

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

February 25, 2026
& March 3, 2026

Presented by
John O'Donald II, PE
WoodWorks



WoodWorks | The Wood Products Council

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

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

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

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



Course Description

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.

MASS TIMBER OVERVIEW



Introduction

Mass timber products come premanufactured in many forms, including:

- » Large panels (floor or wall “planks”)
- » Glue-laminated timber (glulam) beams and columns
- » Structural composite lumber (SCL) beams and columns

Mass timber refers to a category of wood framing styles typically characterized by large, engineered wood panels paired with glulam beams and columns. Due to their premanufacturing, SCL and T&G may also be considered mass timber.



Catalyst

MGA | Michael Green
Architecture / KPFF

Photo Benjamin Benschneider

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

Glulam Specs

Typical Widths

- » 3-1/8", 3-1/2", 5-1/8", 5-1/2", 6-3/4", 8-3/4", 10-3/4", 12-1/4"

Typical Depths

- » Based on number of lams: 6" to 60"+
- » Western species lams: Typically 1-1/2" thick
- » Southern pine lams: Typically 1-3/8" thick

Typical Species

- » Douglas-Fir, Southern Pine, Spruce
- » Also available in Cedar & others

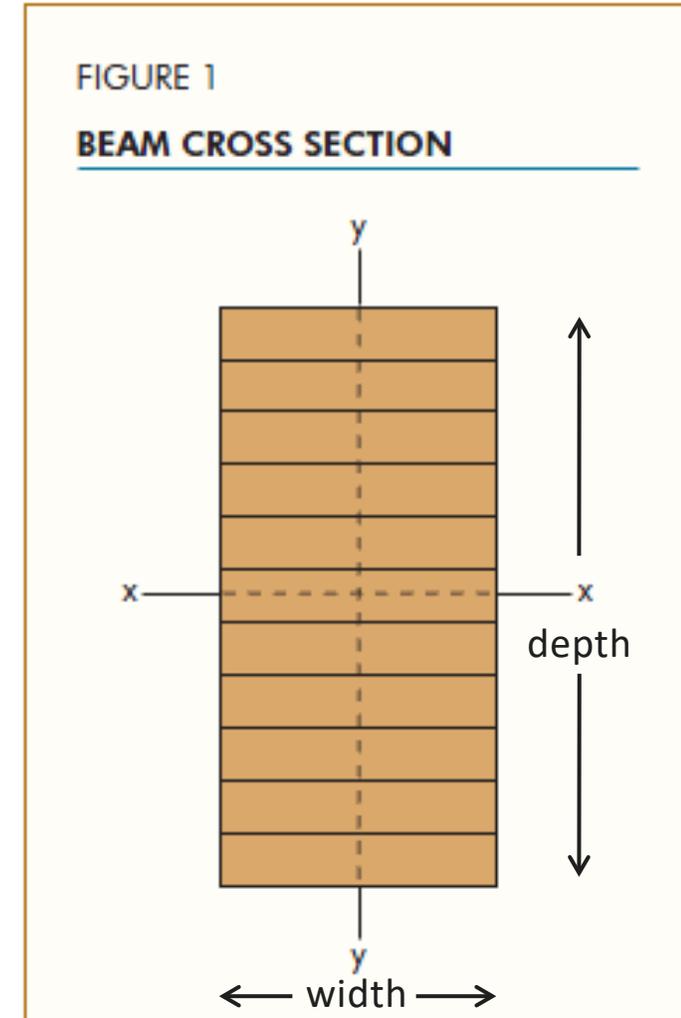


Image: APA Glulam Product Guide

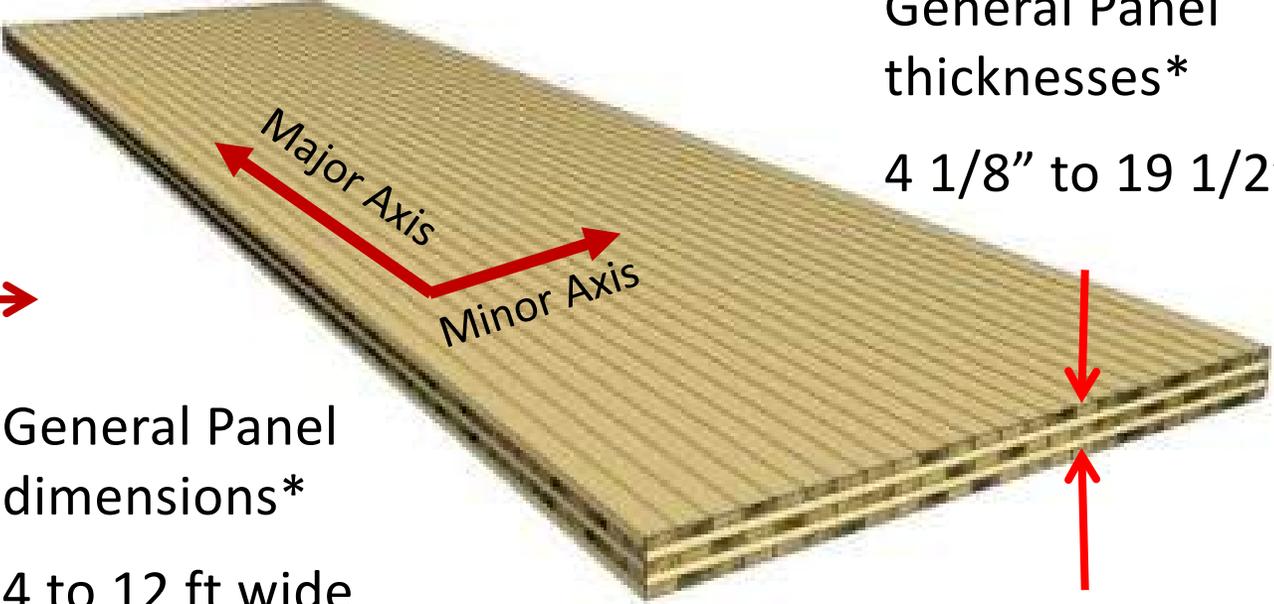
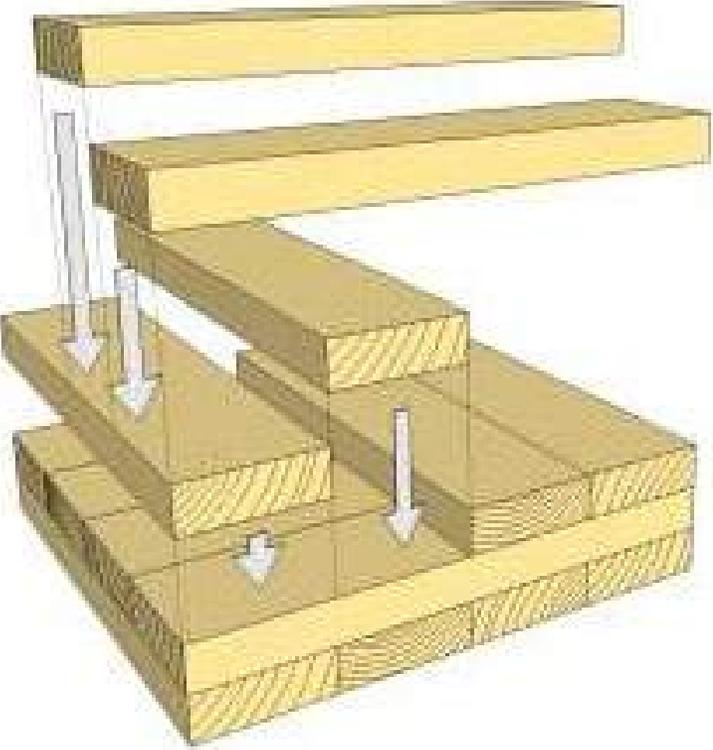
Flexibility of Spans and Shapes



Richmond Olympic Oval, Richmond, BC, Canada
Design Team: Cannon Design Architecture, Fast + Epp, Glotman Simpson
Photo Credit: Stephanie Tracey, Craig Carmichael, Jon Pesochin, KK Law Creative, Ziggy Welsch

Cross Laminated Timber (CLT) Common Layups

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) Common Layups

3-ply 3-layer



5-ply 5-layer



7-ply 7-layer



9-ply 9-layer



7-ply 5-layer



9-ply 7-layer



Cross Laminated Timber (CLT) Prefabrication

- » Panels planed, sanded, cut to size
- » Openings cut with CNC routers
- » 3rd party inspection at factory
- » Custom designed and engineered
- » Panels delivered/ installed in predetermined sequence



Photo Credit:
Sissi Slotover-Smutny



APEX PLAZA

CHARLOTTESVILLE, VA

Office building

CLT panels / glulam frame & braced
frames

8 stories (6 mass timber), 187,000 sqft



William McDonough + Partners
Simpson Gumpertz & Heger
Photo Prakash Patel

SCL CLT



Photo Marcus Kauffman

Mass Ply Panels (MPP)



