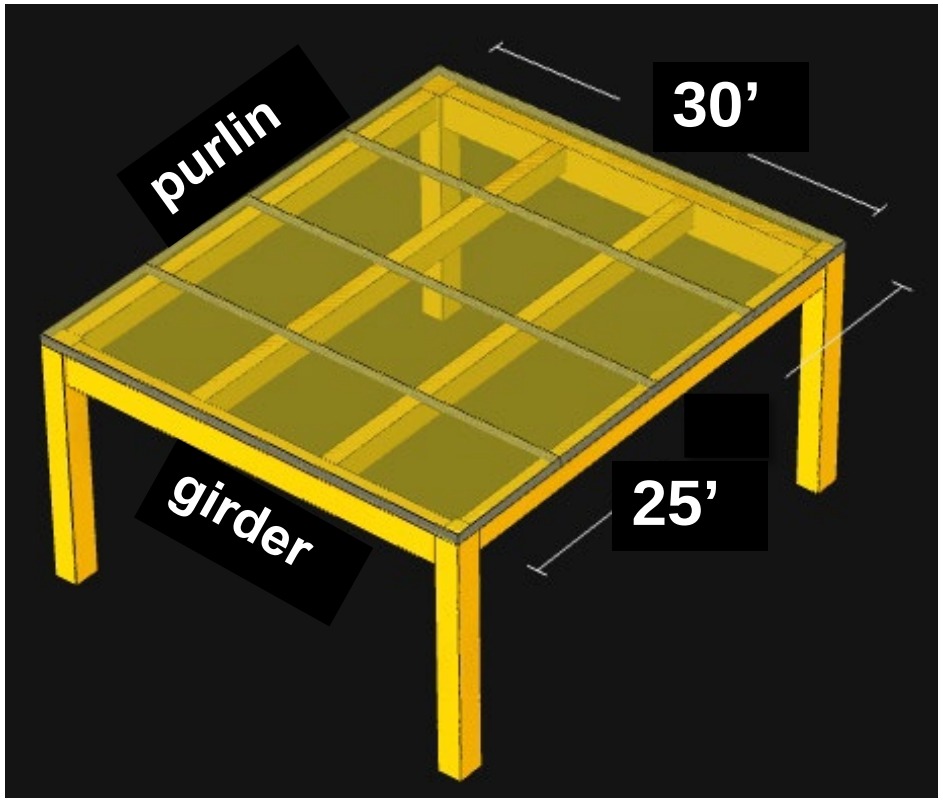
Type IIIA option 1

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

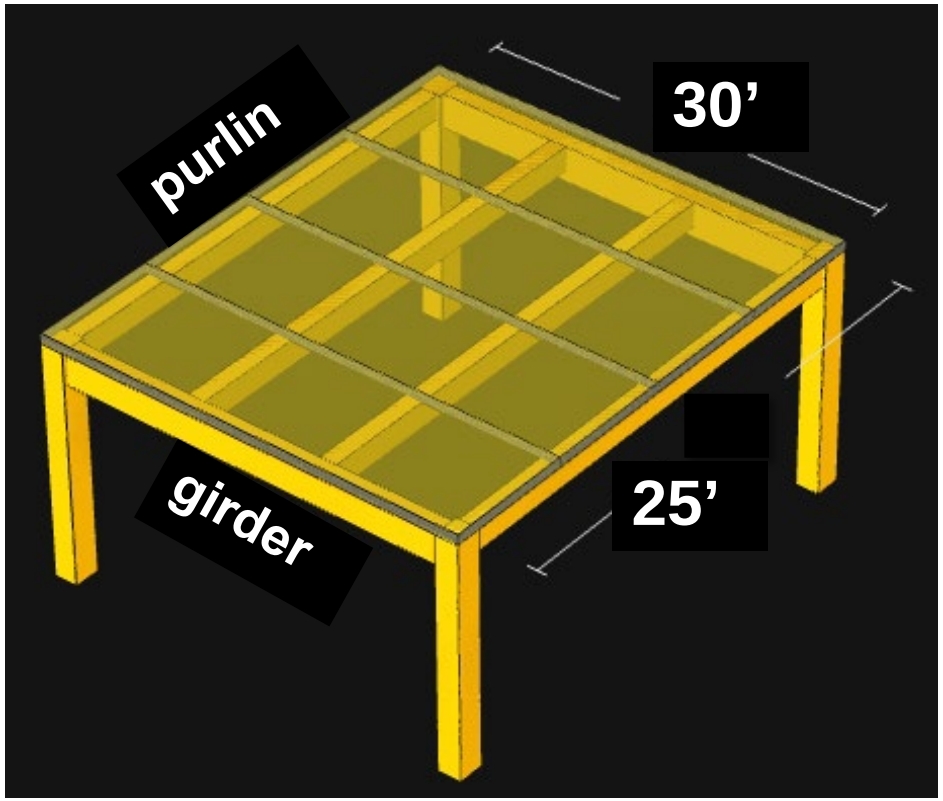
1-hr FRR
Purlin: 5.5”x24”
Girder: 8.75”x33”
Column: 10.5”x10.75”
Floor panel: 5-ply

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

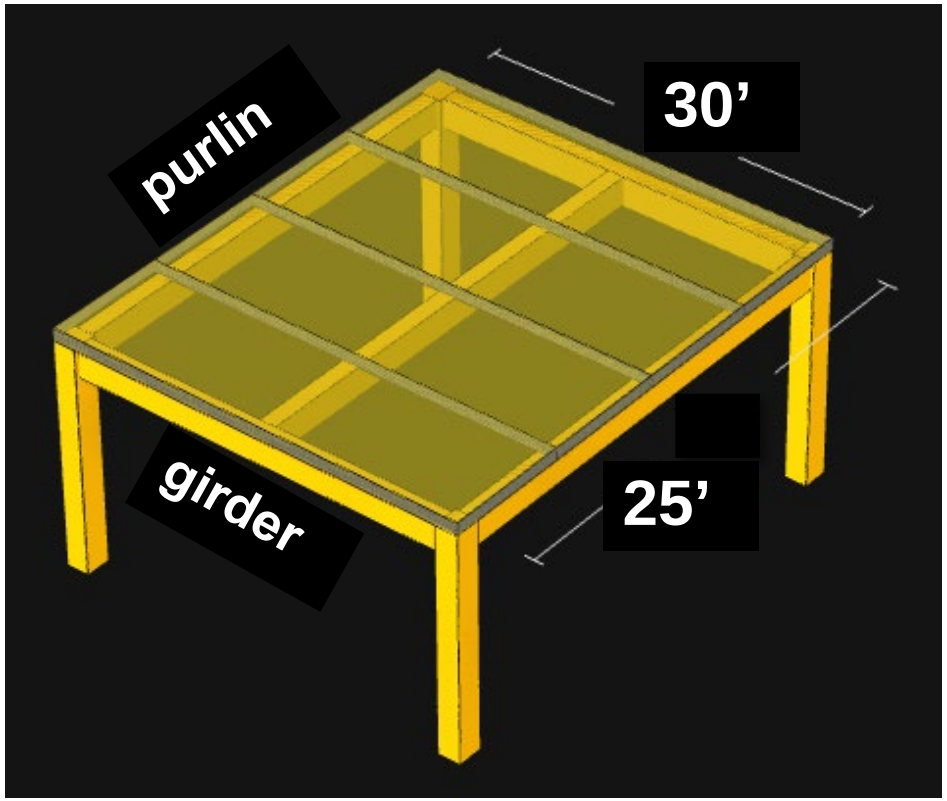
Type IV-HT

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.

