

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

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WoodWorks
December 2, 2022



John W. Olver Design Building at UMass Amherst, Leers Weinzapfel Associates, Equilibrium Consulting, photo Alexander Schreyer



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



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

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)

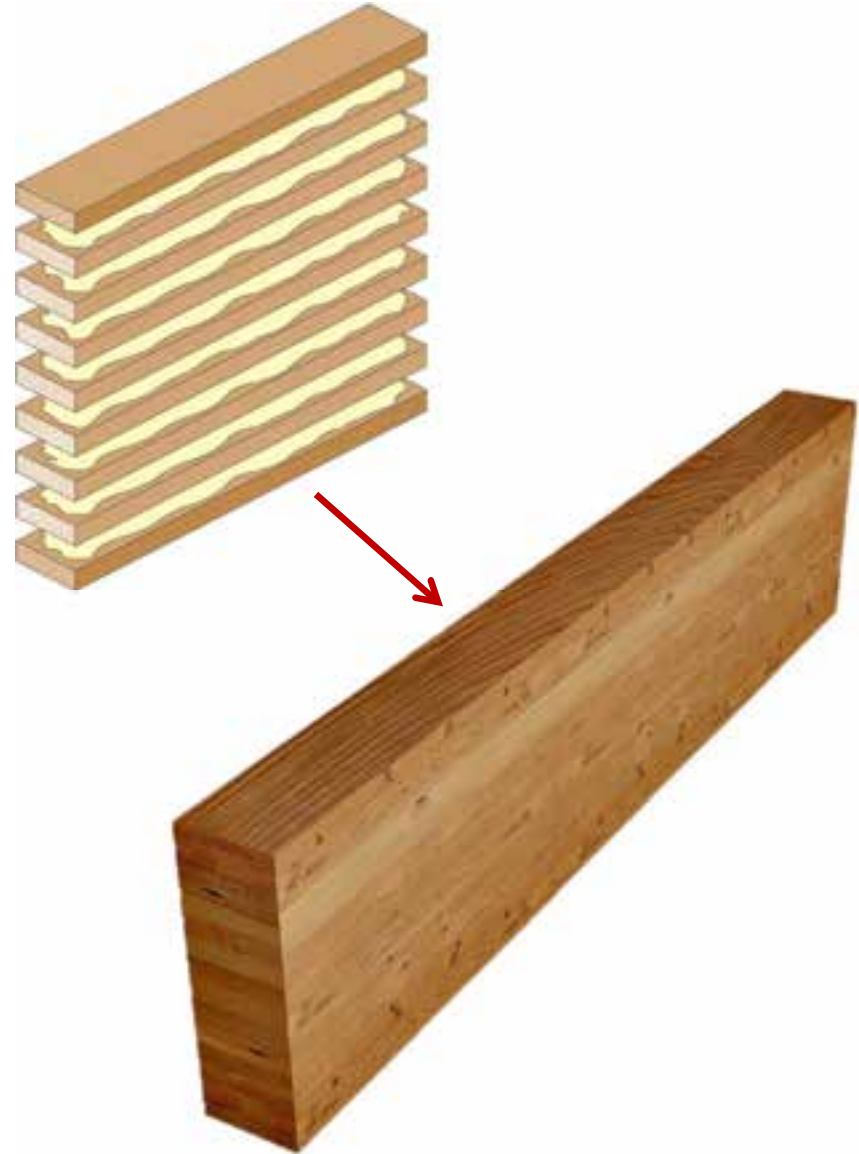


Photo: Alex Schreyer

Glue Laminated Timber (GLT)



Photo: Manasc Isaac Architects/Fast + Epp

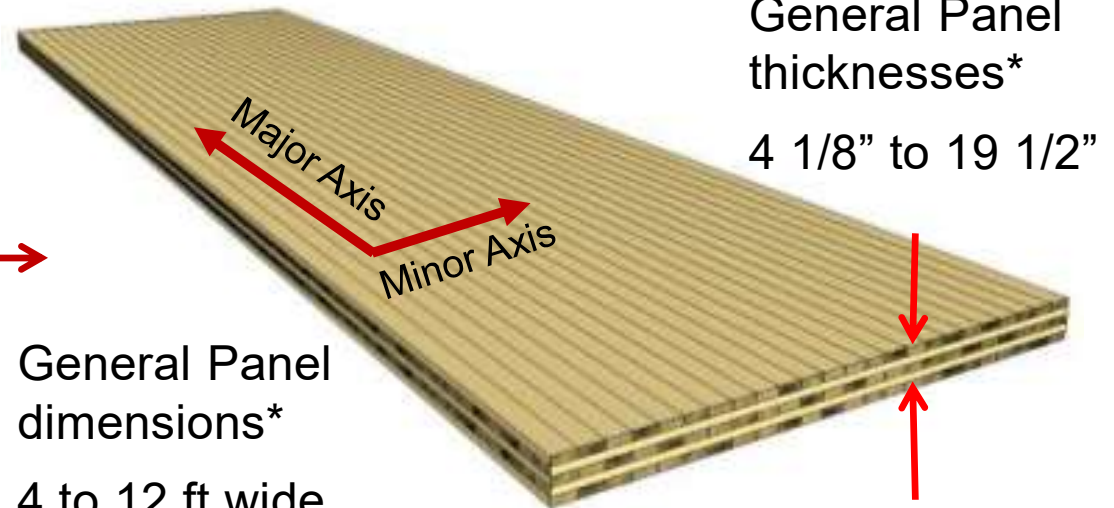
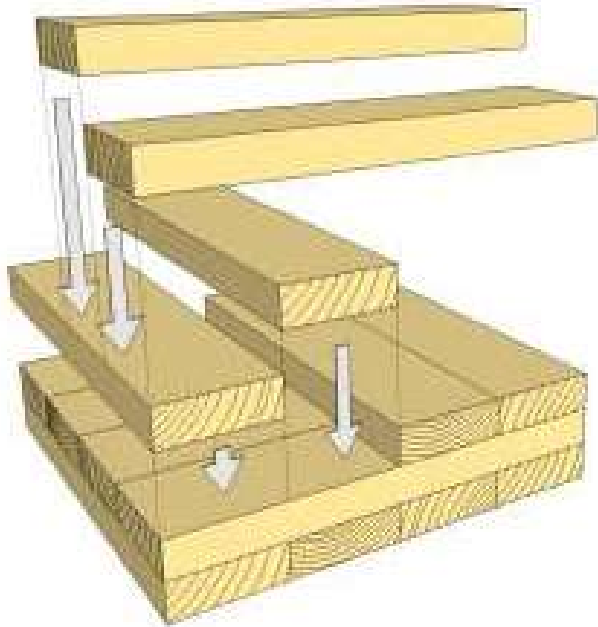


Cross-Laminated Timber (CLT)



Cross-Laminated Timber (CLT)

With solid sawn laminations



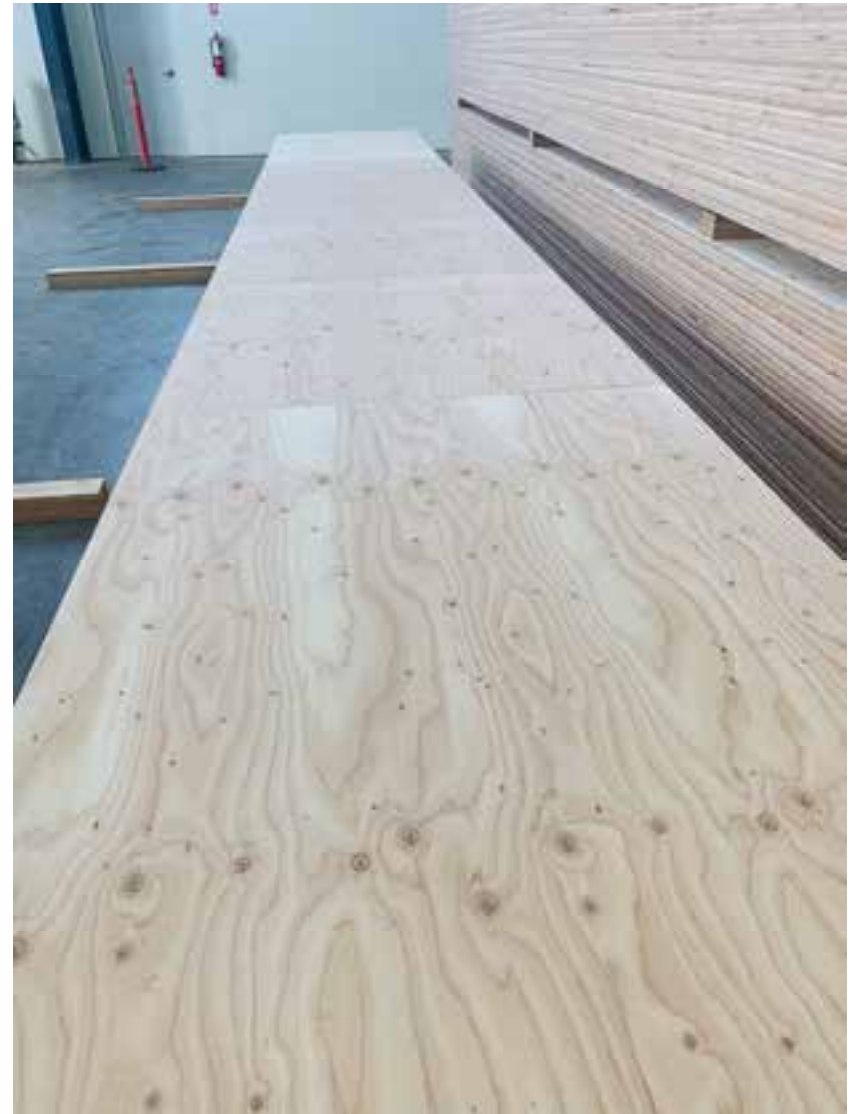
General Panel
thicknesses*
4 1/8" to 19 1/2"

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)



Photo: StructureCraft

Nail-Laminated Timber (NLT)



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 | HONEYCOMB



Photo: John Klein

STRUCTURAL SOLUTIONS | HYBRID LIGHT-FRAME + MASS TIMBER



Photo: TimberLab

STRUCTURAL SOLUTIONS | HYBRID STEEL + MASS TIMBER

OVERVIEW | CONNECTIONS



Concealed Connectors

Photo Marcus Kauffman



Self Tapping Screws

Photo Simpson Strong Tie

OVERVIEW | CONNECTIONS



Beam to Column

Photo: StructureCraft



Photo: Structurlam

OVERVIEW | CONNECTIONS



Column to Foundation

Photo: Alex Schreyer

OVERVIEW | CONNECTIONS



Panel to Panel & Supports

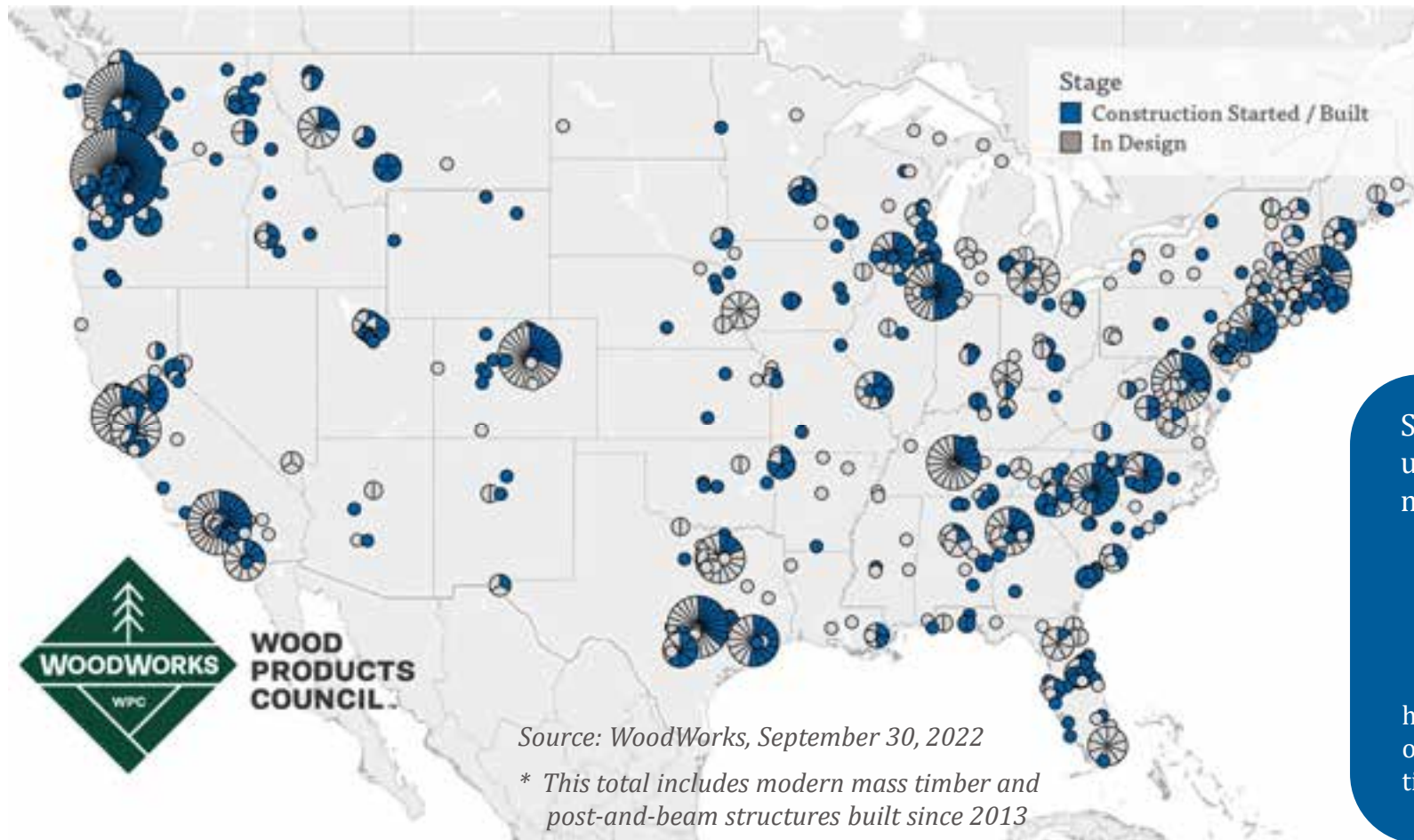
Photo: Charles Judd



Photo: Marcus Kauffman

Current State of Mass Timber Projects

As of September 2022, in the US, **1,571** multi-family, commercial, or institutional projects have been constructed with, or are in design with, mass timber.