District Office
Hacker / KPFF /
Andersen Construction
Photo Hacker

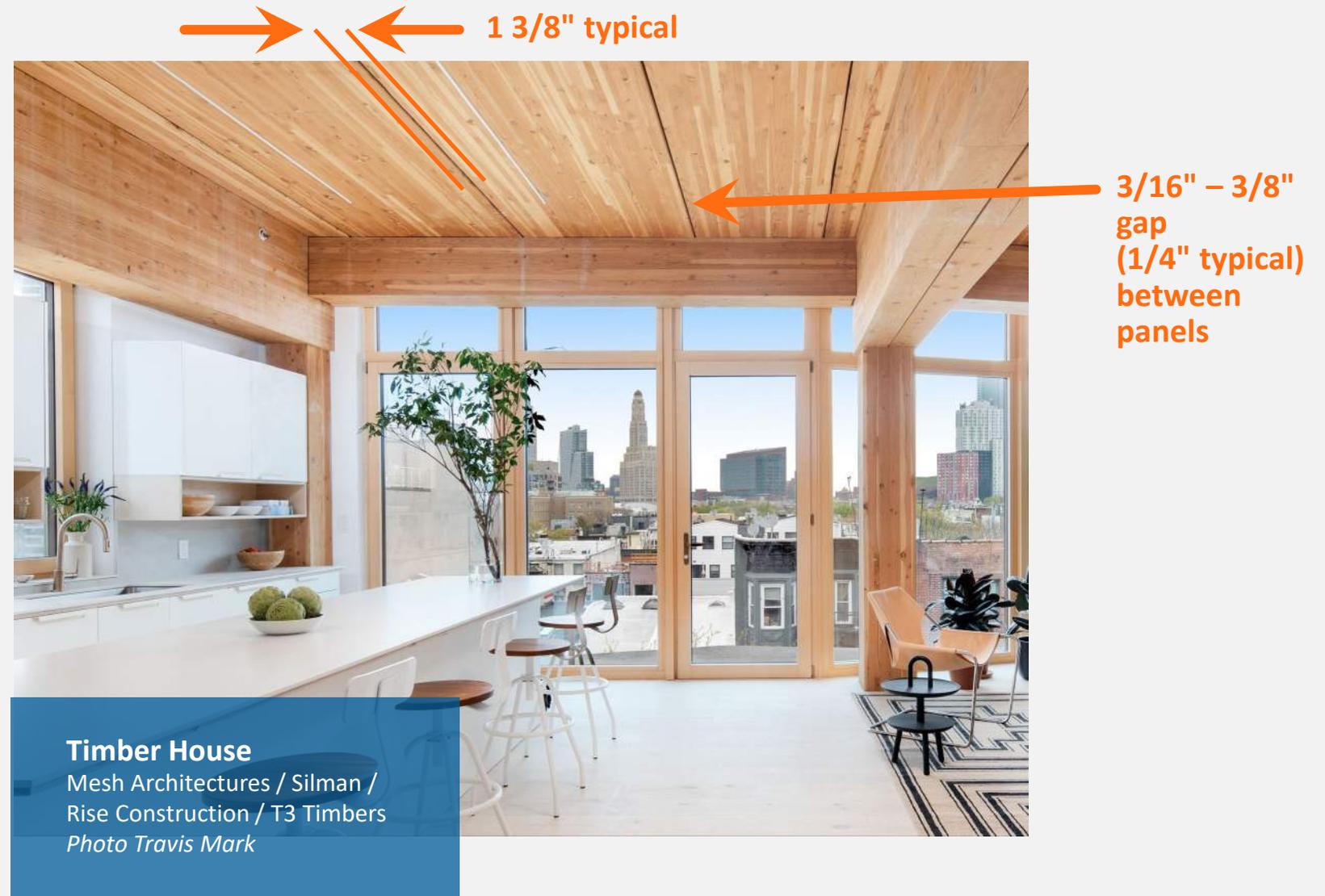


Portland International Airport – Main Terminal Portland, OR

SGF Architects
KPF Consulting Engineers
Photo: Timberlab

GLT Basics

- » Solid sawn lumber laminations (typically 2x) are bonded together.
- » One method is to have the “visual width” of one board equal to 1-3/8".
- » This dimension is achieved by sanding a typical 1.5" nominally thick “2x” board to precisely 1-3/8".
- » Adhesive adds FP, Moisture mgmt., dimensional stability





WOOD INNOVATION
AND DESIGN CENTRE

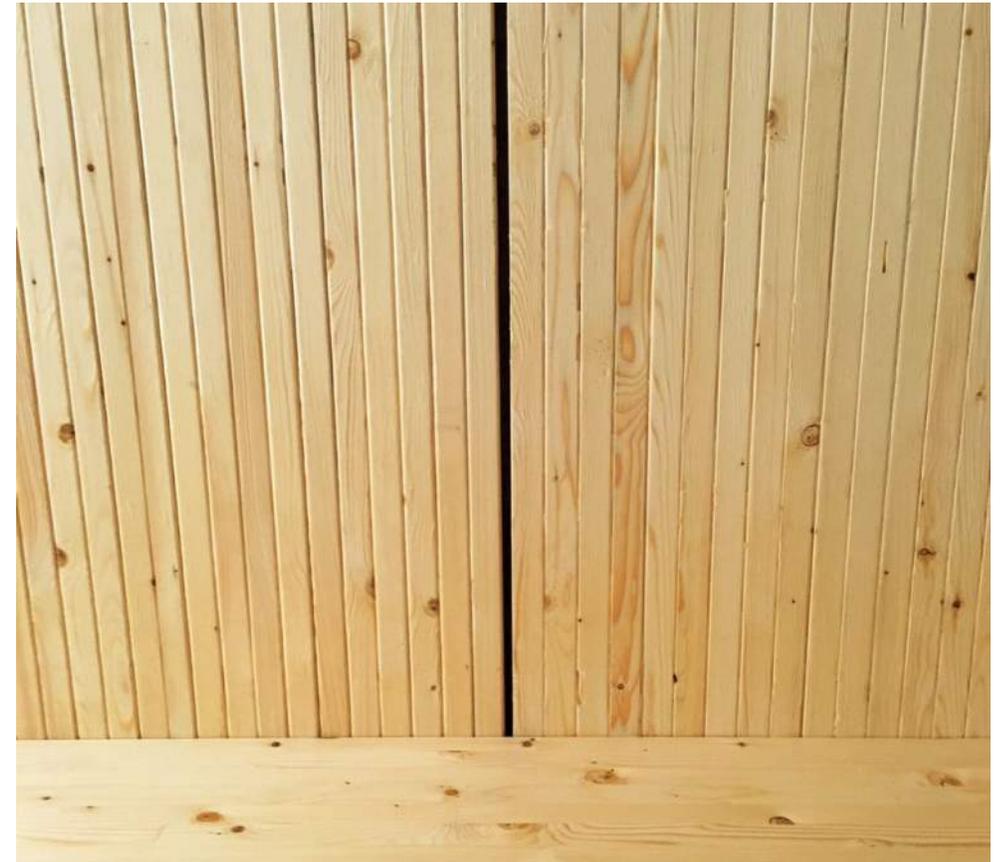
- LECTURE THEATRE →
- GALLERY OF WOOD ←
- RESEARCH LAB →
- ELEVATOR ACCESS →
- EXIT TO 2ND FLOOR ←
- LECTURE THEATRE ←
-