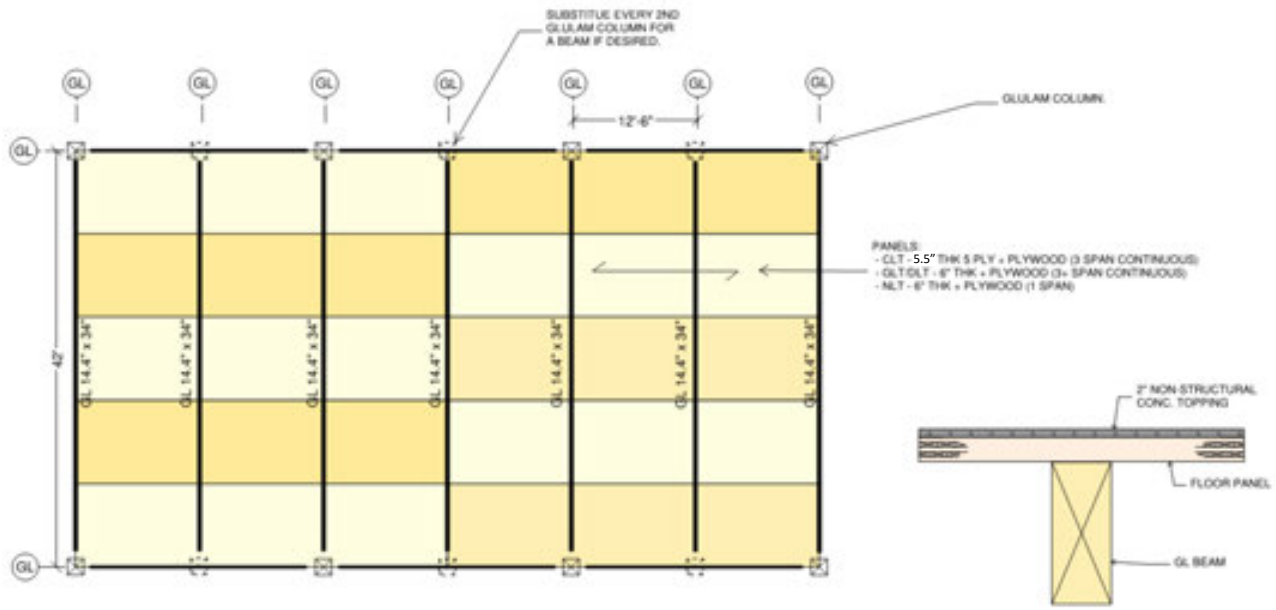
Share

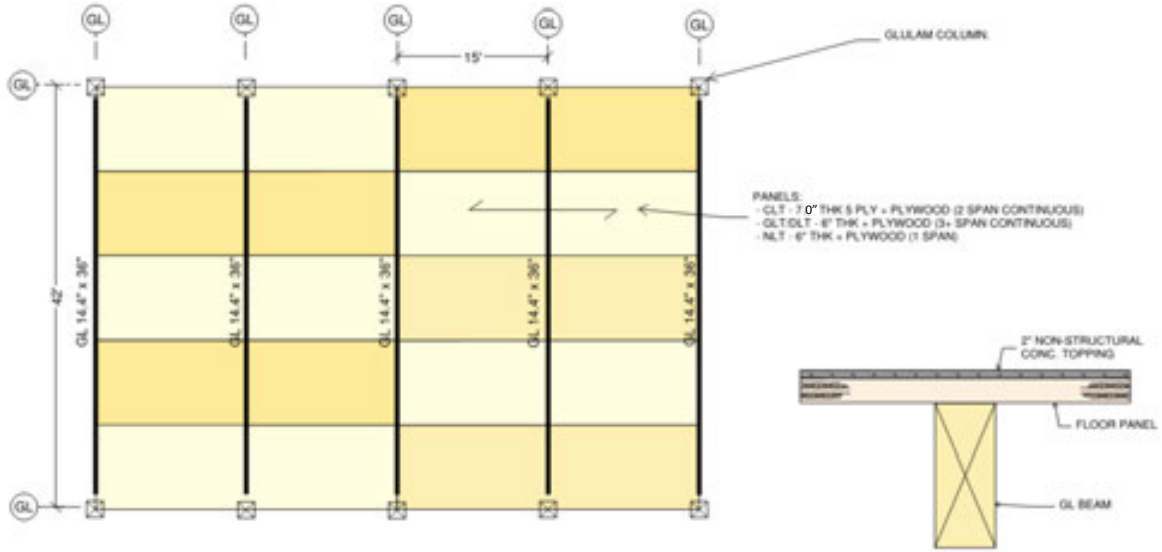
Selecting a Construction Type

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

Photo: Swinerton

Cost: Structural System & Grid





Baseline

12’-6” Glulam Spacing

5.5” CLT

$ +5%

15’ Glulam Spacing

7” CLT

Source: Seattle Mass Timber Tower Book

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

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

Value Analysis

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

Perimeter Glazing

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

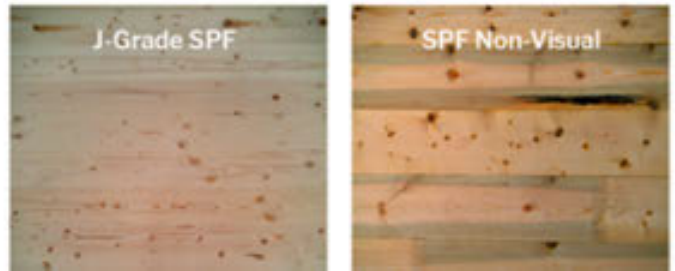
Expert Tips

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

Insurance Perspective on Mass Timber

- Lack of historic loss data = Unknowns
- Unknowns = Risk
- Risk = Higher Premiums
- Some take a ‘wood is wood’ approach

- Important to understand the significant differences in how mass timber performs in the event of a fire, etc. when compared to light wood-frame and all other building materials

Photo Credit: StructureCraft

Photo Credit: GLI Partners

Insurance vs. Building Codes

- It is important to note the distinct difference between the primary concerns of insurers vs. primary concerns of building codes
- **Insurance** primarily concerned with **property loss**
- **Building codes** primarily concerned with **occupant safety**

- As such, code acceptance and associated testing may be helpful to insurers in evaluating a new product like mass timber, but it will not address all concerns

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

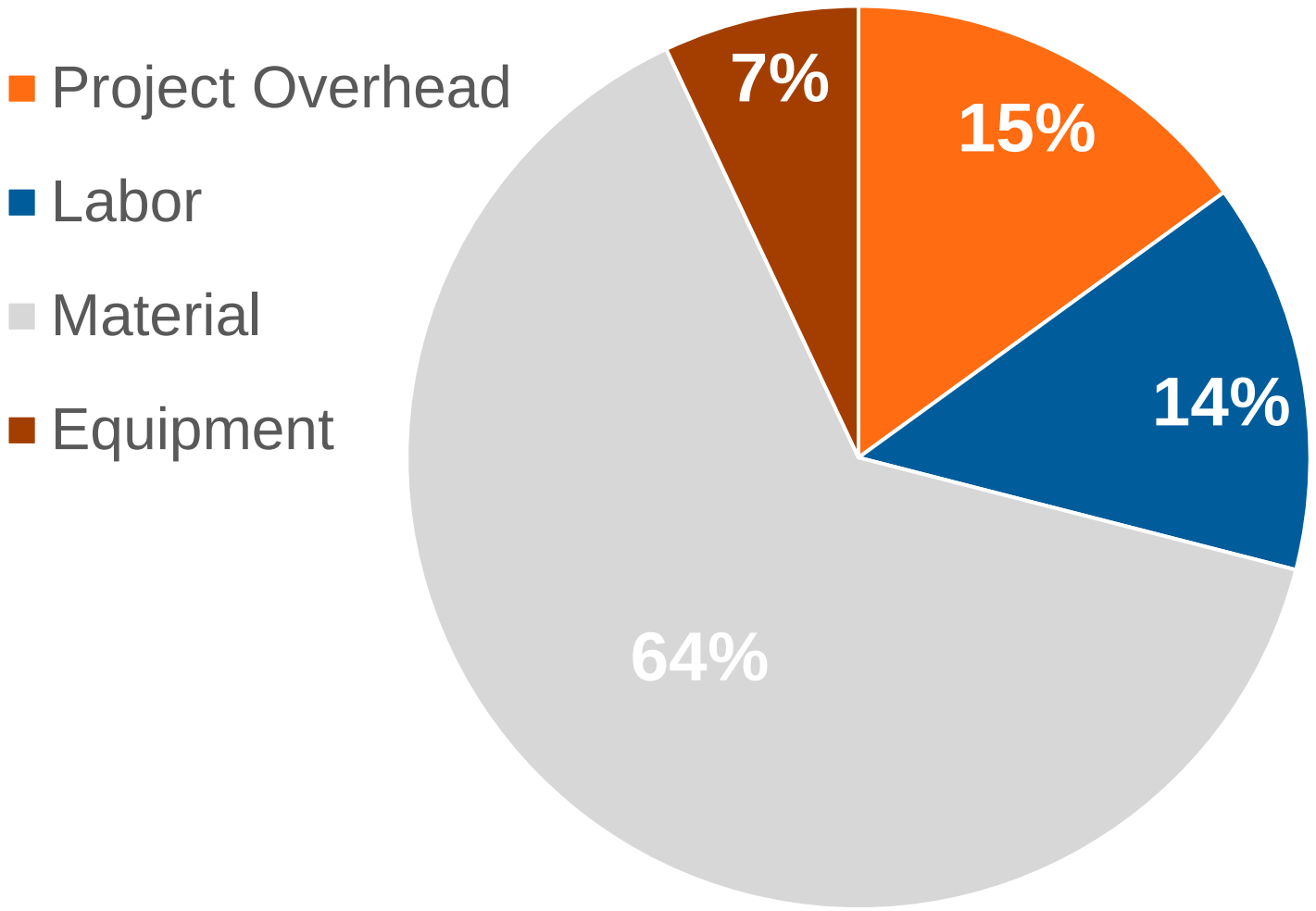
Holistic Costing

$/SF

$/SF

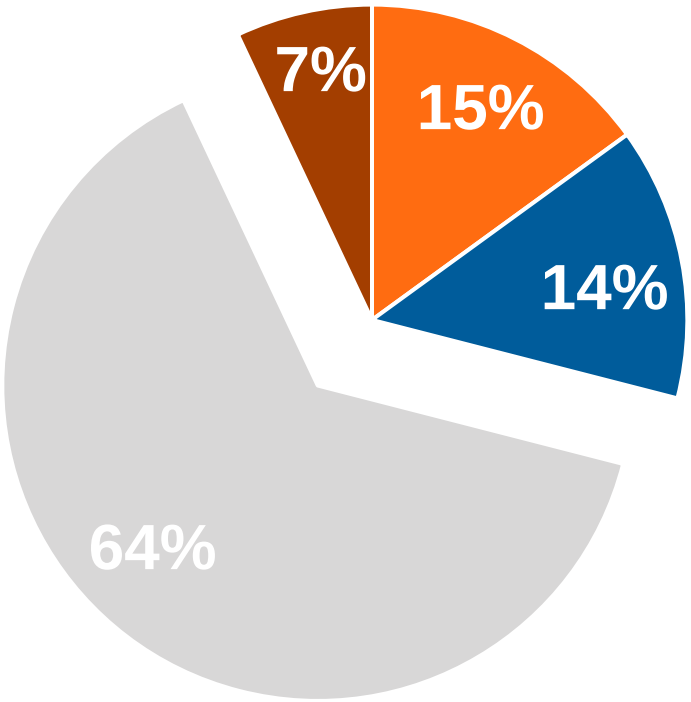
Image: GBD Architects

Anatomy of a Turnkey Mass Timber Package



Source: Swinerton

Material (Direct Cost)