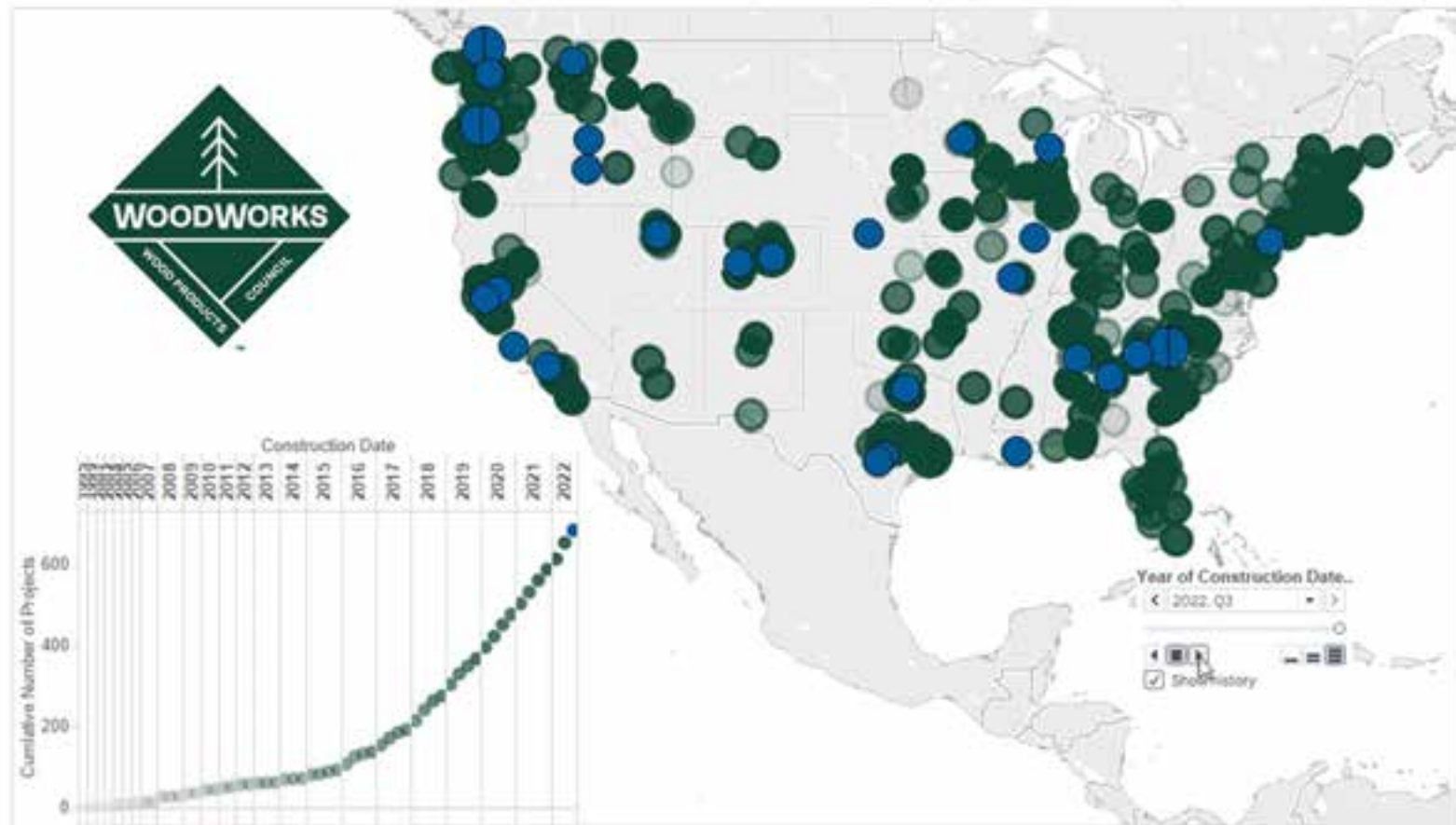
Scan this code or use the url to find the map and more details online.



<https://www.woodworks.org/resources/u-s-mass-timber-projects/>

Current State of Mass Timber Projects

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Photos: Michael Elkan | Naturally Wood | UBC

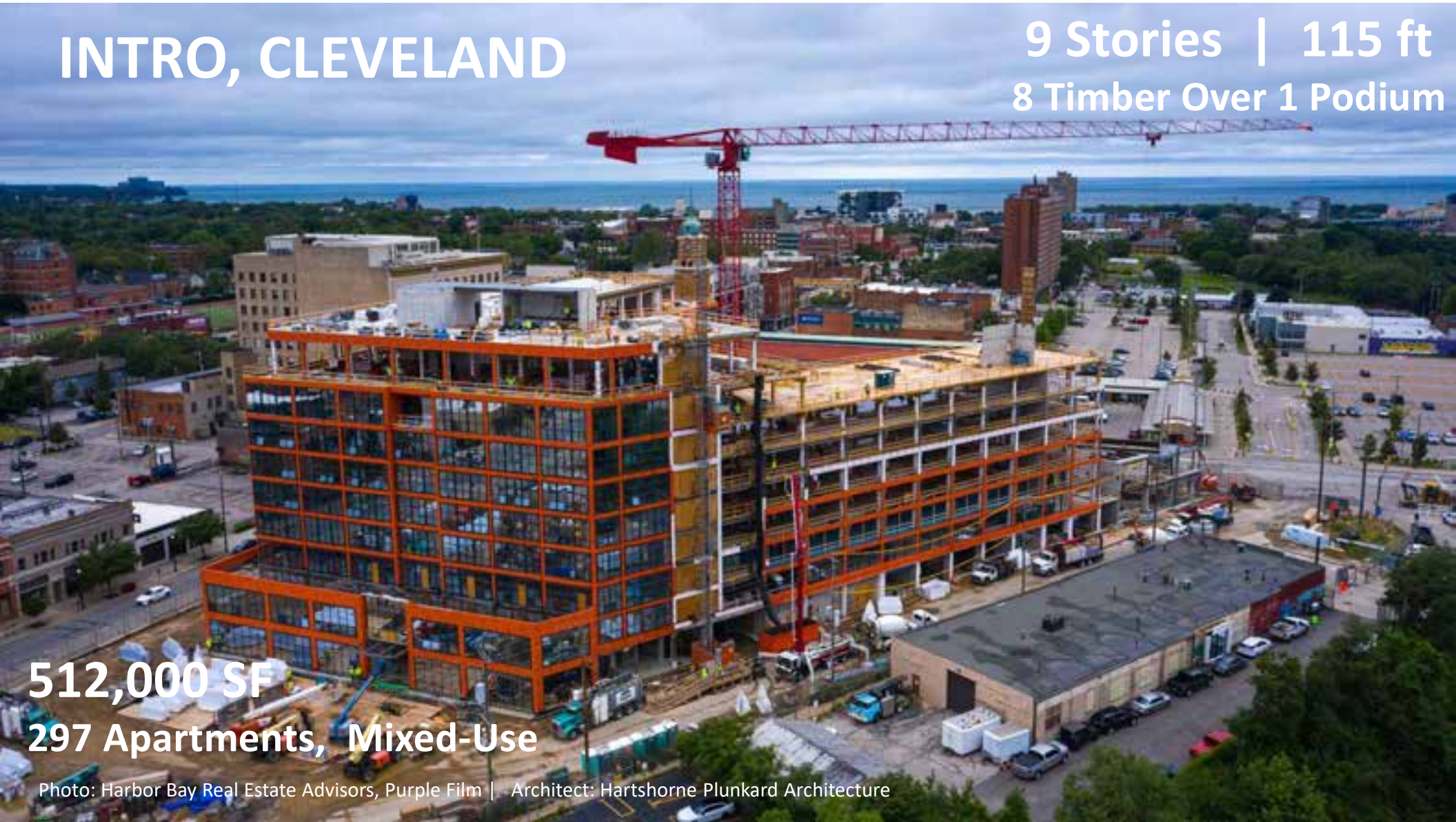
PRECEDENT PROJECTS | BROCK COMMONS

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



25 STORIES

19 TIMBER OVER 6 PODIUM, 284 FT

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

A large, multi-story brick building is under construction. The building has a grid-like facade with many windows. A large construction crane is positioned on top of the building, extending upwards. The sky is clear and blue. In the foreground, there are some construction materials and a street with cars.