Wood Innovation and Design Centre
2015, 51,000SF, 7-stories
Prince George, BC, Canada
Photo: Ema Peter Photography

Nail-Laminated Timber (NLT)



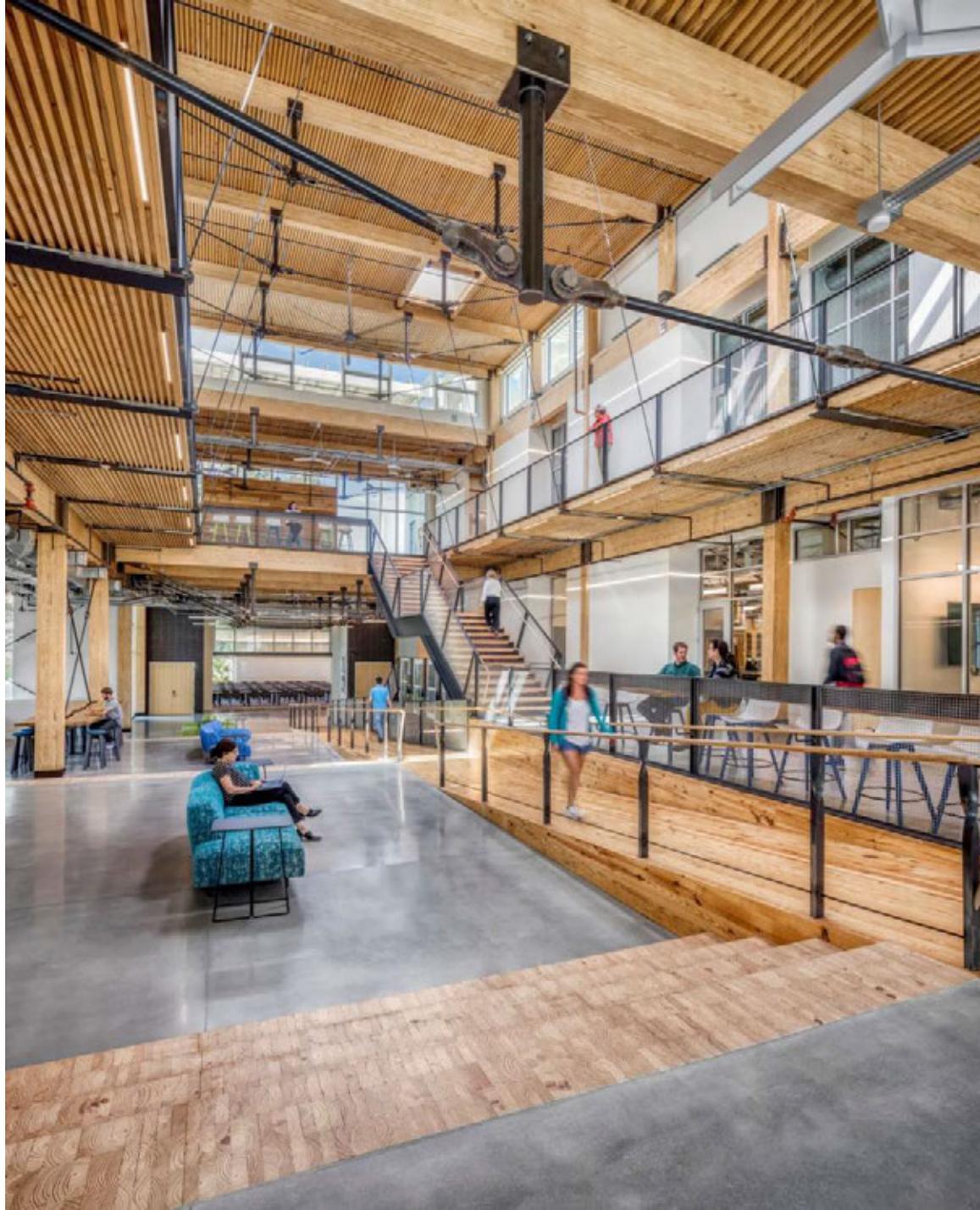
Photo: Think Wood



Nail Laminated Timber (NLT) Panels

- » Pre-fabricated panels often pre-sheathed
- » Once installed, add stitching strips, tape joint if applicable