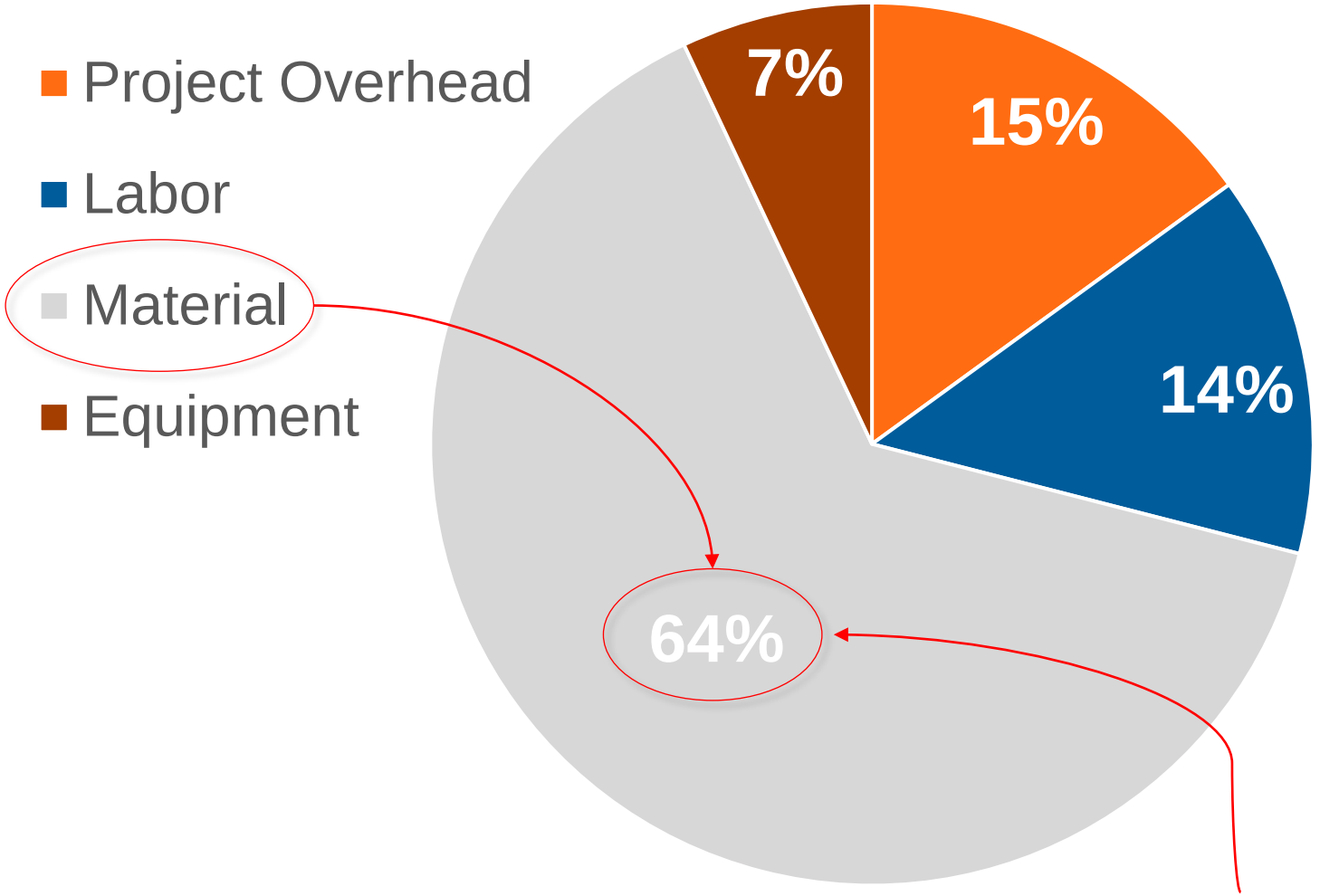


Turnkey Mass Timber Package

or

Source: Swinerton

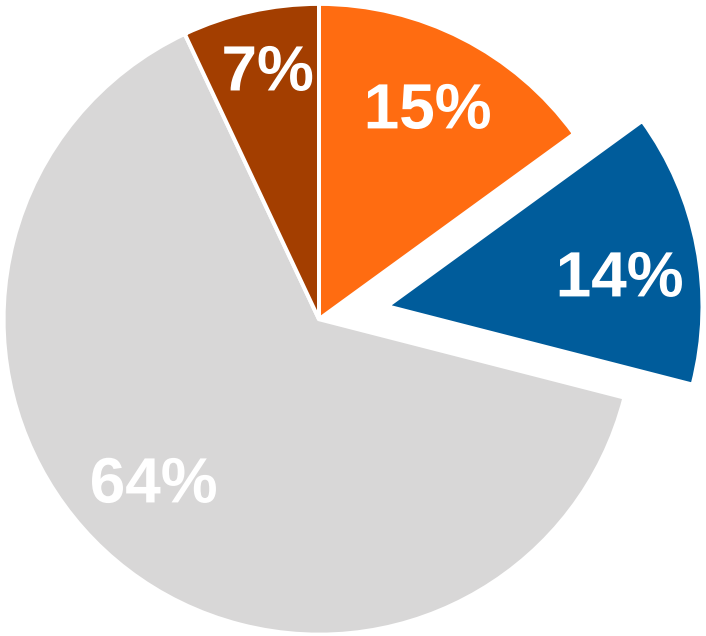
Mass Timber Package Costs



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

Source: Swinerton

Labor (Direct Cost)

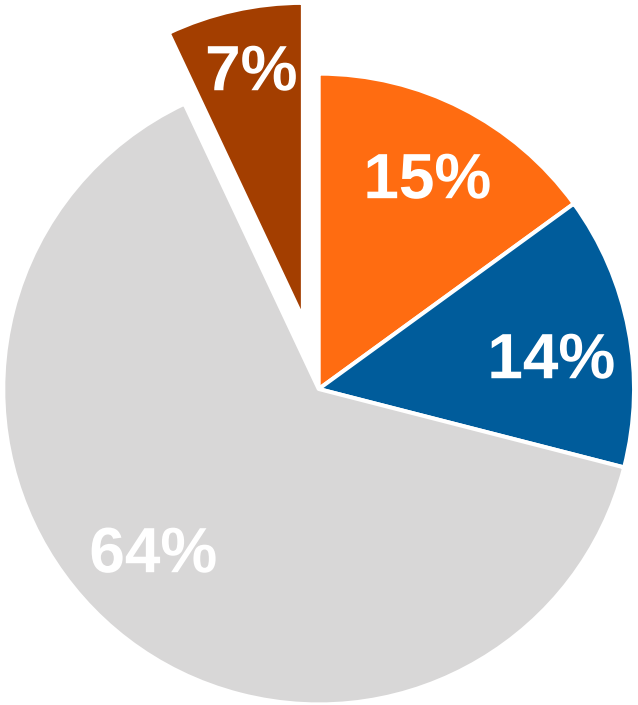


Turnkey Mass Timber Package

Photo: Swinerton

Source: Swinerton

Equipment (Direct Cost)



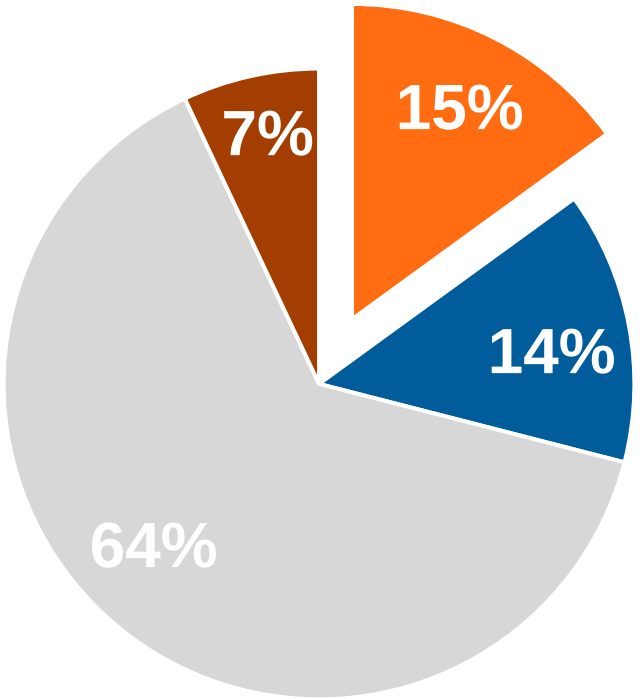
Turnkey Mass Timber Package

Photo: Swinerton

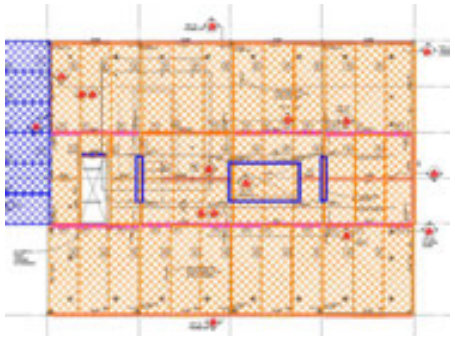
Photo: Alex Schreyer

Source: Swinerton

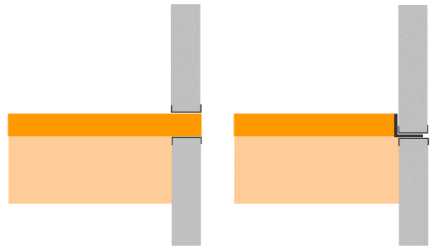
Project Overhead



Turnkey Mass Timber Package

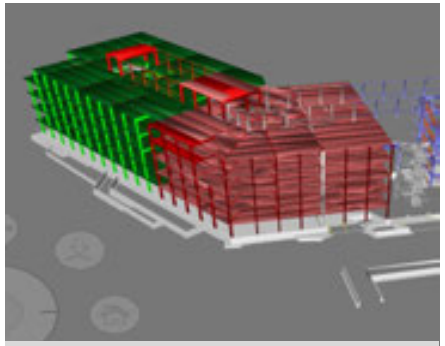


Cost Analysis

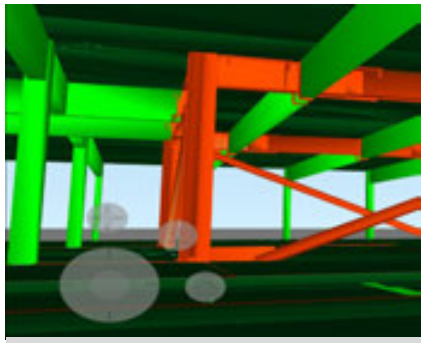


Design Refinement

System Integration



VD&C



Detail Optimization

Logistics Planning

Photos: Swinerton

Source: Swinerton

Total Project Cost Analysis

CONSIDERATIONS:

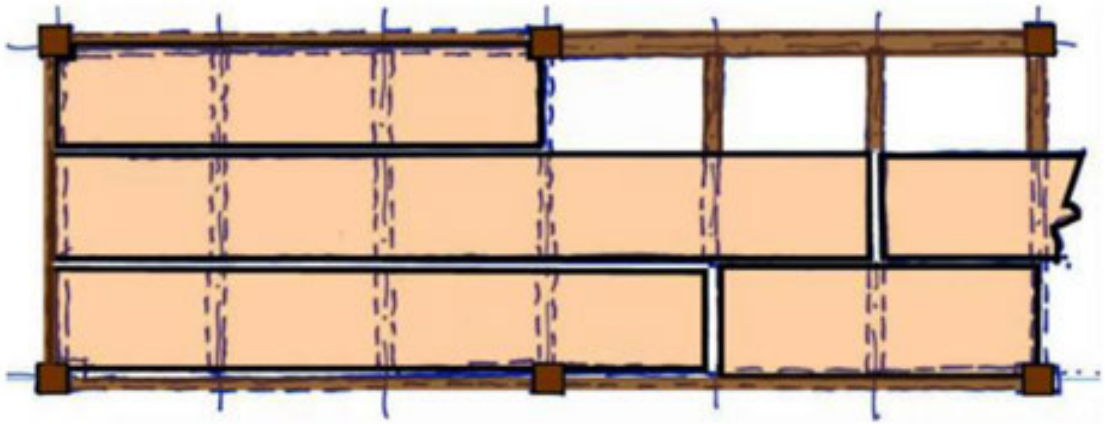
- Ceiling Treatment
- Floor Topping
- HVAC System & Route
- Foundation Size
- Material Savings
- Perimeter glazing
- Value of Time
- Completion Bonds/Insurance