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**



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

PRECEDENT PROJECTS | T3 ATLANTA

MASS TIMBER PROJECT CONSIDERATIONS



Photo: Hacker Architects

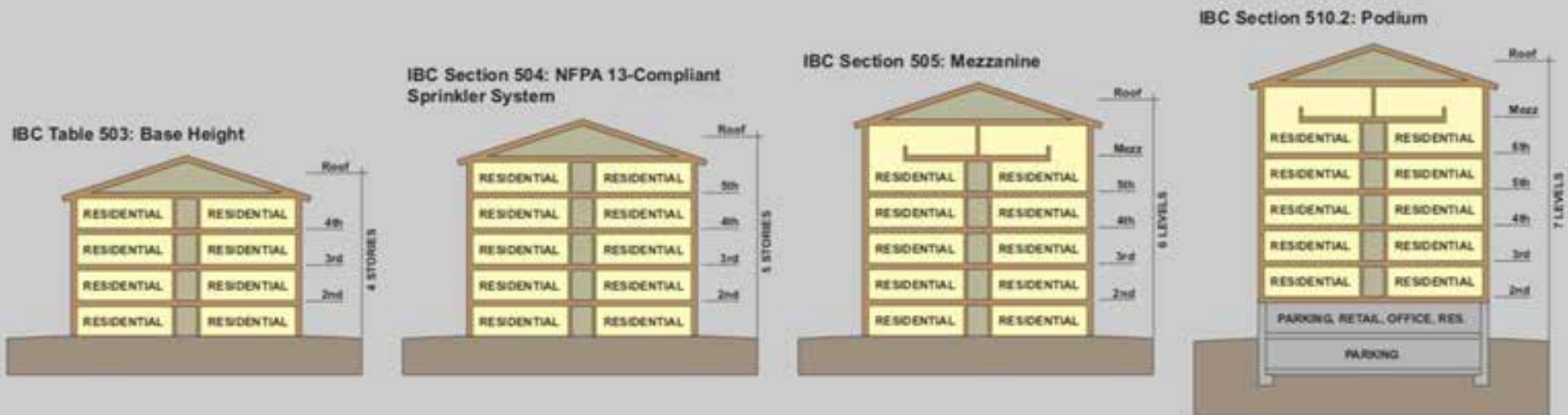
MASS TIMBER IN THE CODE



Photo: Freres Lumber

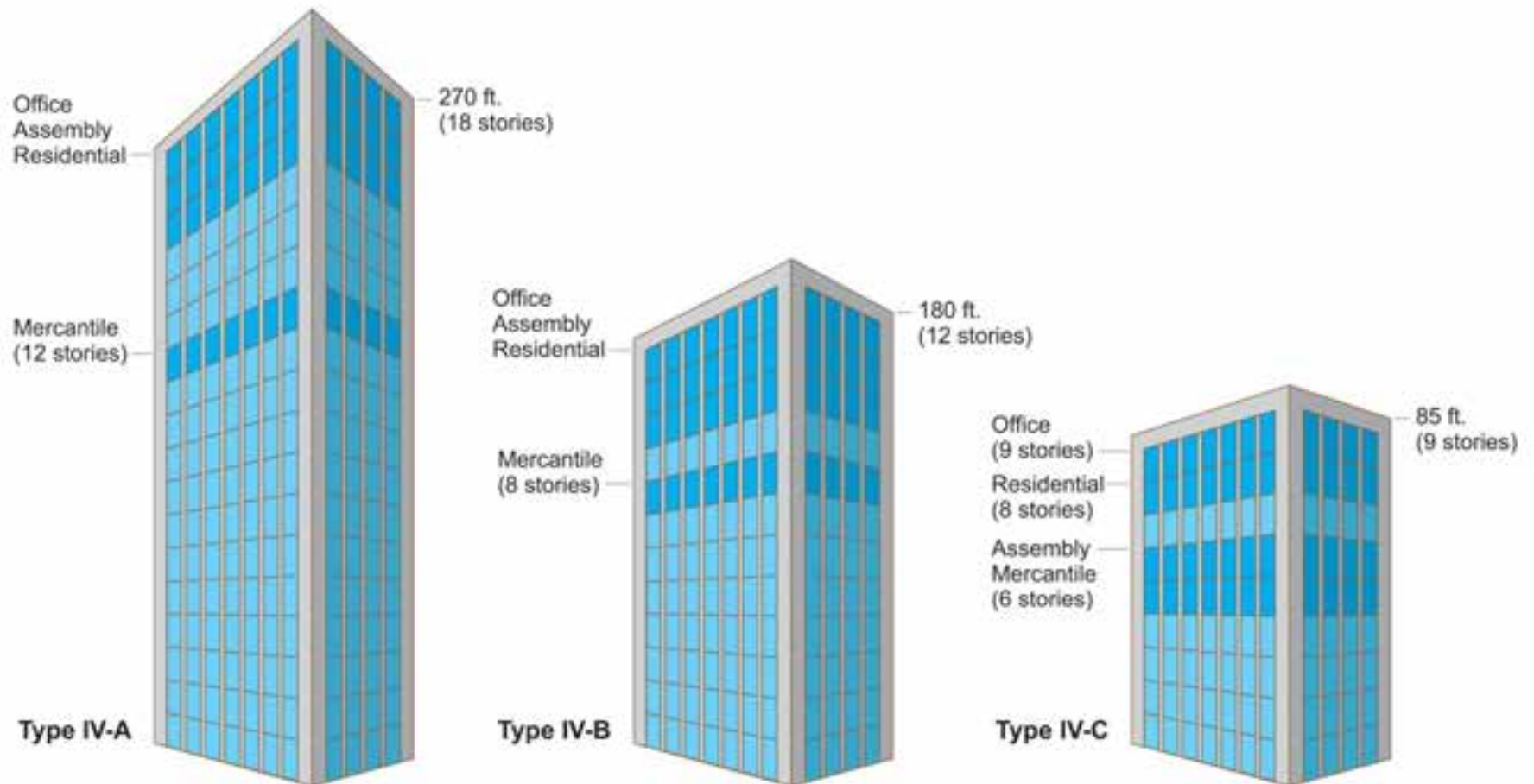
BUILDING CODE APPLICATIONS | CONSTRUCTION TYPE

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



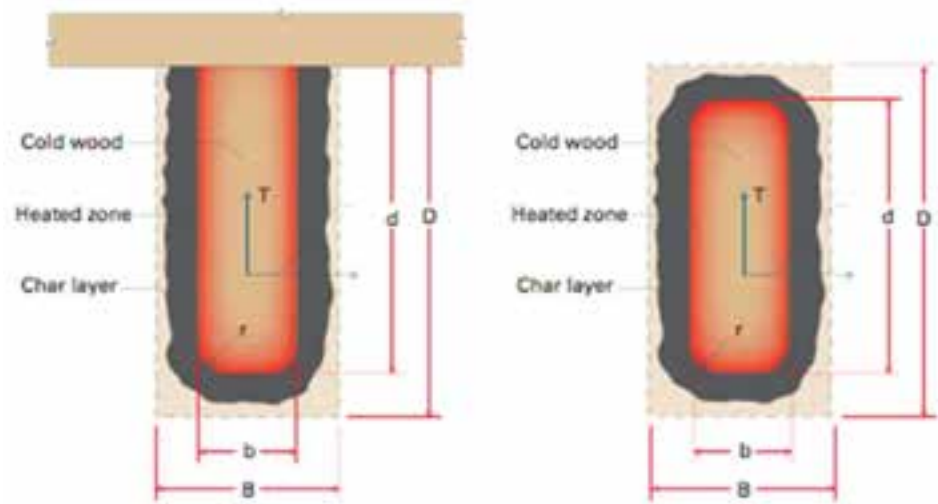
BUILDING CODE APPLICATIONS | CONSTRUCTION TYPE

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



BUILDING CODE APPLICATIONS | FIRE RESISTANCE

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



Source: AWC’s TR 10

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

Source: AWC’s NDS



Credit: David Barber, ARUP



Richard Whitt, pp. 94, 95
 Richard Whitt, pp. 94, 95
 Richard Whitt, pp. 94, 95

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

Changes to the 2002 International Building Code (IBC) have created opportunities for smart buildings that are much larger and taller than previously allowed in past versions of the code. Occupant safety and the need to secure the performance of a particular task is a fundamental consideration as the changes were formulated and approved. The result is three new construction types—Type I(A), II(B) and III(C)—which are based on the proposed Heavy-Timber construction type (proposed Type IV) but with additional fire protection requirements.

State of the main body is approximately that a building will have the required level of passive fire protection regardless of structural materials, is through finding the maximum ratings (R_{int}) of its elements and assemblies. The IBC authors use a 90 min as the period of time a building element, component or assembly maintains its ability to contain a fire, continuous in place from its source without failure, as listed or determined by the tests at the standards listed on their respective or Section 703.

Files in the new construction type are similar to those required for Type I construction, which is generally steel and concrete (See Table 1). They are found in IRC, Section 601, which includes TBC requirements for all construction types and building elements, however, other code



TABLE 5. FRR Requirements (Among the Top Mass Transit Commissioner Types and Ranking Type)

Building Element	1-A Unfinished steel weight and area**	1-B Steel 1/2" x 1/2" 1/2" x 1/2" x 1/2" 1/2" x 1/2" x 1/2"	1-C Steel 1/2" x 1/2" 1/2" x 1/2" x 1/2" 1/2" x 1/2" x 1/2"	1-D Steel 1/2" x 1/2" 1/2" x 1/2" x 1/2" 1/2" x 1/2" x 1/2"	1-E Steel 1/2" x 1/2" 1/2" x 1/2" x 1/2" 1/2" x 1/2" x 1/2"
Primary Frame	0	0	0	0	0
Secondary Steeling Walls	0	0	0	0	0
Interior Steeling Walls	0	0	0	0	0
Roof Construction	0	0	0	0	0
Primary Frame at Wall	0	0	0	0	0
Steel Connections	0	0	0	0	0

According to Phillips (1999), the following are the main reasons for the failure of the

출판사: 중앙교육문화사 | 주소: 서울특별시 중구 남대문로 2가 11-1 | 전화: 02-313-1111 | 팩스: 02-313-1112

Experiments 1 and 2 were performed for 1000 subjects.

¹² <http://www.fishbase.org> (accessed 10 July 2008).

Informationen zum Buch ist in <http://www.schubert-studien.at> oder unter der Telefonnummer 0664 259 2590 zu erreichen. Weitere Informationen zum Verlag sind unter <http://www.schubert-studien.at> zu finden.

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


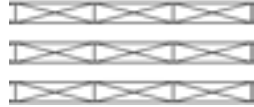



Concept Plan
Hillsboro Community Center at 53rd Ave.
May 11, 2011

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.

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:



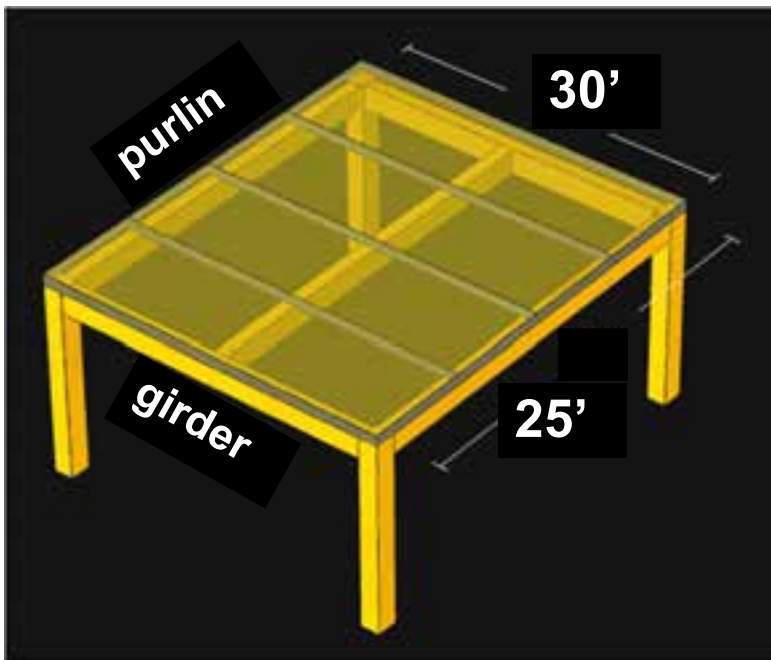
Location of Event Space	3 rd Floor	1 st Floor
Construction Type	III-A	III-B
Assembly Group	A-3	A-3
Fire Resistive Rating	1-Hr	0-Hr
Connections	Concealed	Exposed
CLT Panel Thickness	5-Ply	3-Ply
<u>Superstructure Cost/SF</u>	<u>\$65/SF</u>	<u>\$53/SF</u>

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

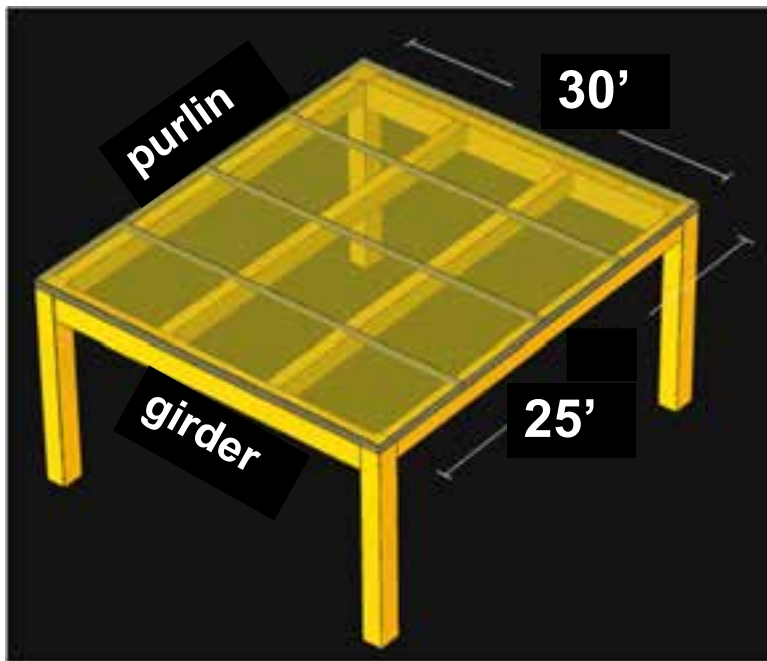
Glulam volume = 118 CF (22% of MT)

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)

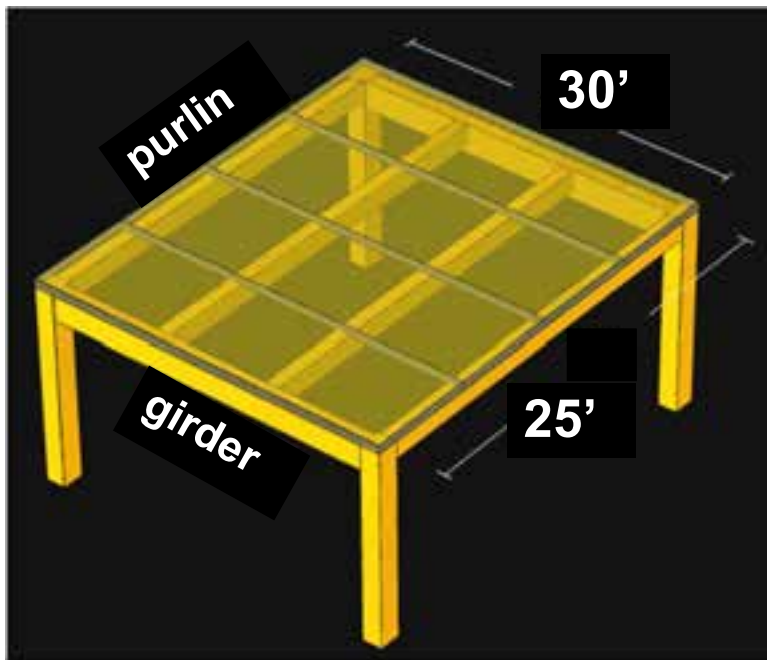
CLT volume = 430 CF (78% of MT)

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)

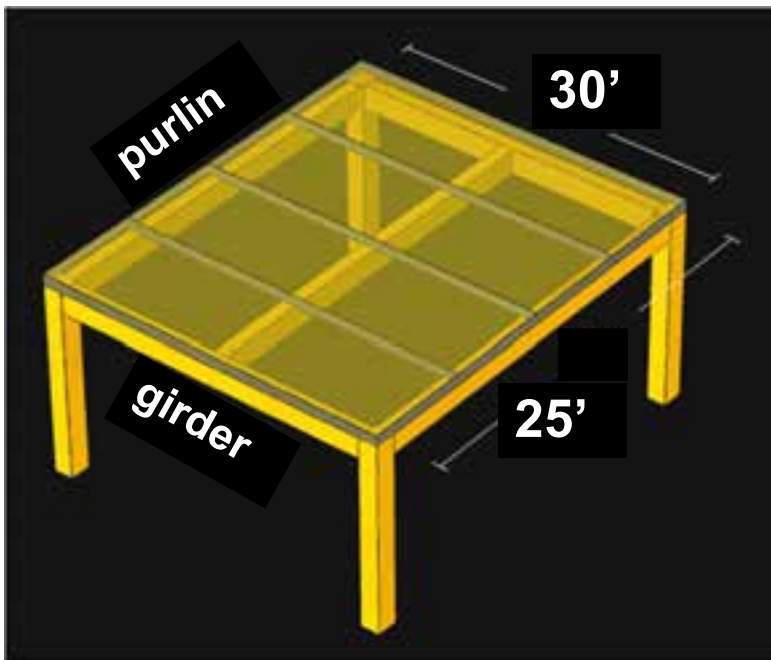
Glulam volume = 120 CF (32% of MT)