Kendeda Building

for Innovative Sustainable Design
Atlanta, GA

37,000 sf, 2 stories

Type III-B

Educational

Completed 2019



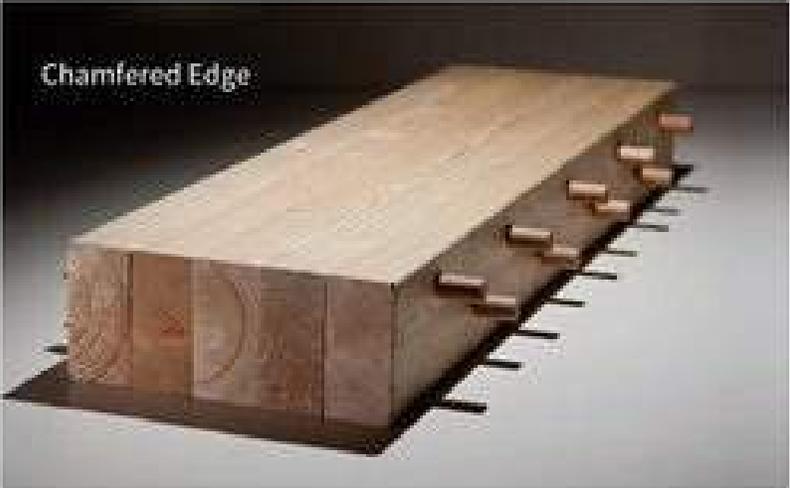
Architect: The Miller Hull Partnership
Engineer: Uzun + Case
Photo: Jonathan Hillyer

Dowel-Laminated Timber (DLT)



Photo: StructureCraft

Dowel Laminated Timber Profile Options

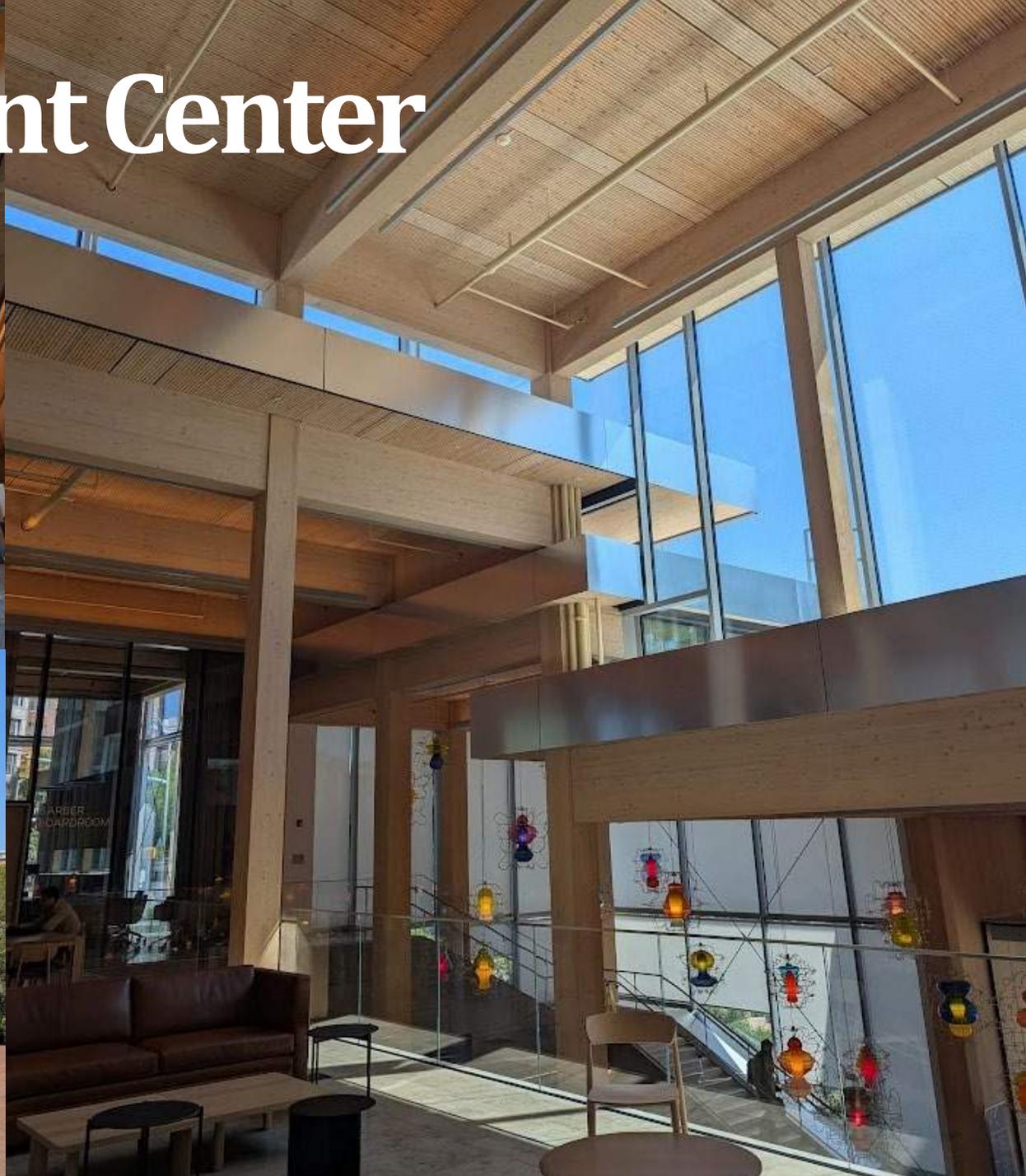


Johns Hopkins Student Center

Baltimore, MD

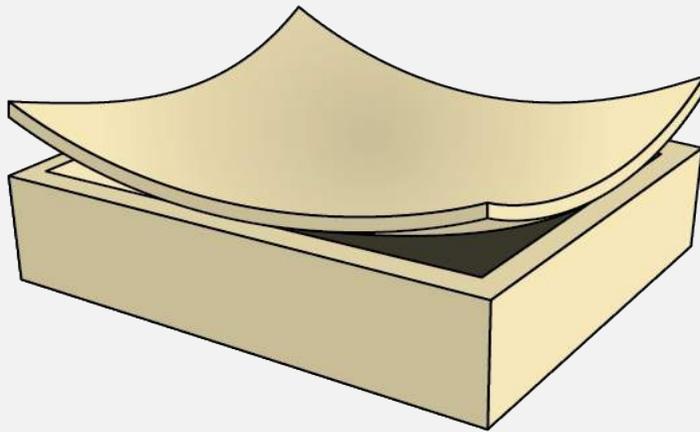


Architect: Shepley Bulfinch
Engineer: Knippers Helbig
Contractor: Clark Construction
MT Supplier: StructureCraft
Photos: Woodworks