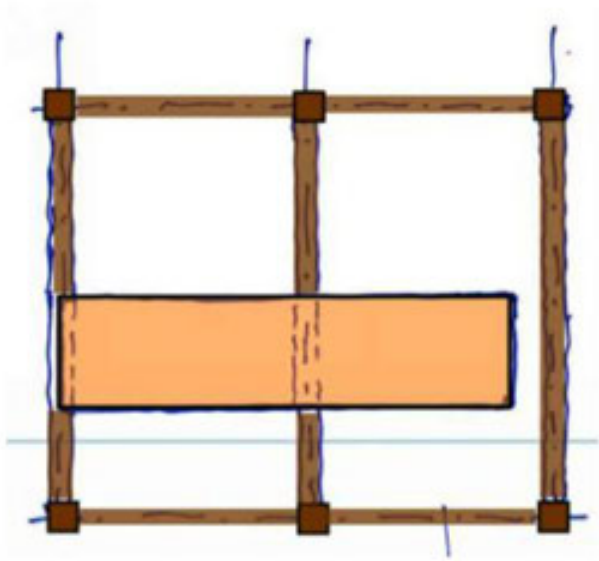
Credit: Hacker Architects

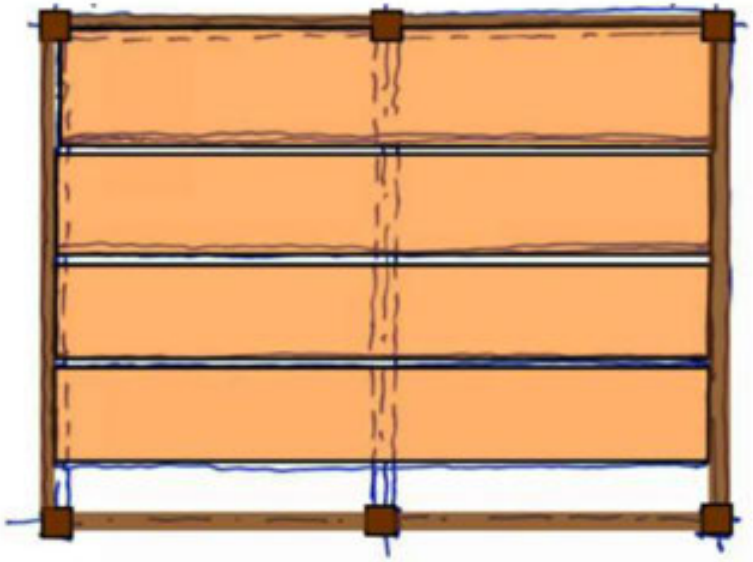
Material Fabrication Planning

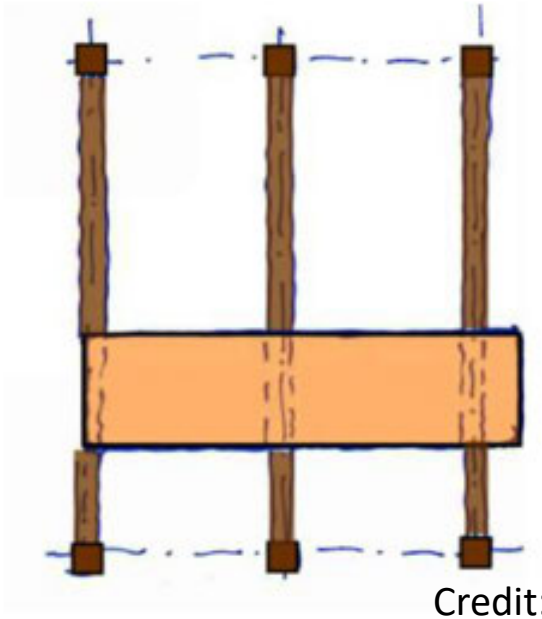
Understand the Supply Chain

Photo: Swinerton





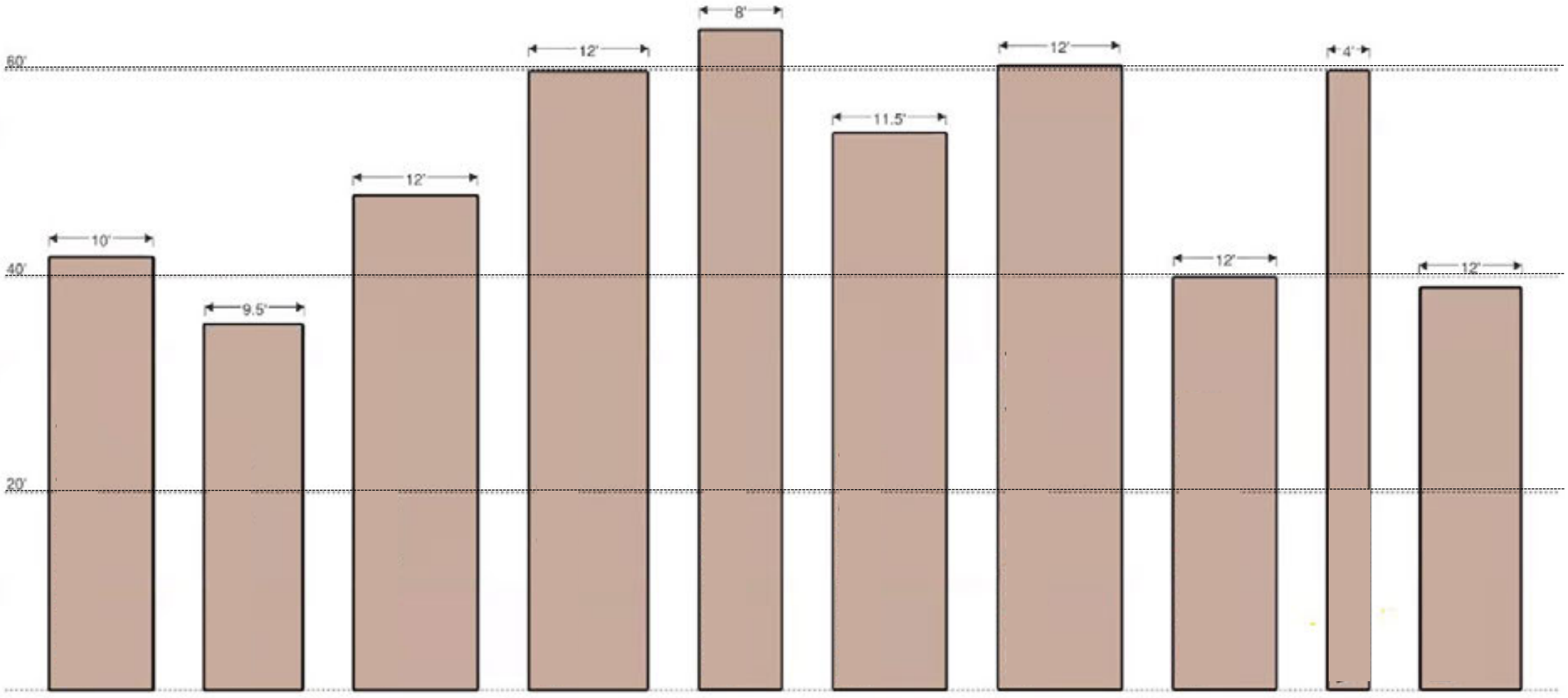




Credit: Tanya Luthi, Entuitive

Understand Manufacturer’s Capabilities

Understand Manufacturer's Capabilities

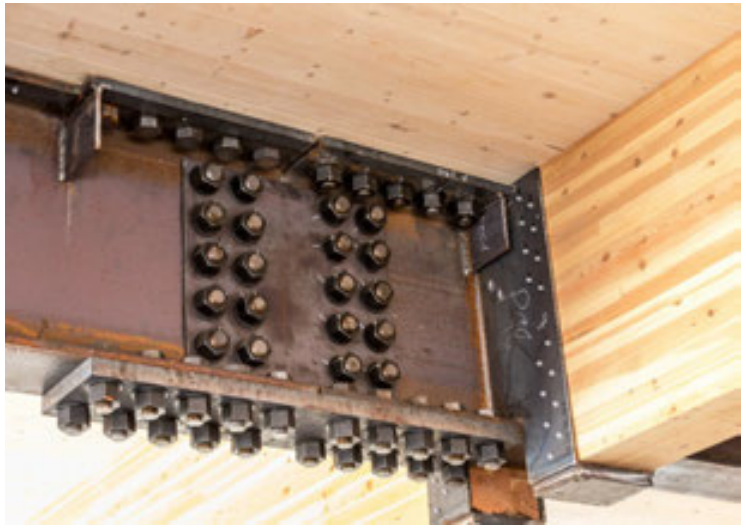


Credit: TimberLab

Embrace the Prefab Advantage