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

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Expert Tips

Key Design Considerations for Mass Timber Projects

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

Share 

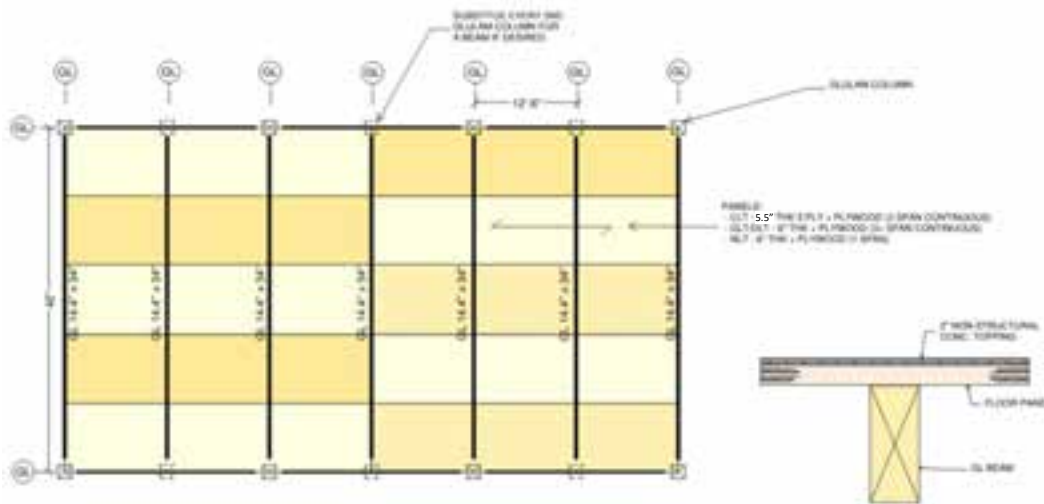
Selecting a Construction Type

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

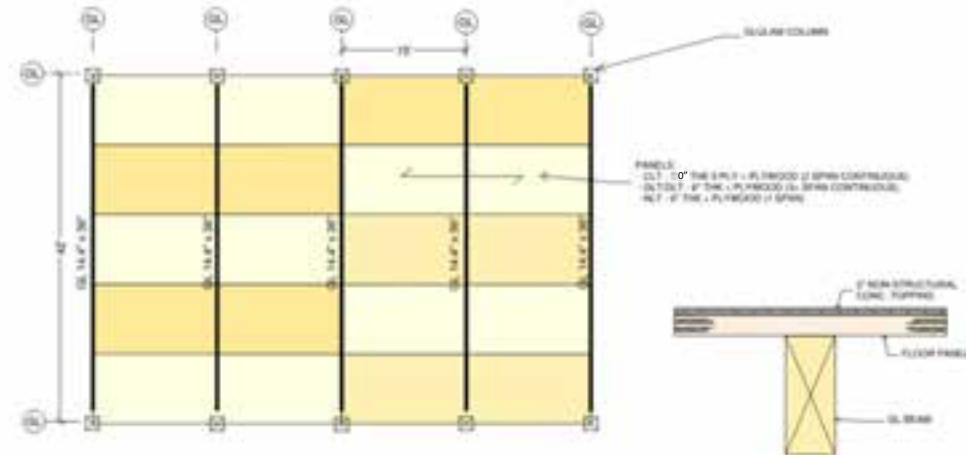
Cost: Structural System & Grid



Baseline

12'-6" Glulam Spacing

5.5" CLT



\$ +5%

15' Glulam Spacing

7" CLT

Source: Seattle Mass Timber Tower Book

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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

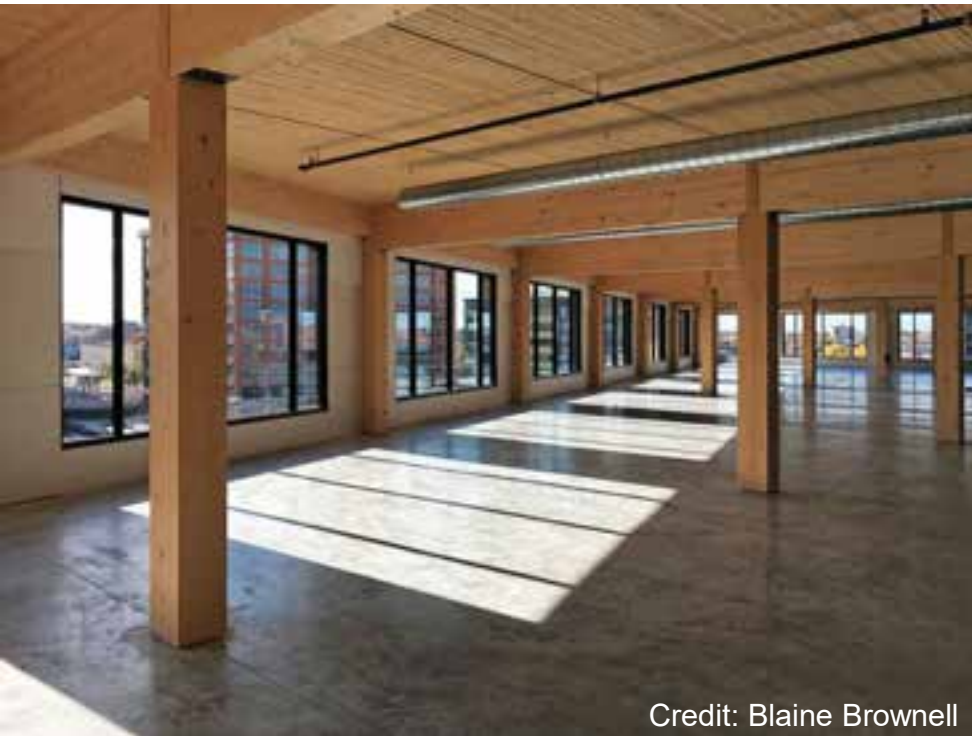
MEP Layout & Integration



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

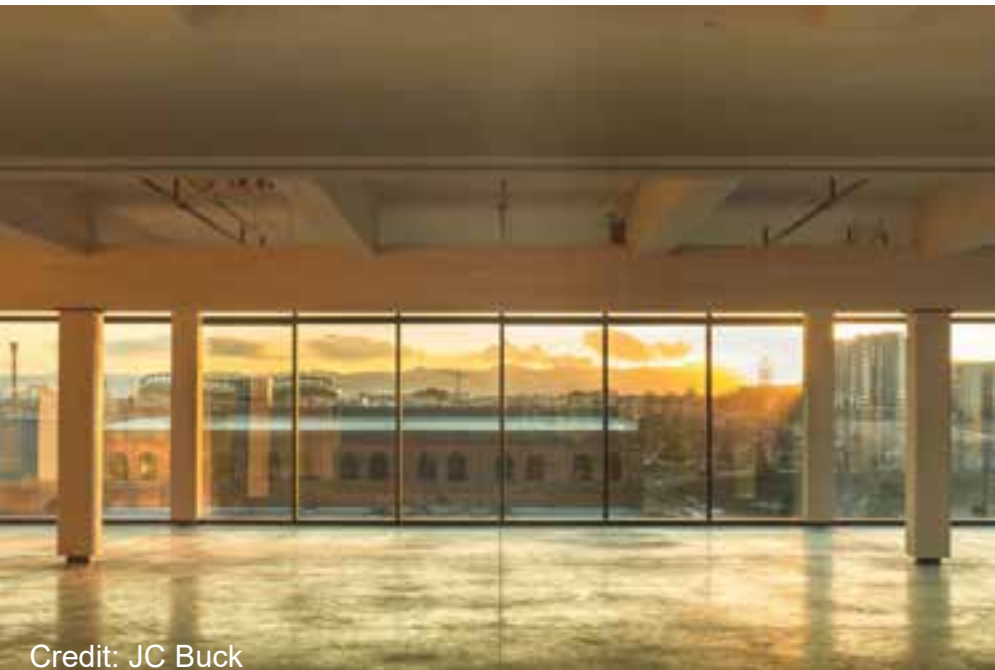
- Requires more coordination (penetrations)
- Bigger impact on structural capacity of penetrated members
- Minimal impact on head height



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

Value Analysis

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



Value Analysis

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





Photo: Mark Bitterman

Perimeter Glazing



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

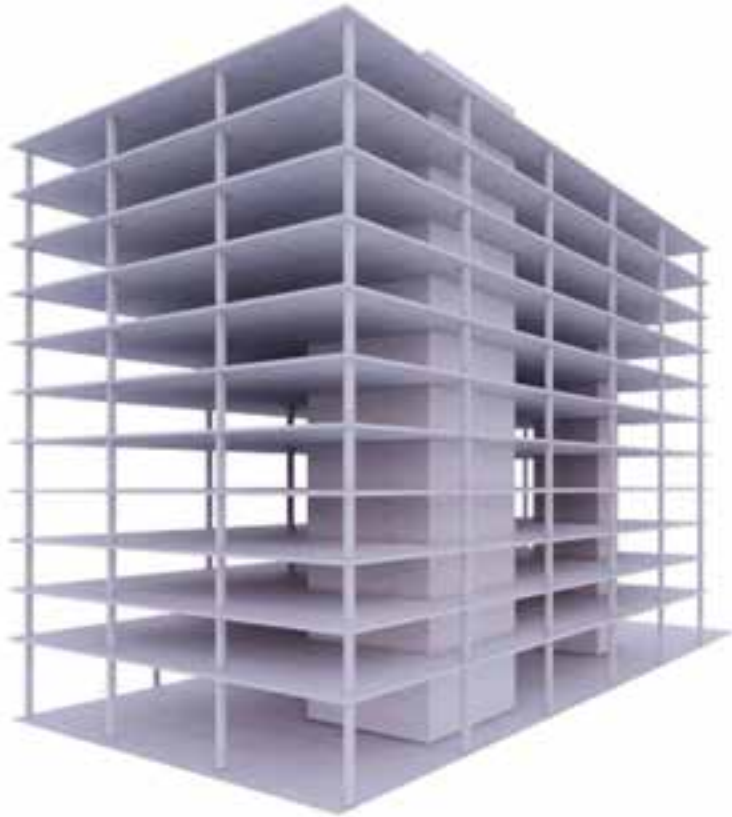
Environmental Exposure

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

Workforce Training

- Strategic Partnerships
- Training/Education
- Resources

Holistic Costing



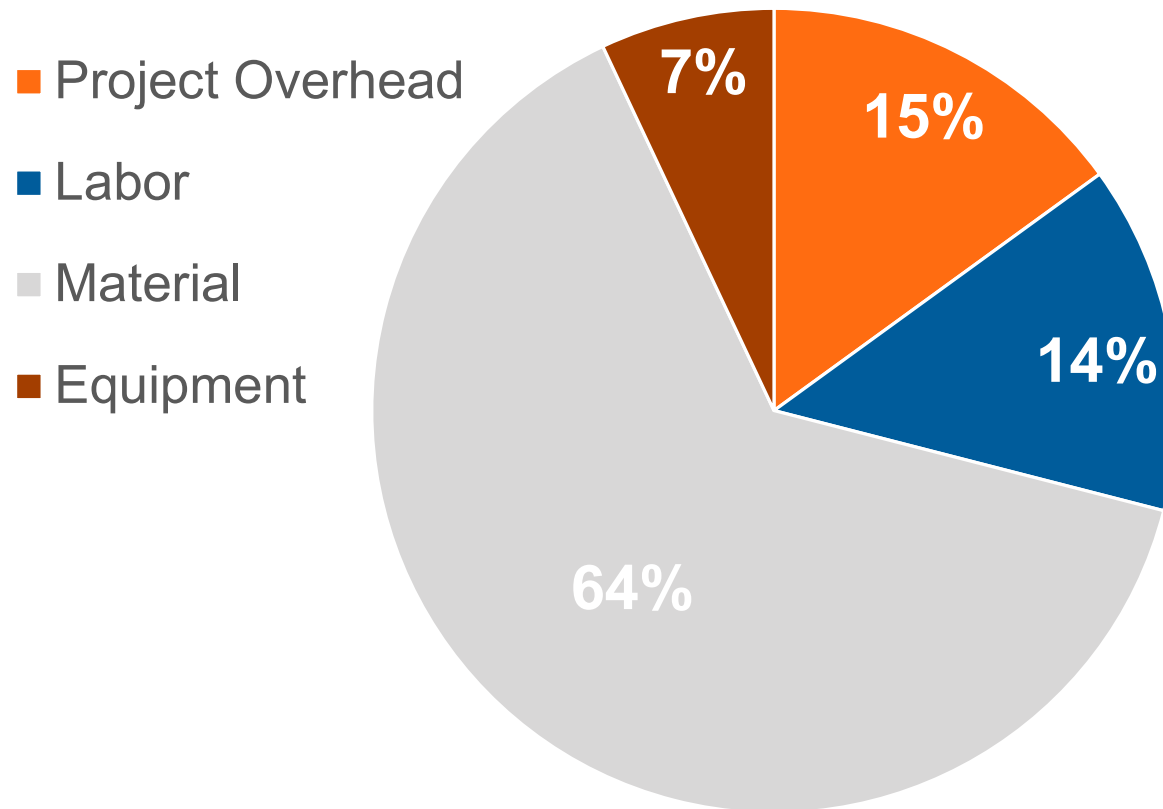
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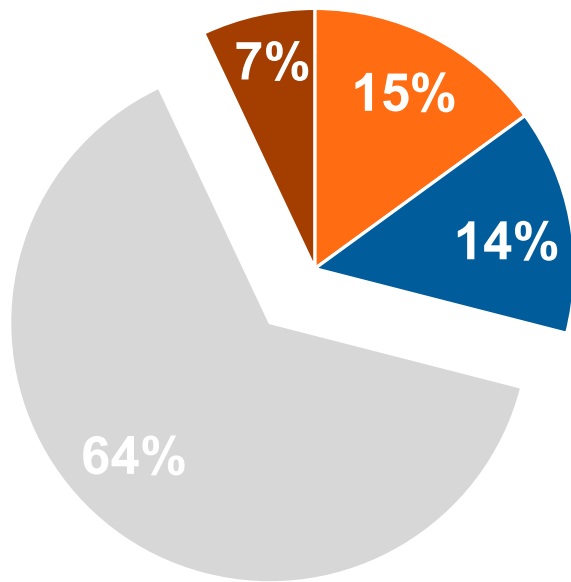
Image: GBD Architects