CLT

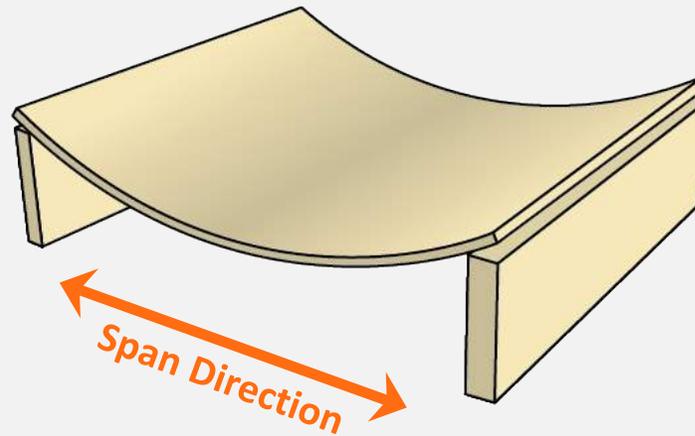
bends in two directions



Deformation of two-way slab

GLT, DLT and NLT

bend in one direction only



Deformation of one-way slab

This situation is also encountered in concrete slabs, where contractors are required to lay down reinforcing steel (rebar) in the correct direction for bending.

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



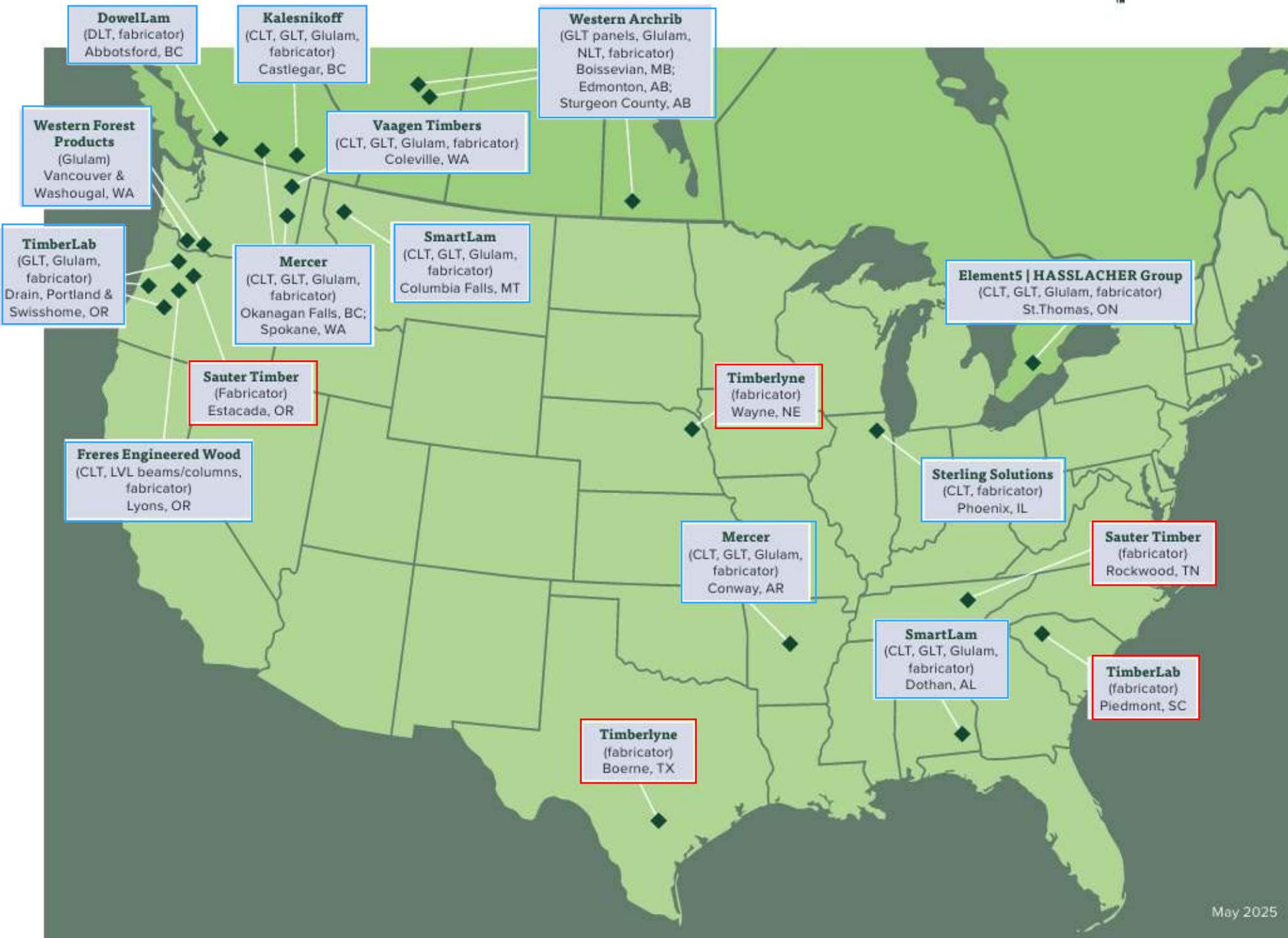
Decking

Timber-Concrete Composite (TCC) Floor Systems

- » Two distinct layers—timber layer and concrete layer—joined by shear connectors
- » Timber layer can be CLT, GLT, SCL, another engineered wood product, or solid sawn lumber
- » Shear connectors can be common fasteners (e.g., nails or screws), notches cut in the wood, connectors such as embedded plates or glue that transfer the load to a larger surface



Mass Timber Manufacturer & Fabricator Locations



Manufacturers

Fabricators

WIN Website:
[mass_timber_manufacturer_locations.pdf](https://www.mass-timber-manufacturer-locations.pdf)