Photo: Swinerton

Tolerances: Interface with Other Structural Materials

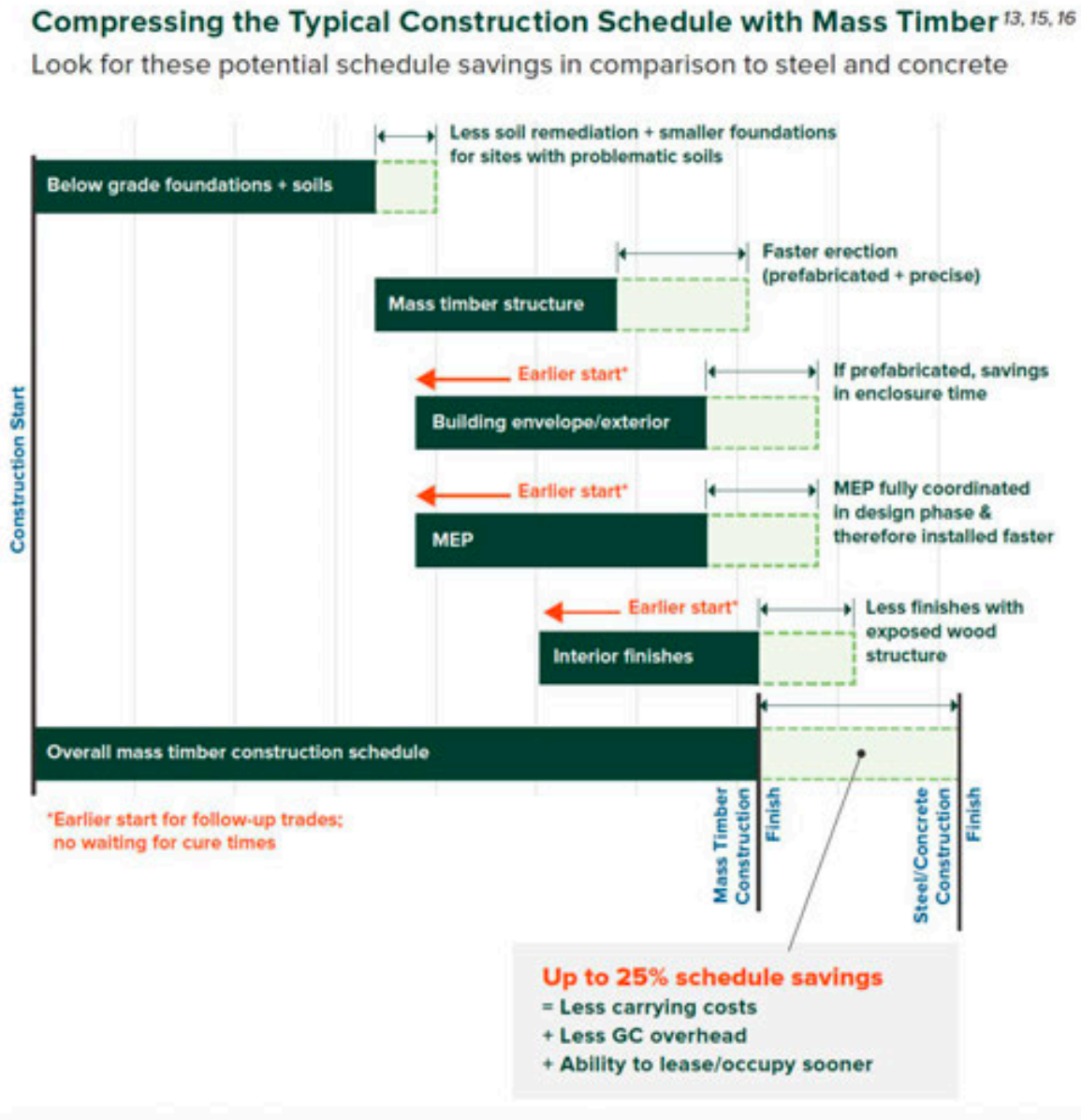


Photos: Swinerton

Schedule Drivers

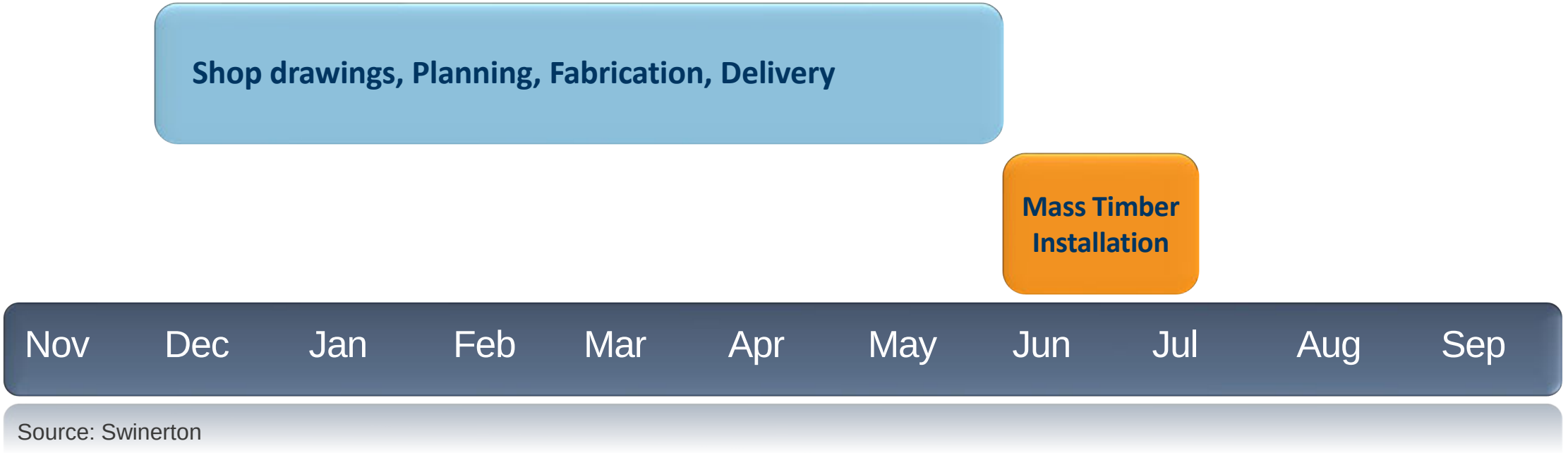
Photo: Swinerton

Procurement Approach Determines Schedule



Source: WoodWorks

Procurement Logic for Scheduling



Source: Swinerton

Example 6 Story Type IIIA Project

Schedule Comparison

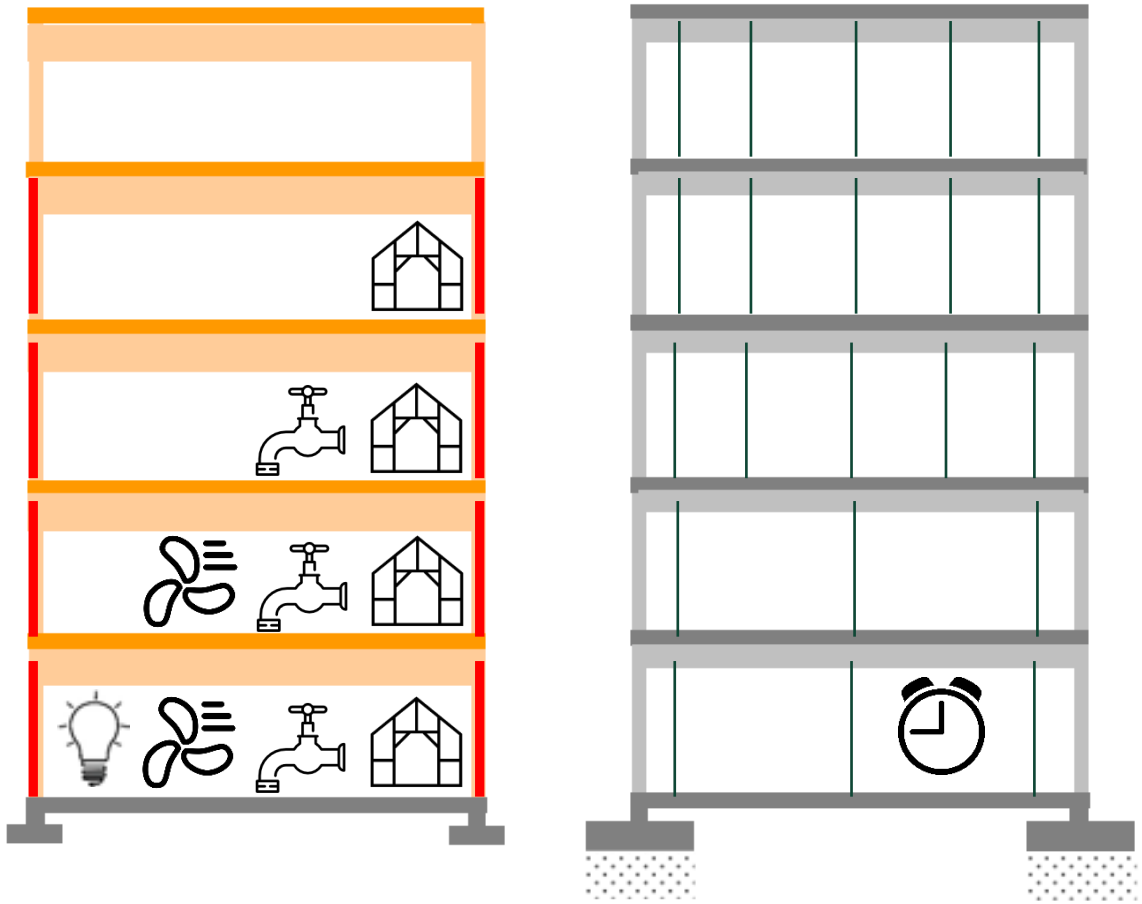
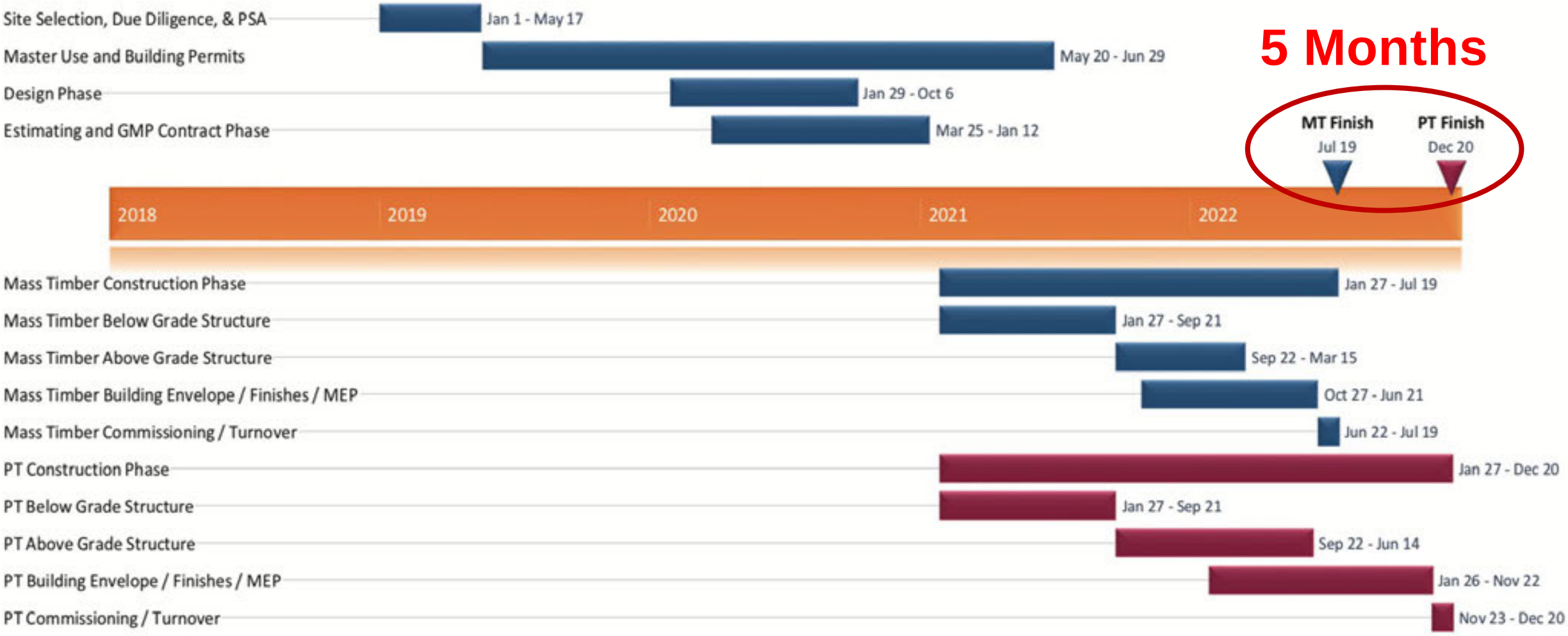