Anatomy of a Turnkey Mass Timber Package



Source: Swinerton

Material (Direct Cost)



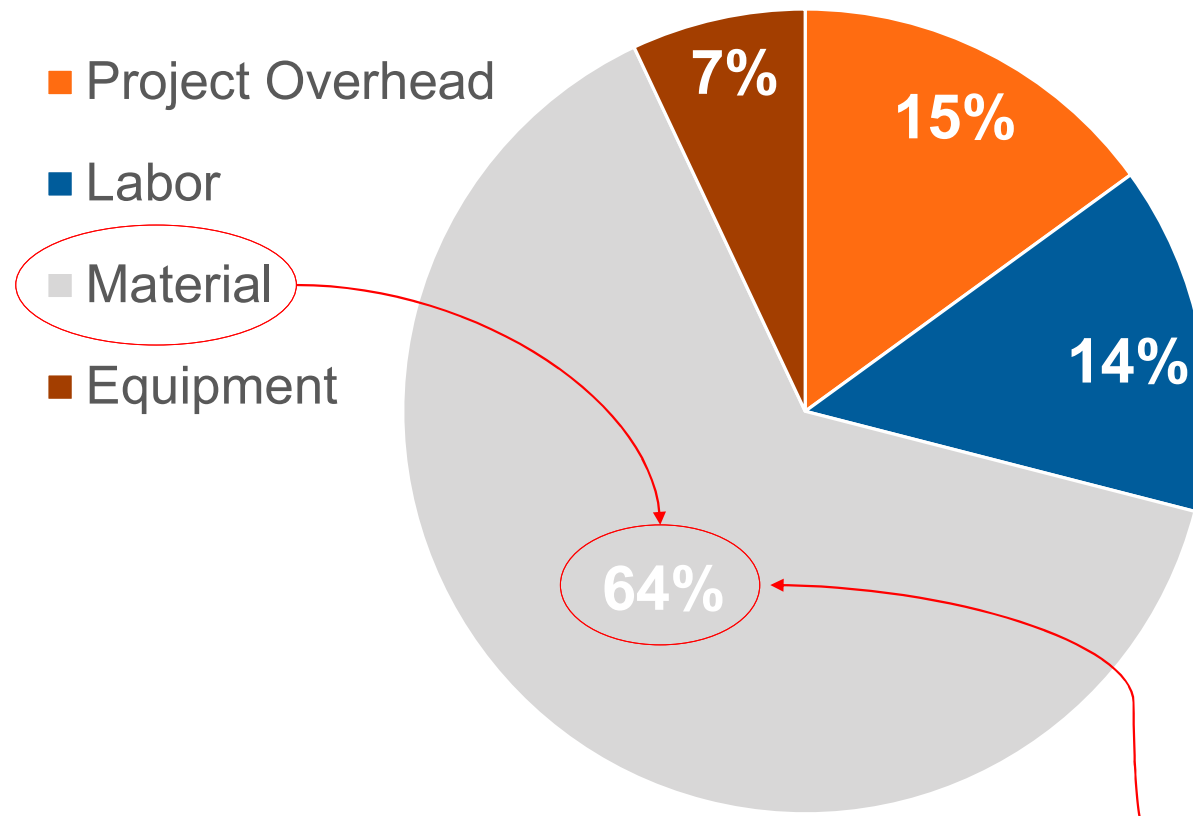
Turnkey Mass Timber Package



or

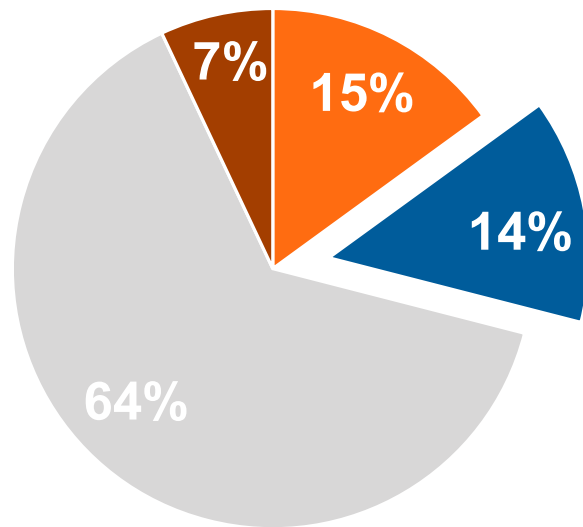


Mass Timber Package Costs



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

Labor (Direct Cost)

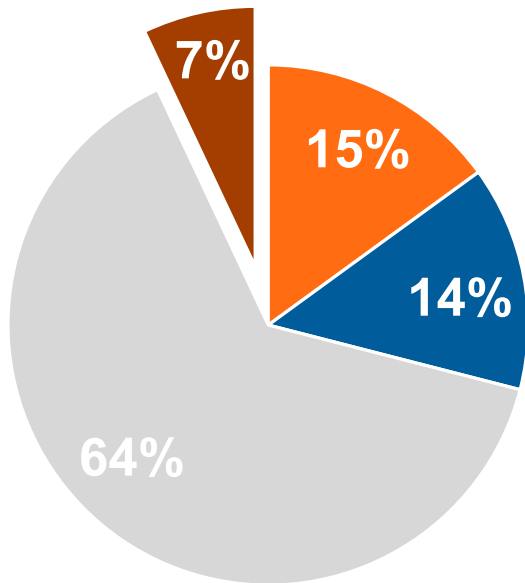


Turnkey Mass Timber Package



Photo: Swinerton

Equipment (Direct Cost)



Turnkey Mass Timber Package

Source: Swinerton

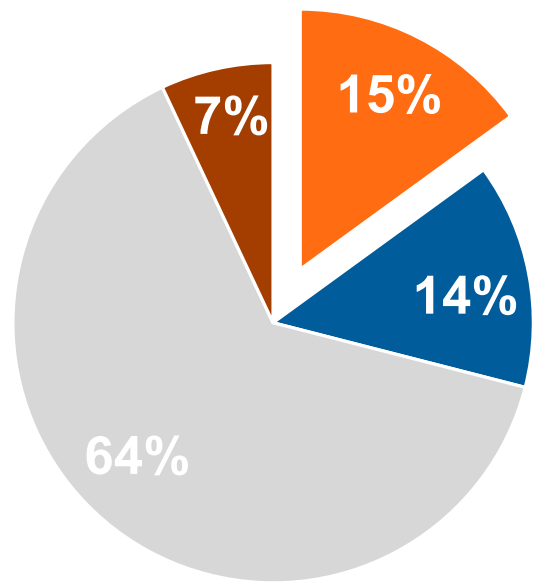


Photo: Swinerton

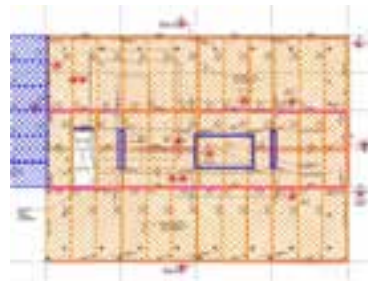


Photo: Alex Schreyer

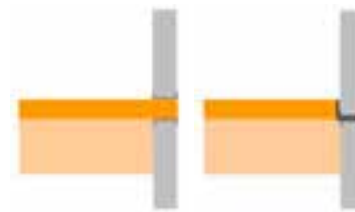
Project Overhead



Turnkey Mass Timber Package



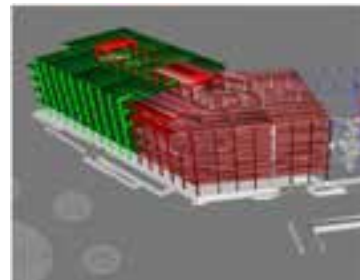
Cost Analysis



Design Refinement



System Integration



VD&C



Detail Optimization



Logistics Planning

Photos: 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



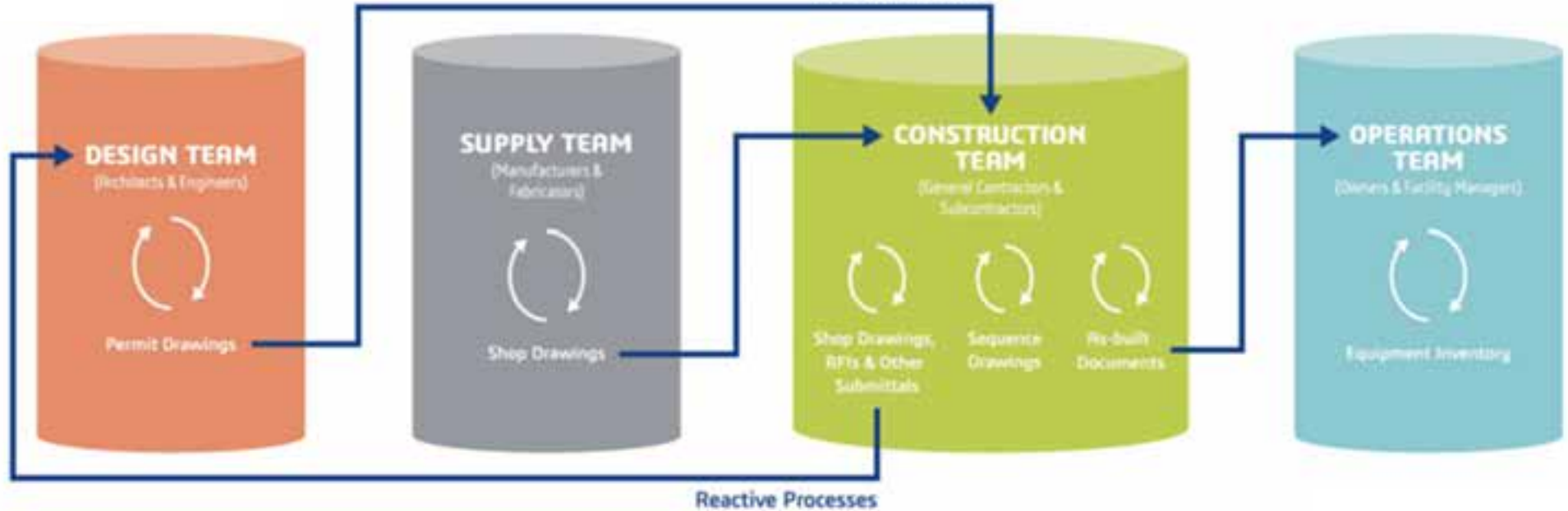
Credit: Hacker Architects

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		
<ul style="list-style-type: none"> + Hiring experience + Single point of responsibility 	<ul style="list-style-type: none"> + Hiring experience + Single point of responsibility + Financial security of strong GC/CM 	<ul style="list-style-type: none"> + Potential added mark-up
<ul style="list-style-type: none"> – Prequalify capacity of subs – Potential added mark-up 	<ul style="list-style-type: none"> – Lack of familiarity with supply chain – Steep learning curve for coordination 	<ul style="list-style-type: none"> – 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