Photo: Ema Peter

STRUCTURAL SOLUTIONS | POST, BEAM + PLATE



Photo: Seagate Structures

STRUCTURAL SOLUTIONS | POST + PLATE



Photo: Lendlease



Photo: John Klein

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

Mass Timber Shafts

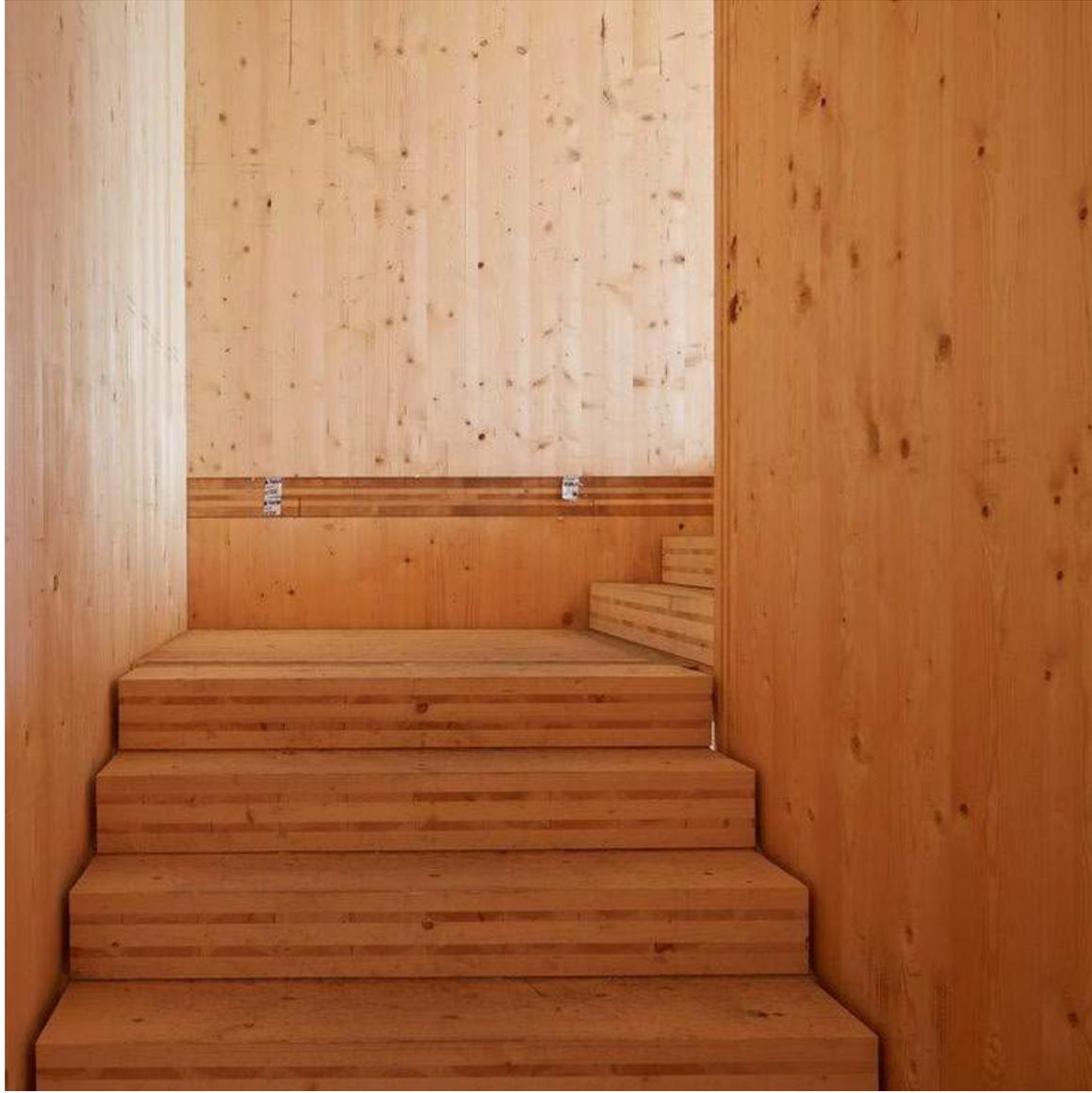


Photo Credit: Will Pryce

Mass Timber Shafts

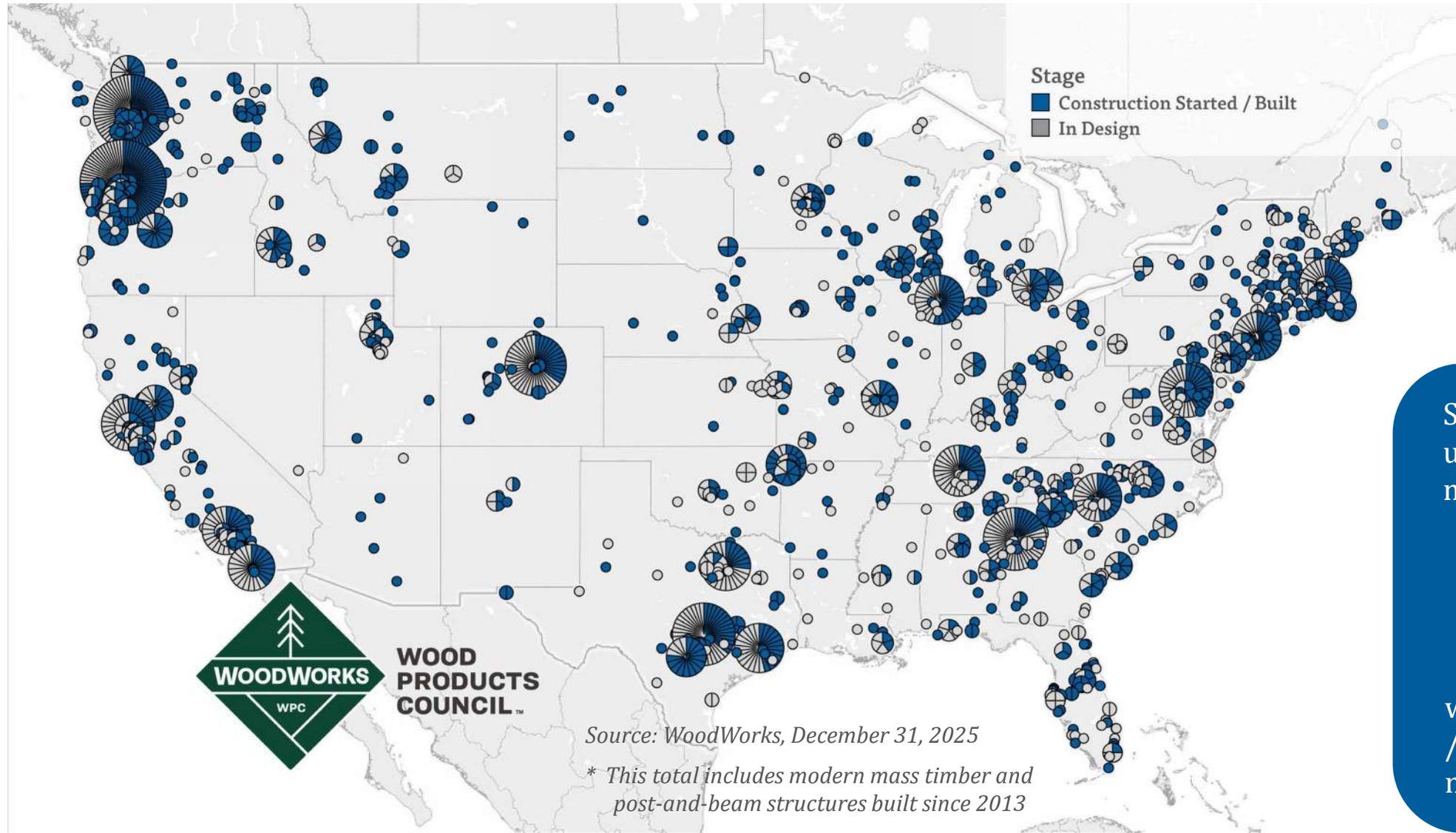
Mass Timber Shaft Wall Considerations:

- » Cost