Image: Swinerton

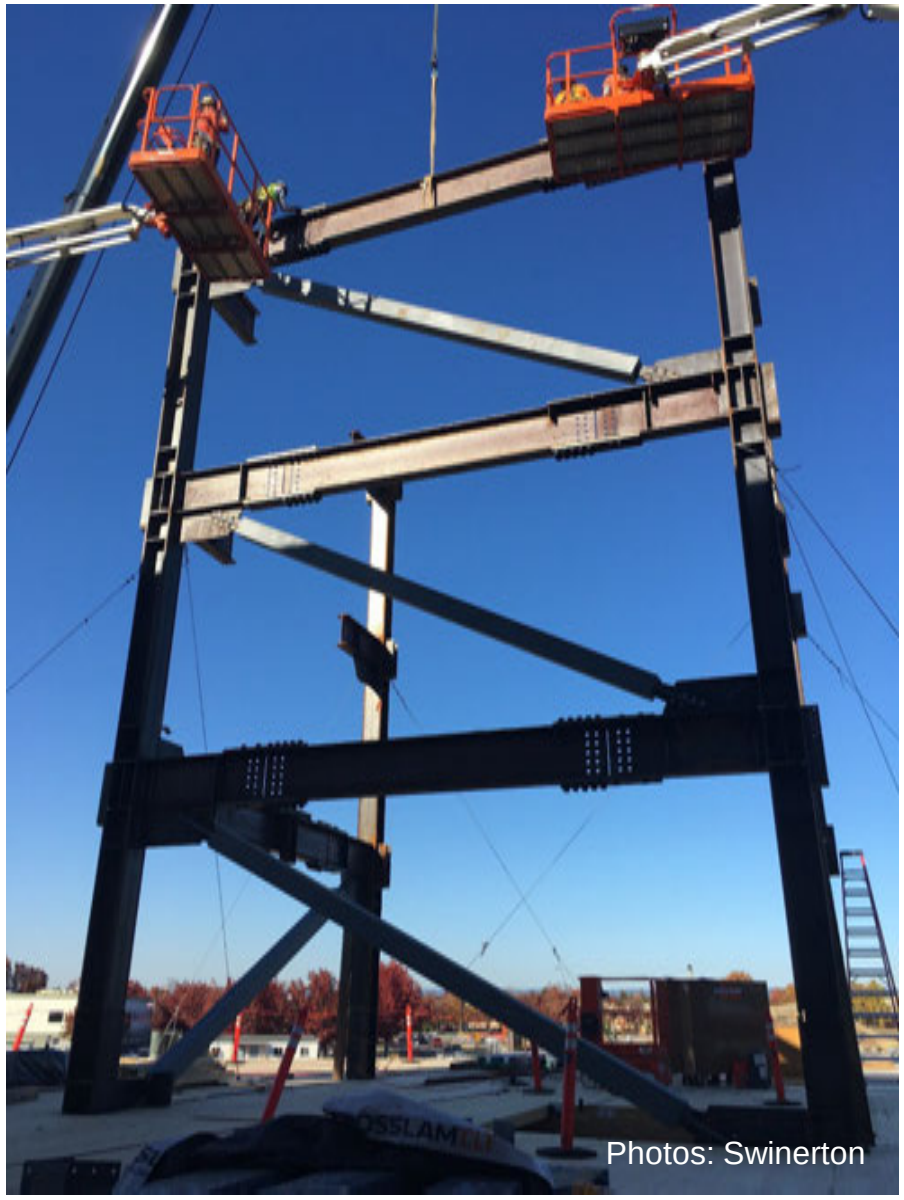
Photo: WoodWorks

Overall Project Schedule Analysis: 12 Story Type IV-B



Source: Swinerton

Schedule Impacts: Hybrid Structures



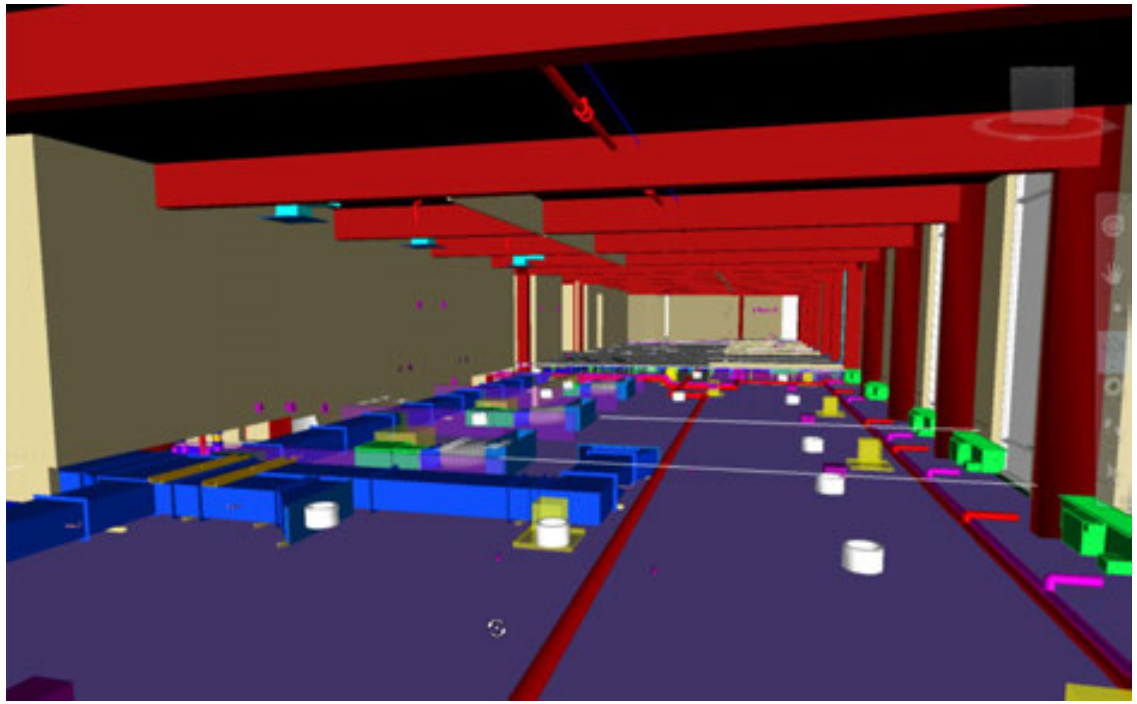
Photos: Swinerton

Schedule Impact on Cost | Value of Time

A large-scale MT project can be up to 2% higher in direct costs, but a minimum of 20% lower in project overhead costs. The net result is cost-neutrality and higher value.

Source: Swinerton
Photo: Alex Schreyer

Embracing BIM for Fabrication



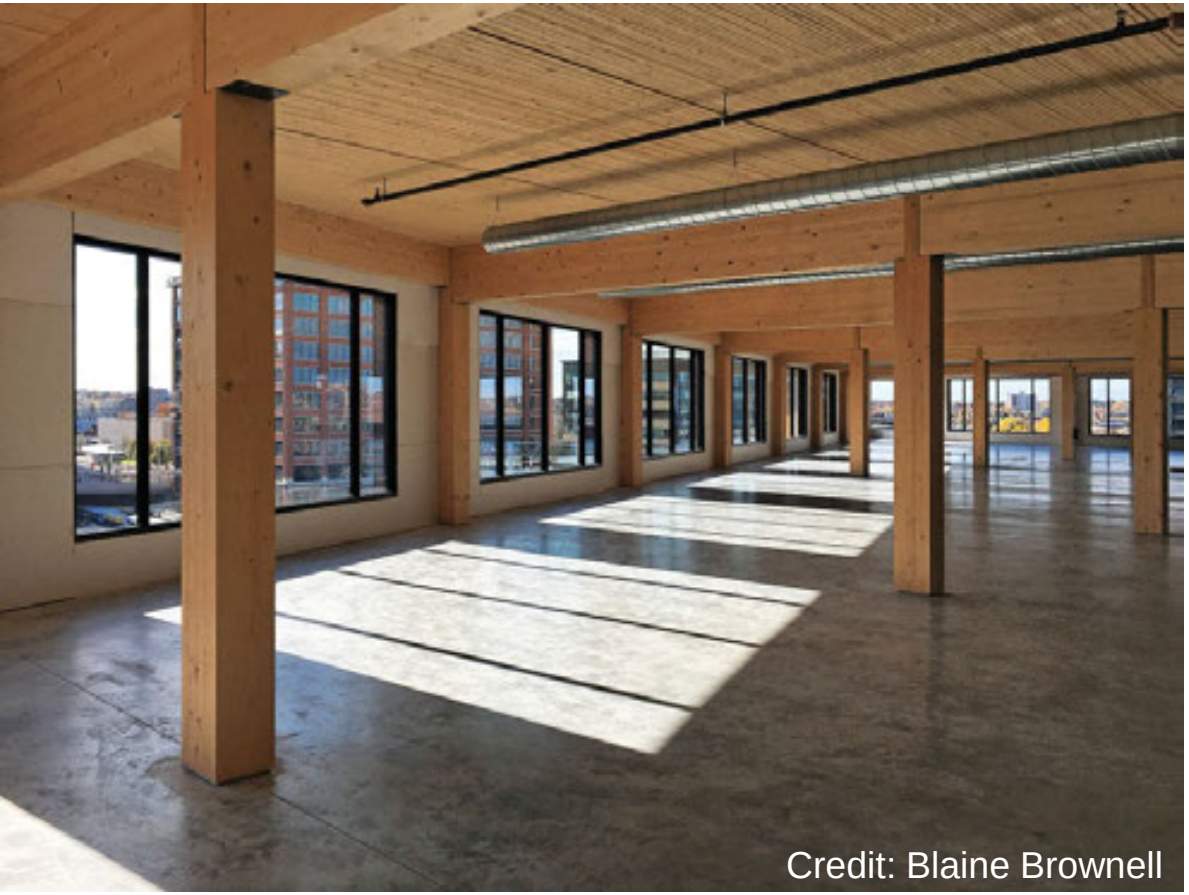
Photos: Swinerton

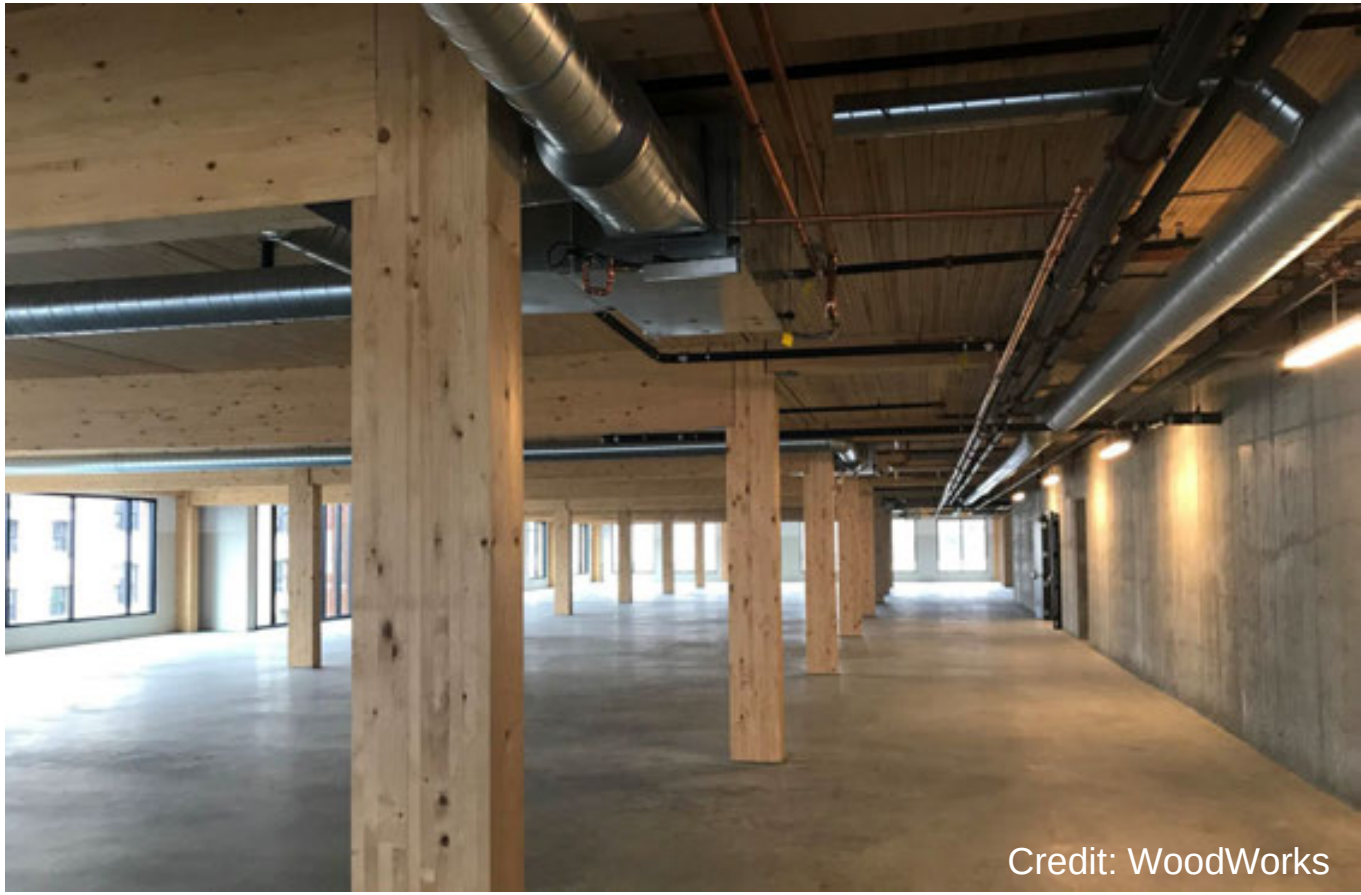
MEP Layout & Integration

MEP Layout & Integration

Smaller grid bays at central core (more head height)