Procurement Strategy is Key to Success



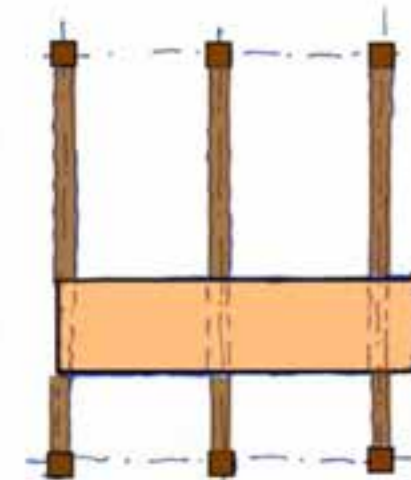
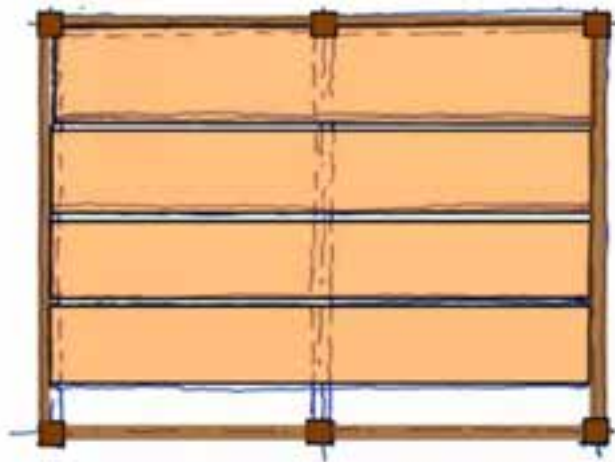
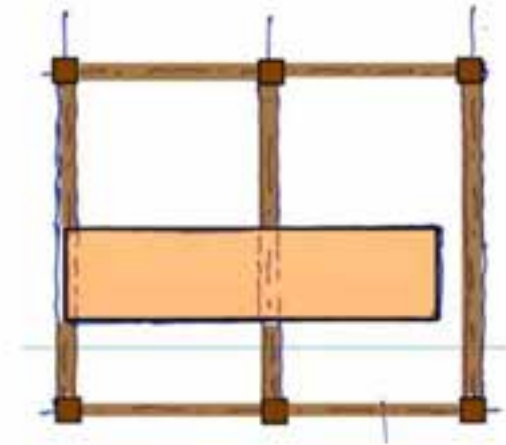
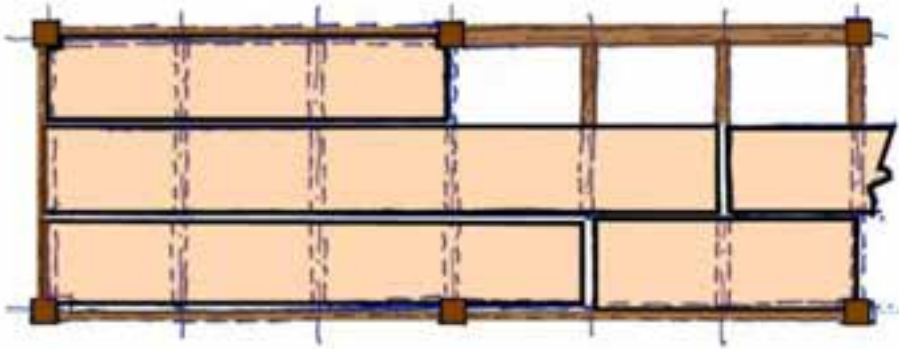
Material Fabrication Planning



Understand the Supply Chain



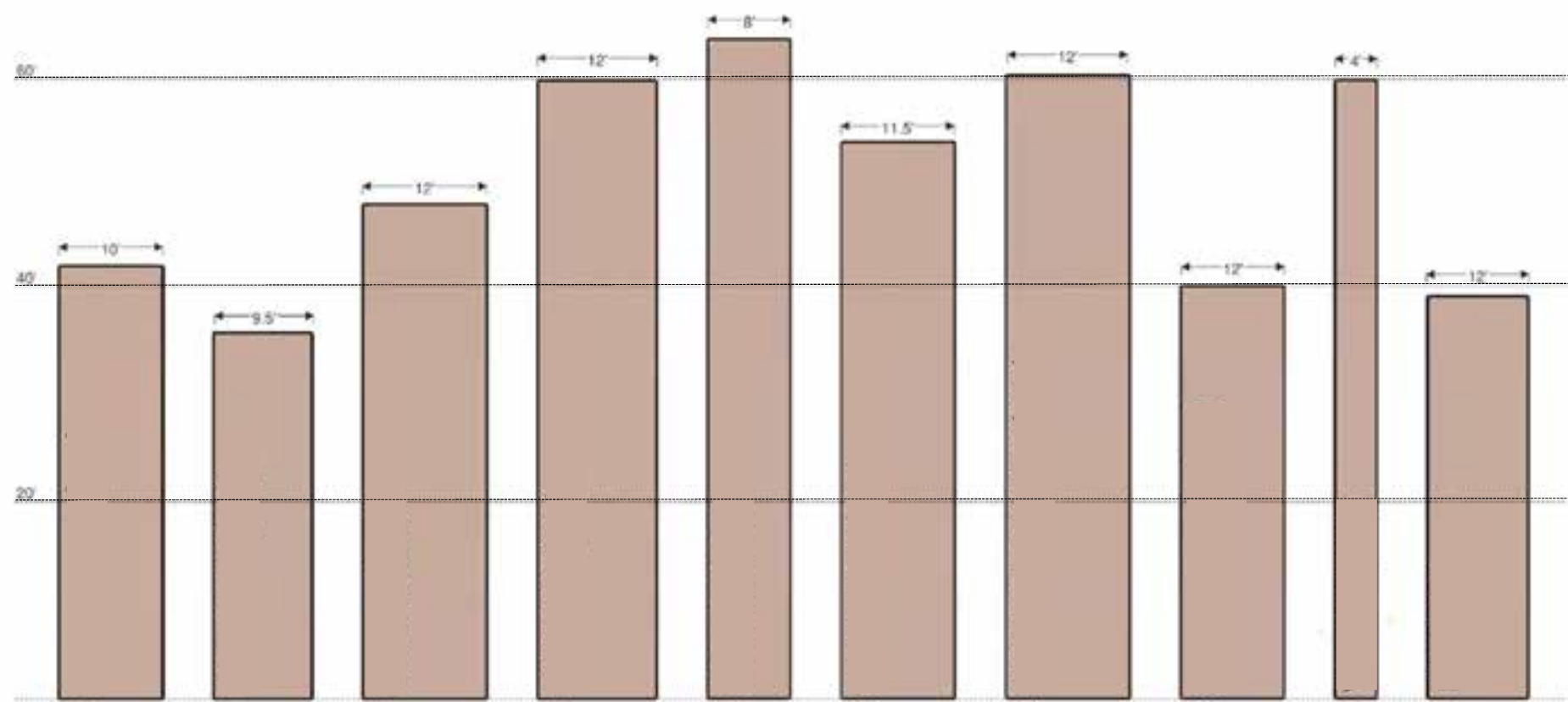
Photo: Swinerton



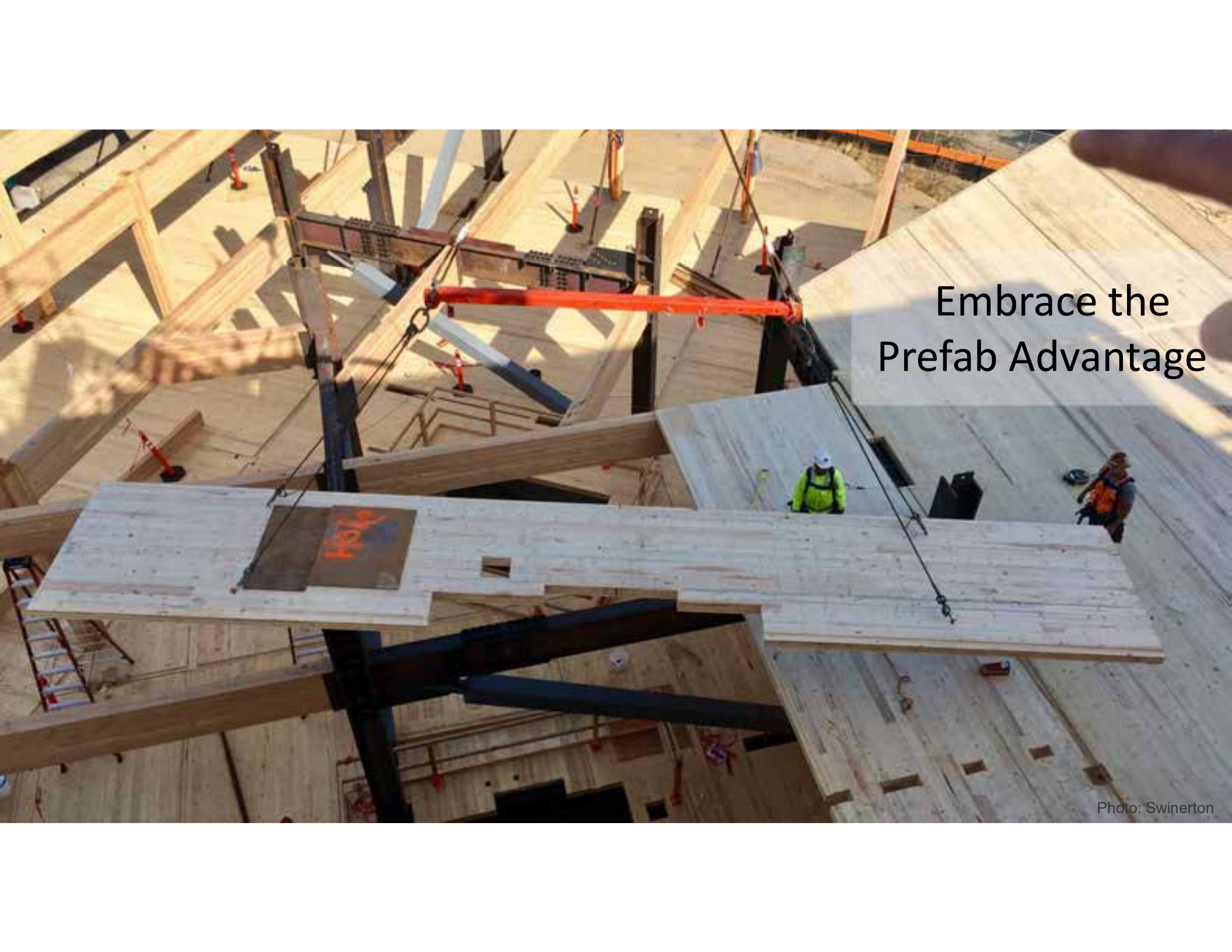
Credit: Tanya Luthi, Entuitive

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

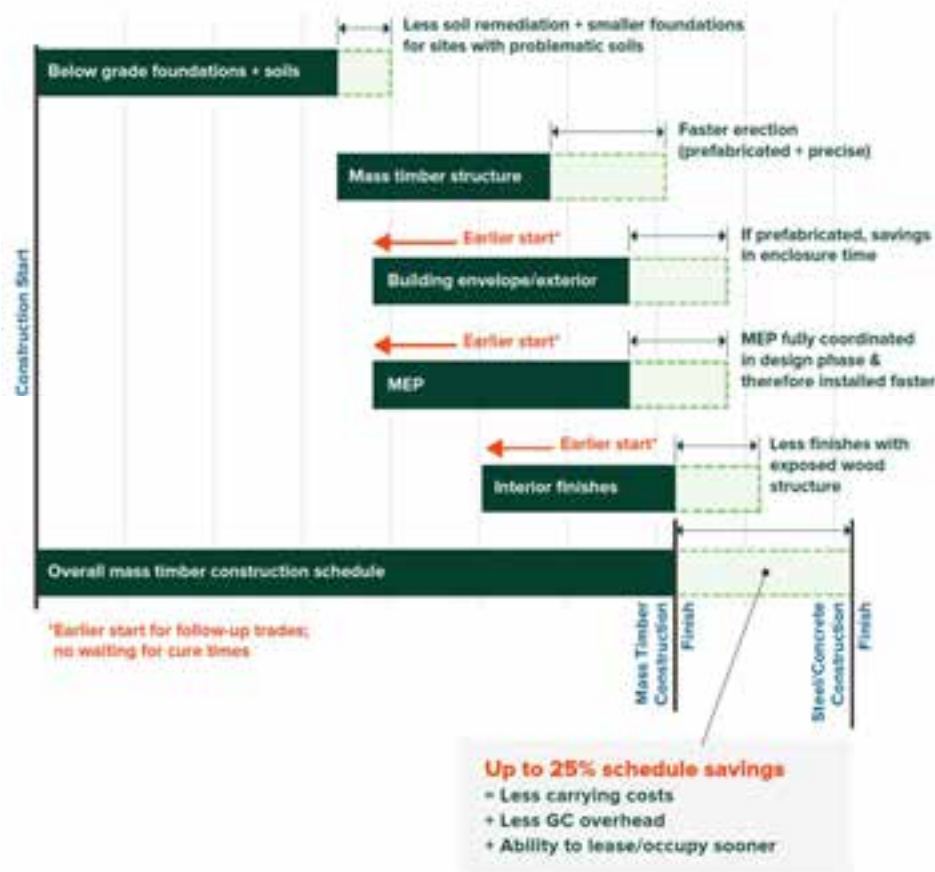


Photo: Swinerton

Procurement Approach Determines Schedule

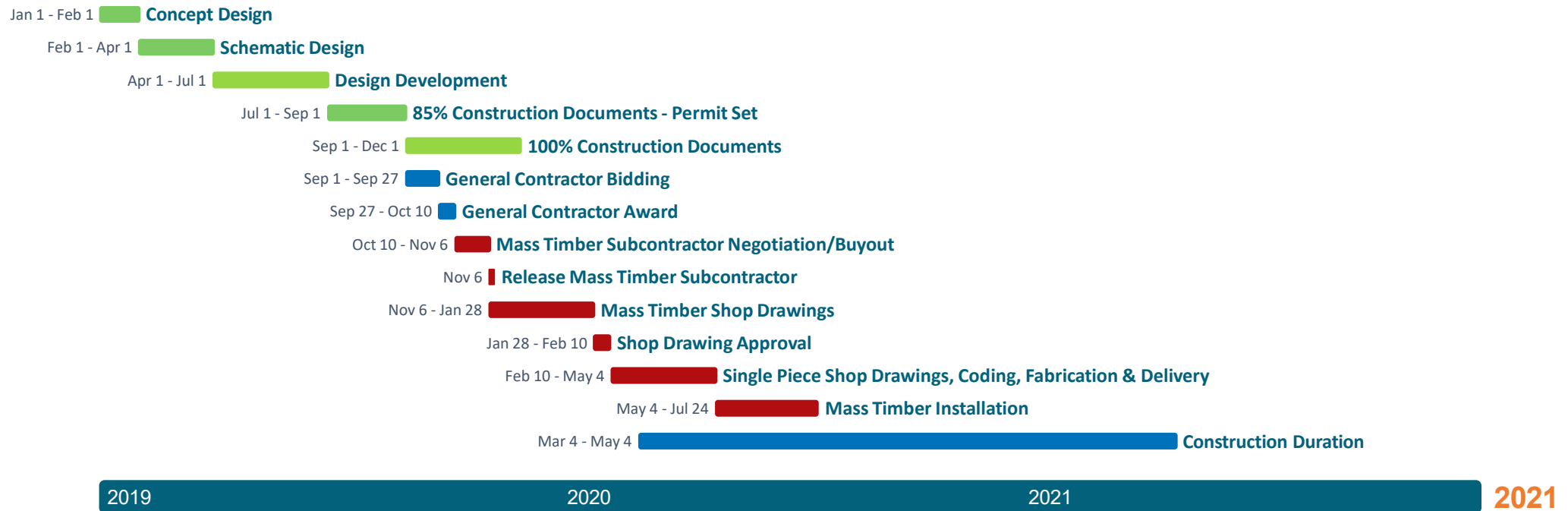
Compressing the Typical Construction Schedule with Mass Timber ^{13, 15, 16}

Look for these potential schedule savings in comparison to steel and concrete



Procurement Approach Determines Schedule

Example 6 Story Type IIIA Project

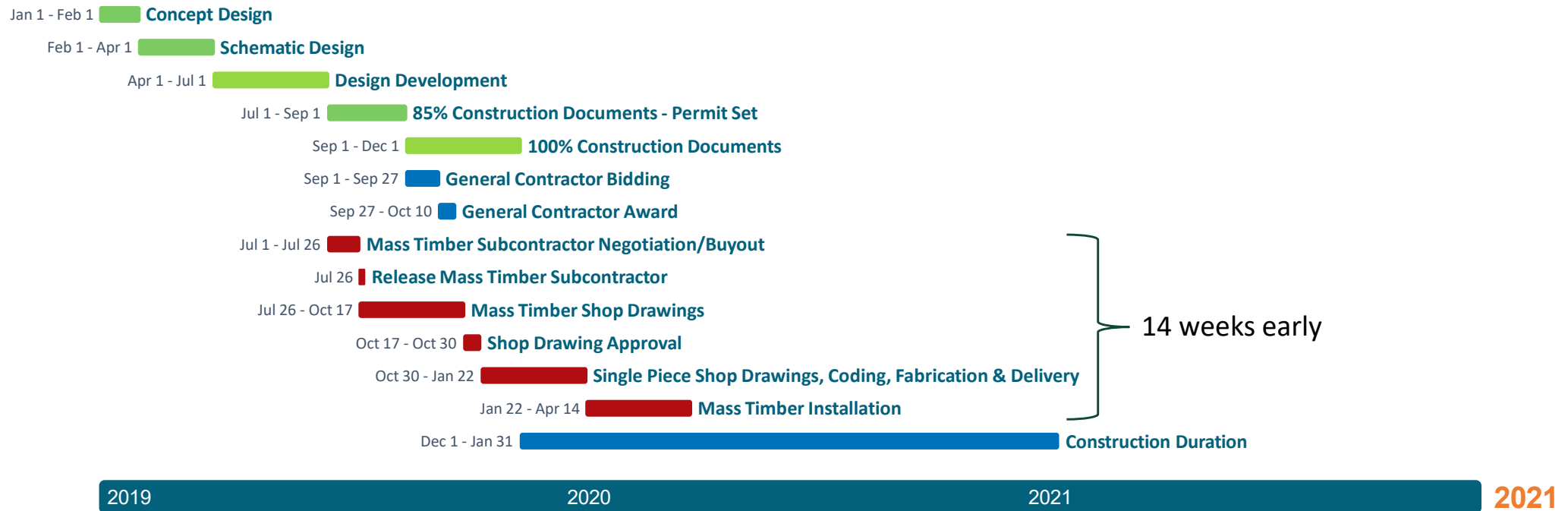


Source: Swinerton

Design-Bid-Build Procurement

Procurement Approach Determines Schedule

Example 6 Story Type IIIA Project



Source: Swinerton

Design-Build/Design-Assist Procurement

Procurement Logic for Scheduling



Example 6 Story Type IIIA Project

Procurement Approach Determines Schedule



Photo: Alex Schreyer

Schedule Comparison



Image: Swinerton



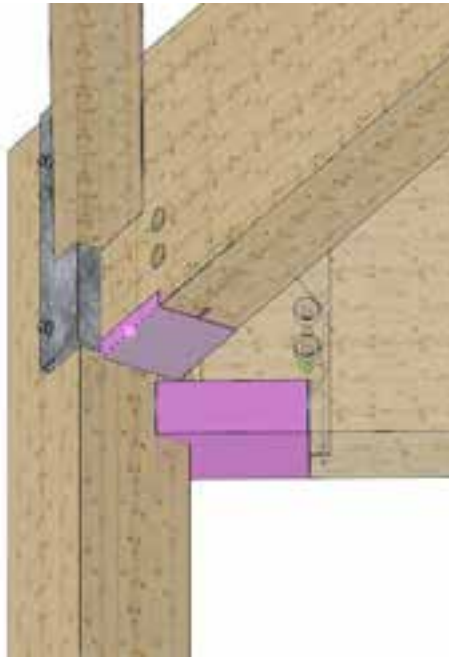
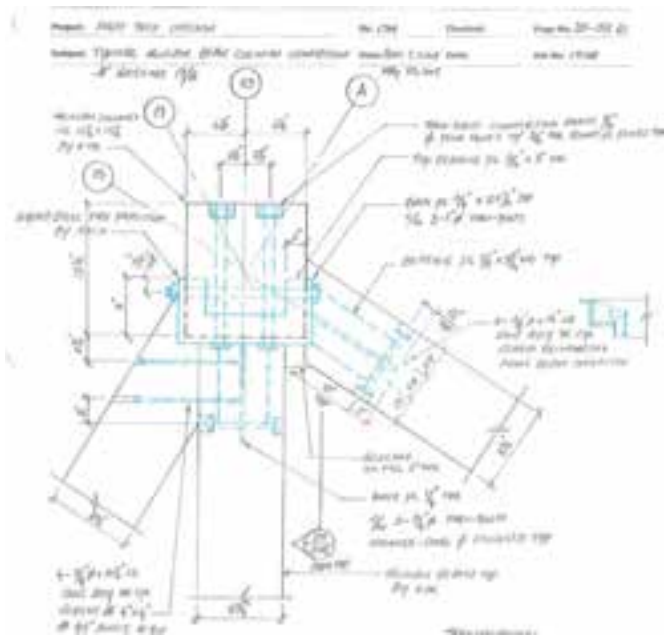
Photo: WoodWorks

Schedule Drivers



Photo: Lendlease

BIM/Digital Twins



Photos: Swinerton

Schedule Impacts: Hybrid Structures

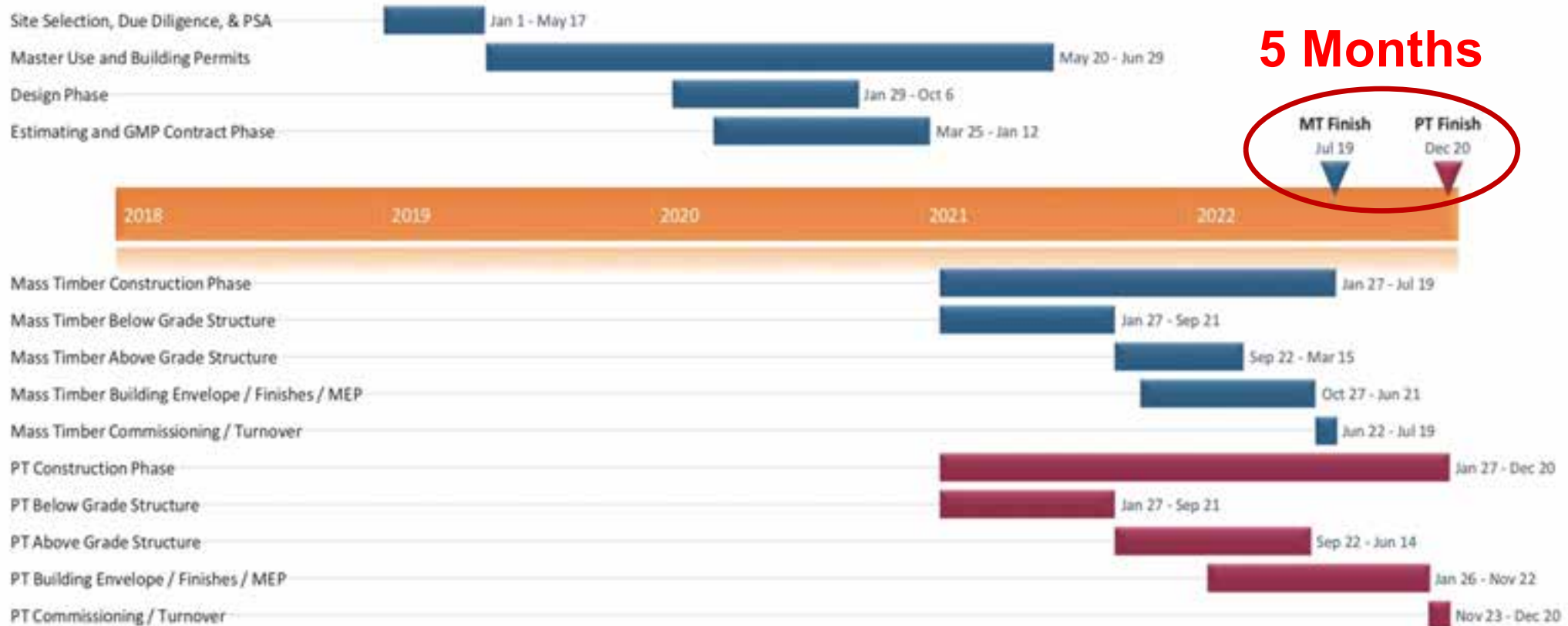




Look At Schedule Holistically

Photo: StructureCraft Builders

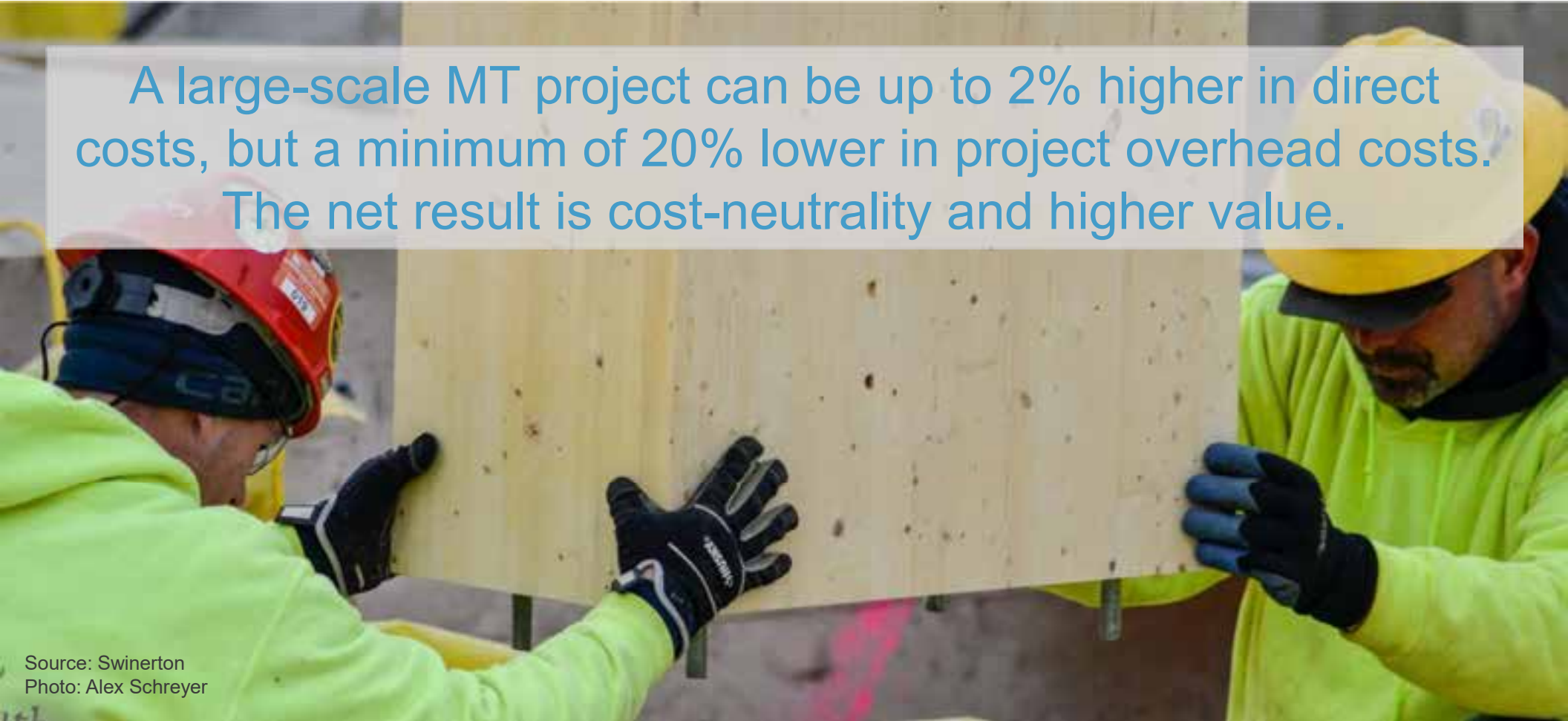
Overall Project Schedule Analysis: 12 Story Type IV-B



Source: 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.