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


Credit: Blaine Brownell


Credit: WoodWorks

MEP Layout & Integration

Dropped below MT framing

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

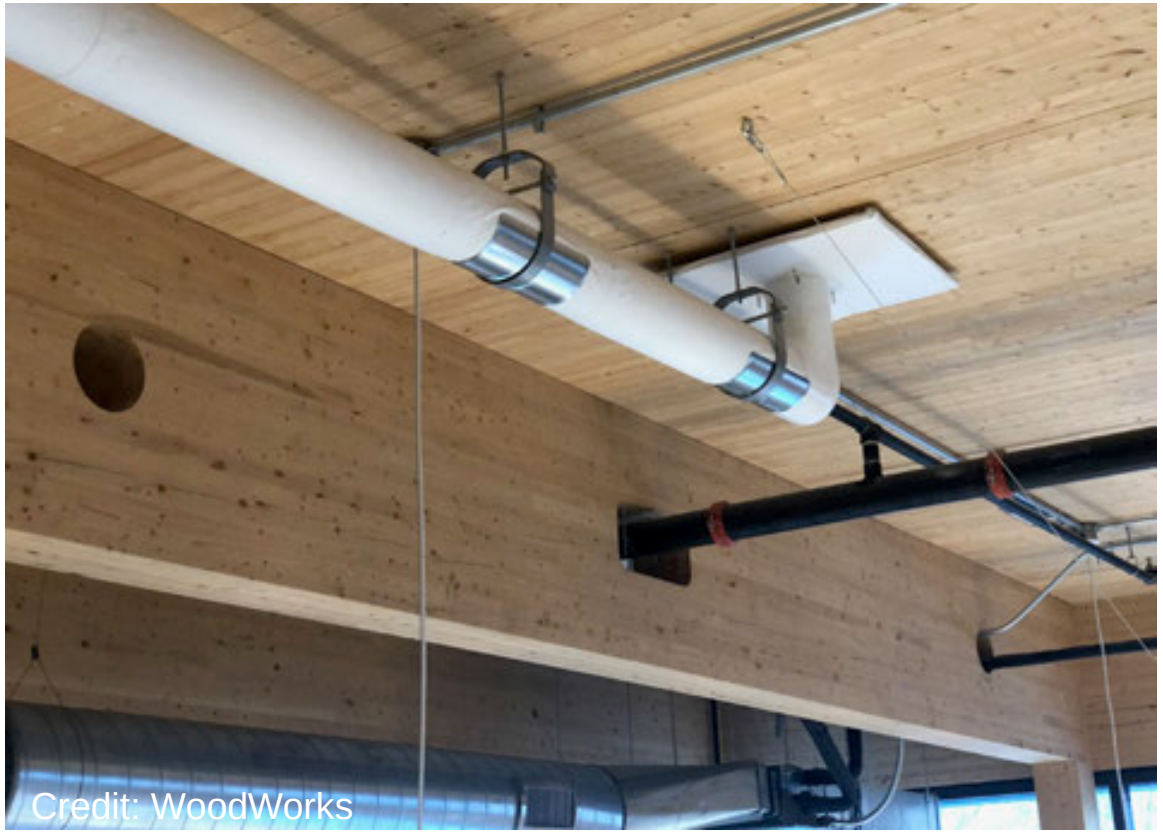

Credit: Alex Schreyer


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

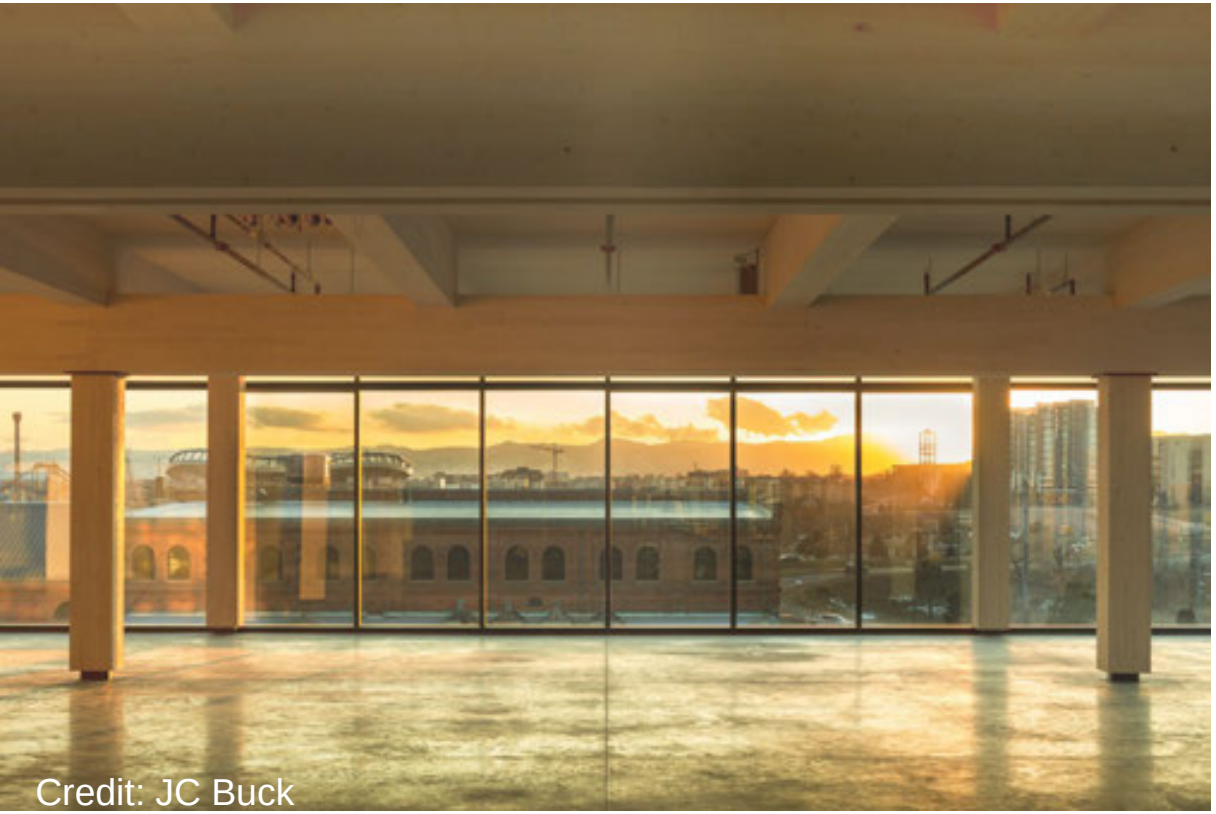

Credit: WoodWorks


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

MATERIAL DELIVERY

Photo: Swinerton

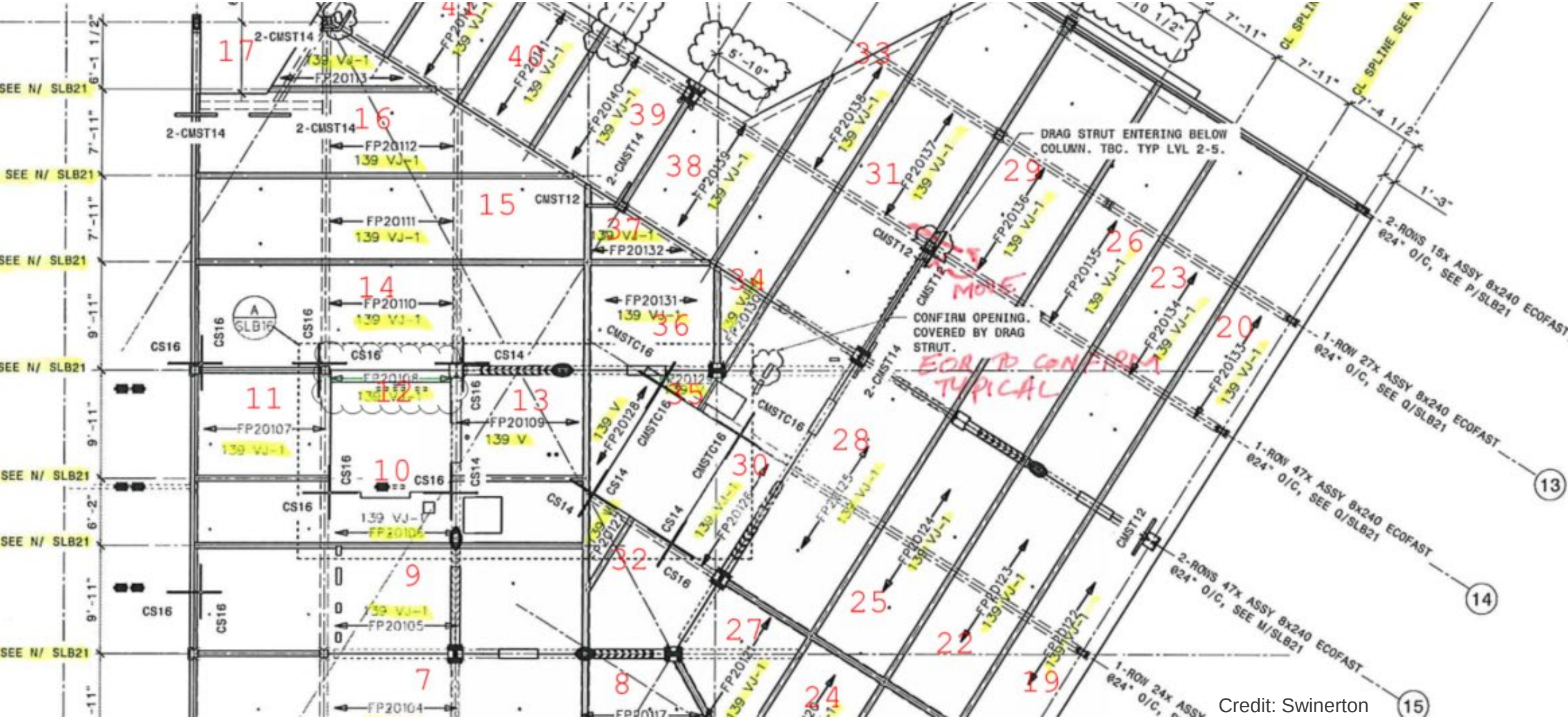
Photo: Swinerton

STAGING

QA/QC

Photo: Swinerton

Sequencing



Credit: Swinerton

PICK PLAN

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