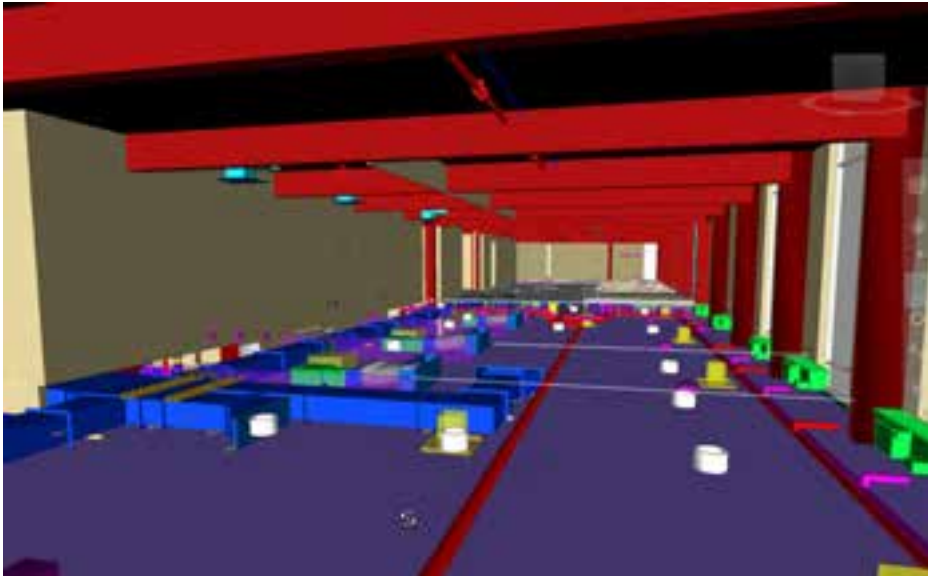


Source: Swinerton
Photo: Alex Schreyer

Early Move-In for Rough-In Trades.



Embracing BIM for Fabrication



Photos: Swinerton

SITE PLANNING



Photo: Swinerton

QA/QC



Photo: Swinerton

SITE INSPECTIONS



Photo: H+O Structural Engineering, Kure Creative

Tall Mass Timber Special Inspections

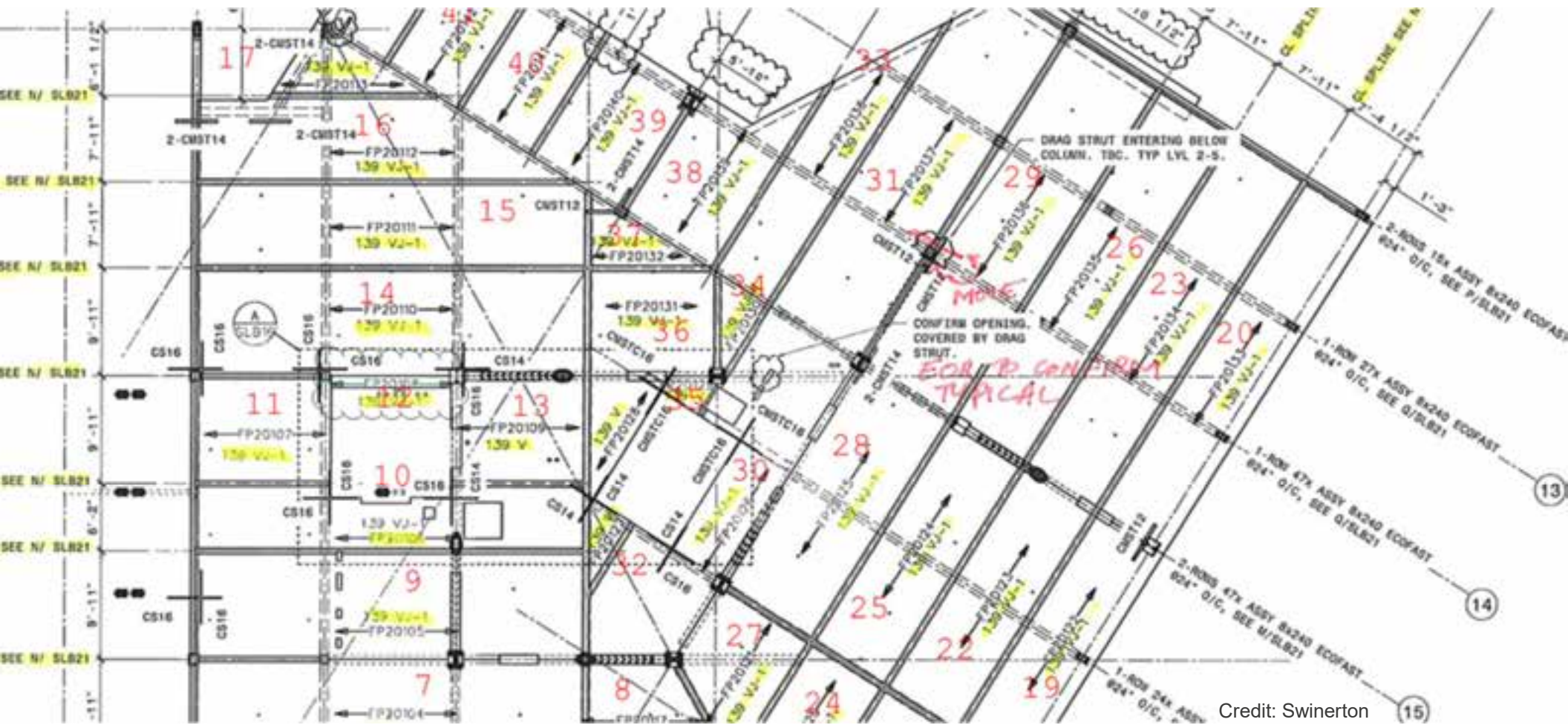
TABLE 1705.5.3
REQUIRED SPECIAL INSPECTIONS OF MASS TIMBER CONSTRUCTION

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

Source: International Building Code

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

Sequencing



Credit: Swinerton

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

BB0



Photo: Swinerton



Material Environmental Exposure and Moisture Management

Enroute
Onsite
Post-Install
Other Material

Photo: Alex Schreyer



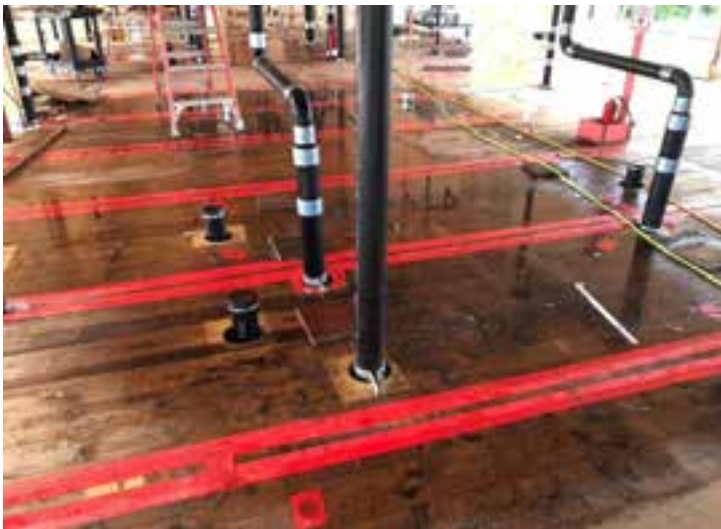
Enroute Exposure



On Site Considerations



On Site Considerations

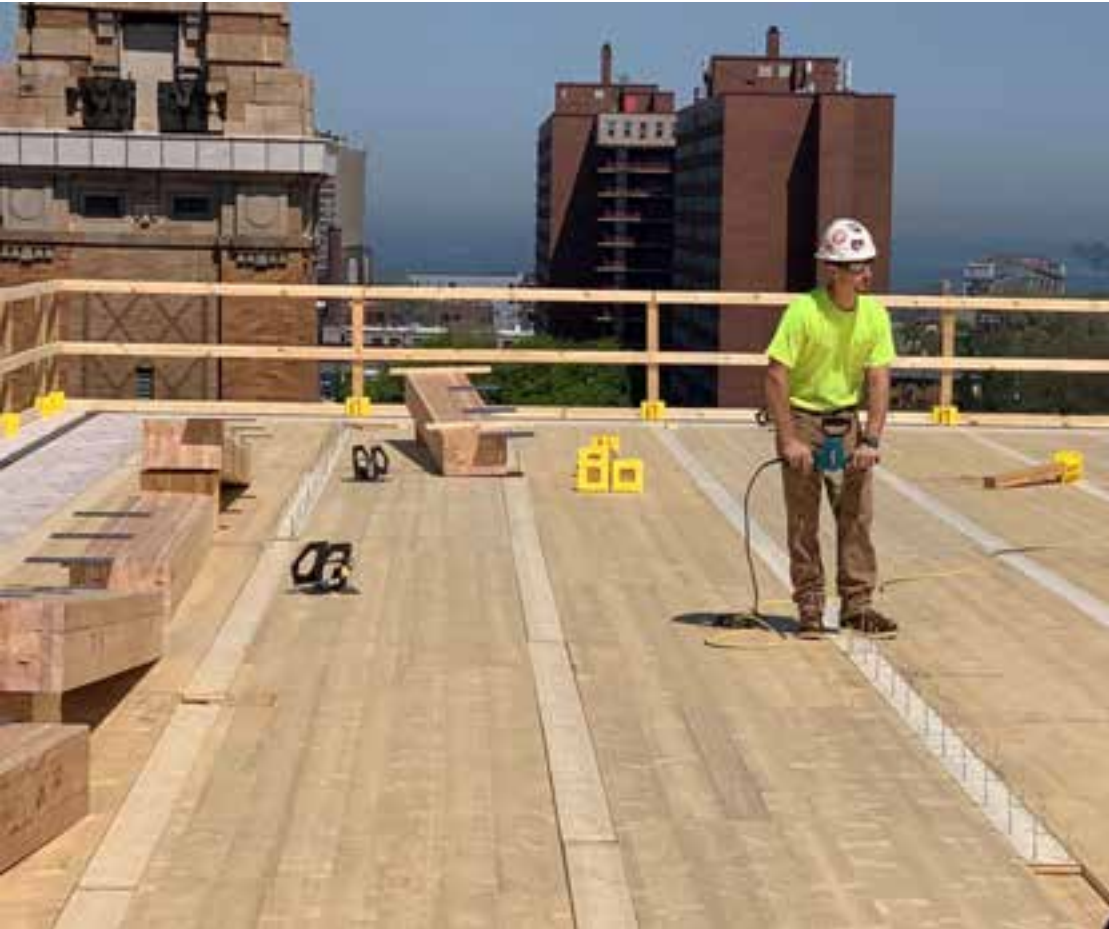


Onsite Considerations



BB0

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



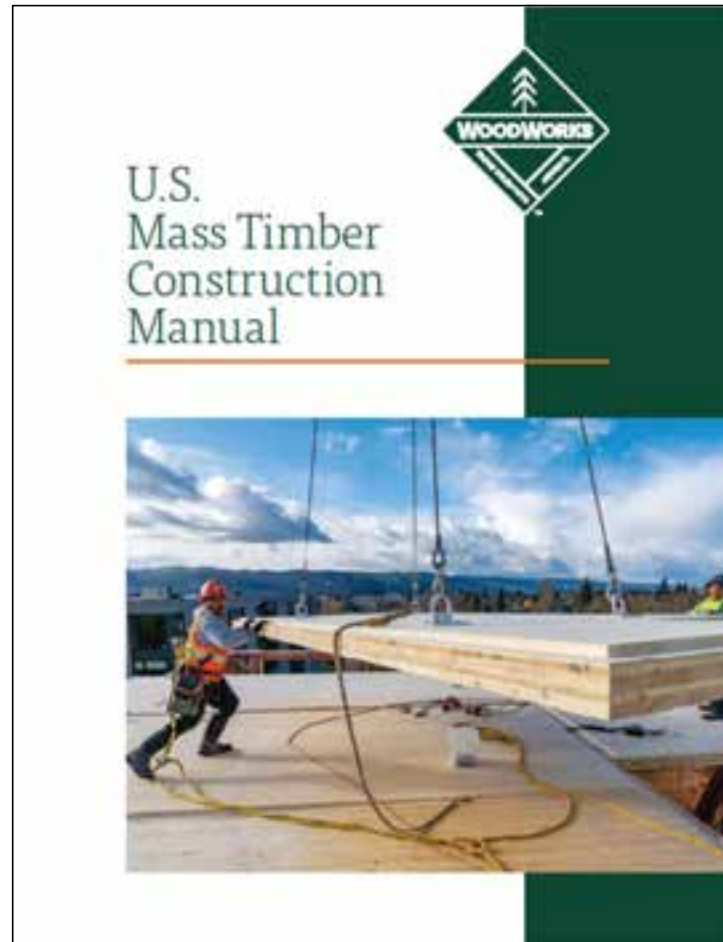
PROJECT TOURS



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

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Questions? Ask us anything.



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





Thank You

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