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

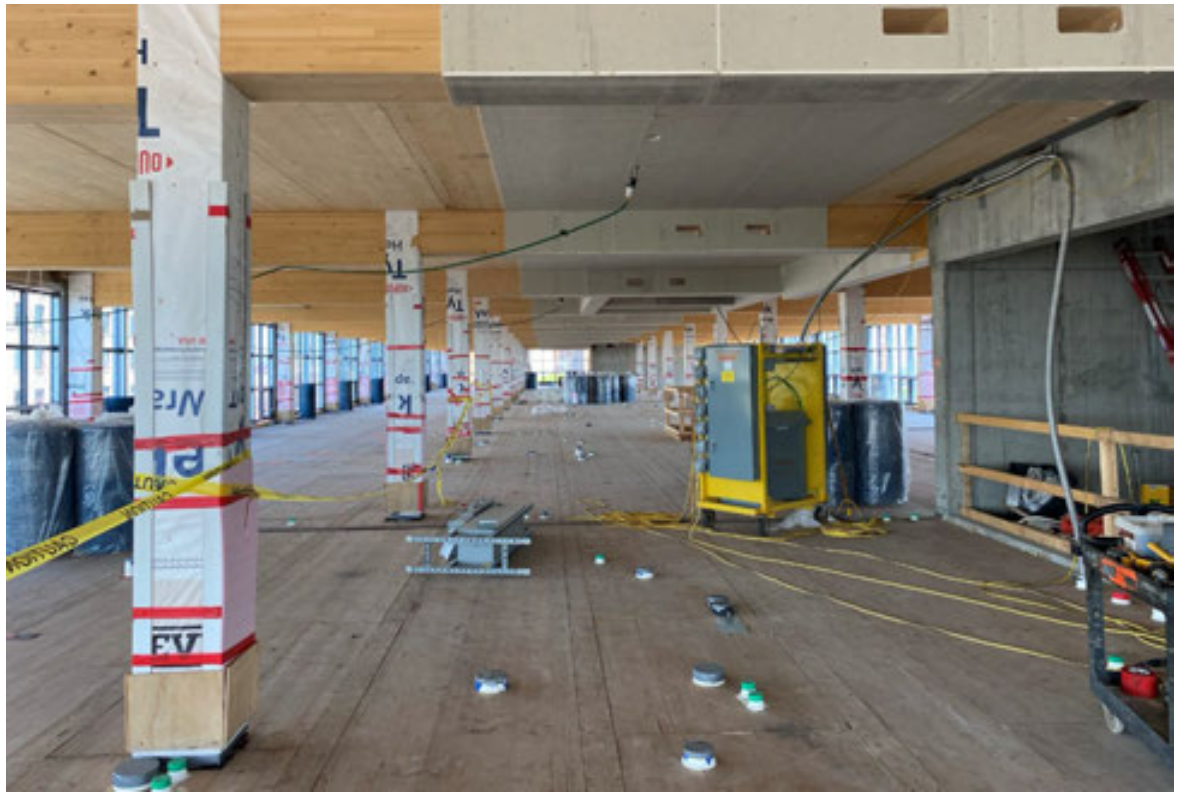
Photo: Swinerton

Material Environmental Exposure and Moisture Management

Enroute
Onsite
Post-Install
Other Material

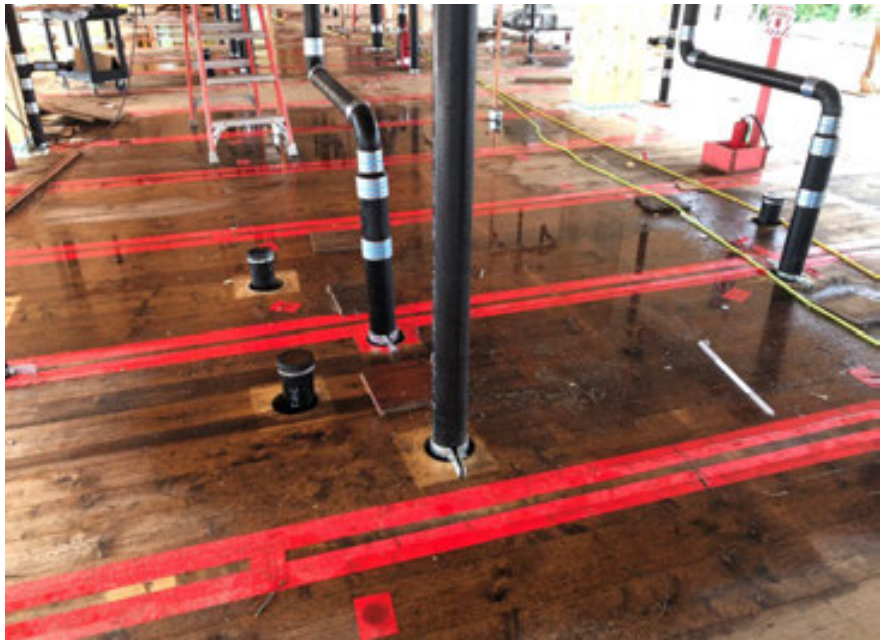
Photo: Alex Schreyer

Enroute Exposure

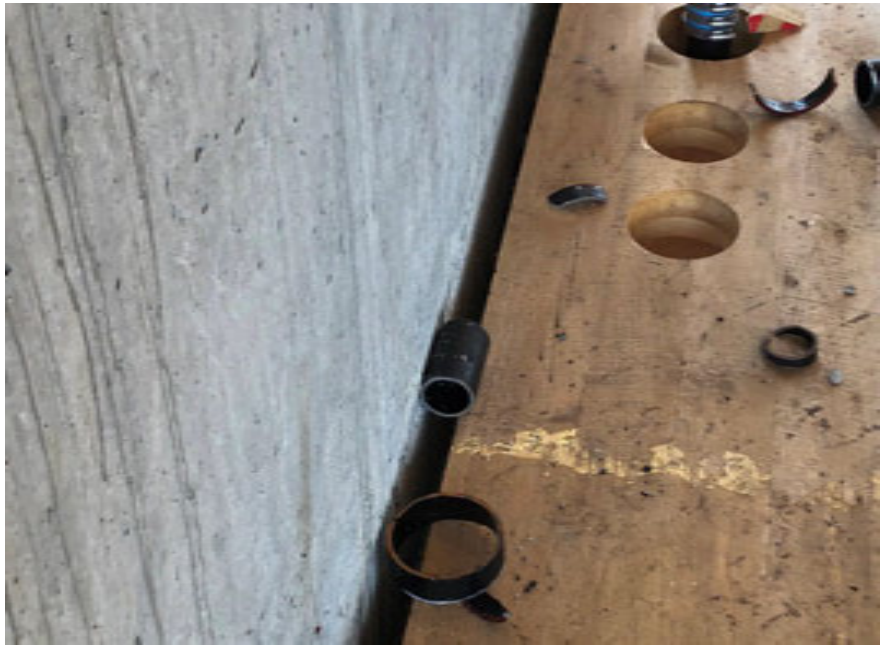


On Site Considerations

On Site Considerations



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

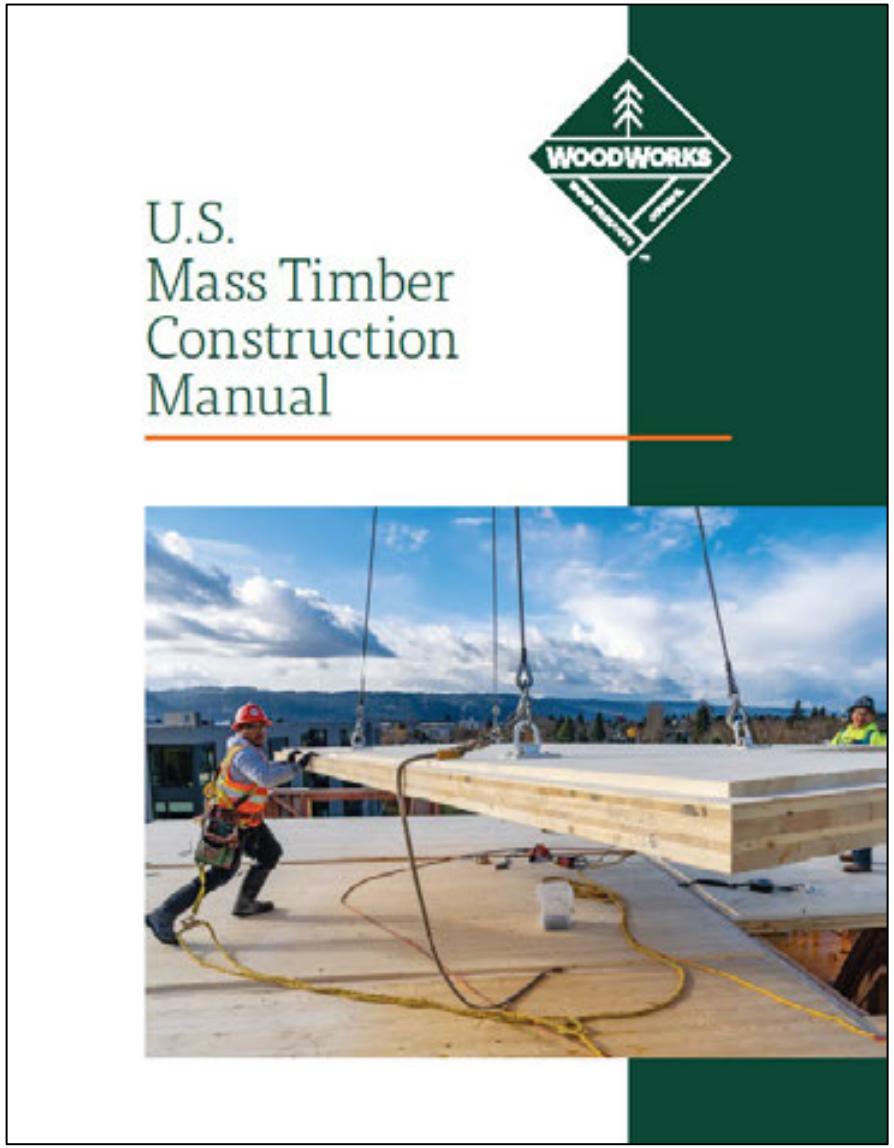
COMMUNITY COLLEGE AND UNIVERSITY CM PROGRAMS

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

Questions? Ask us anything.

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