- » Construction Schedule
- » Material Compatibility
 - » Movement
 - » Lateral load resistance
- » Architectural feature
- » Fire tests for 2-hour mass timber shaft
 - » Exposed and protected



Current State of Mass Timber Projects

As of Q4 2025, in the US, **2,664** multi-family, commercial, or institutional projects have been constructed with, or are in design with, mass timber.



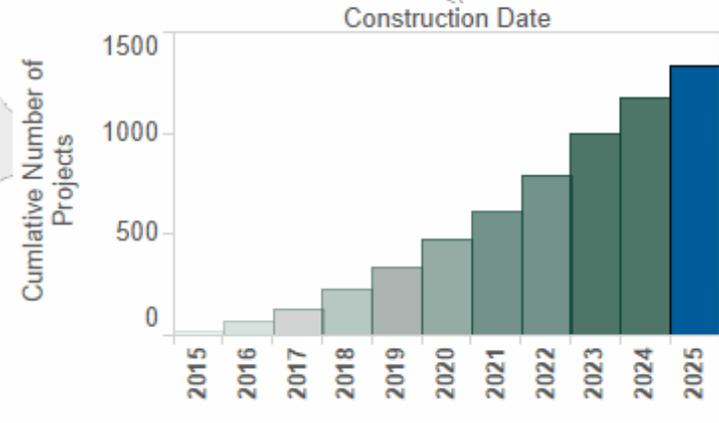
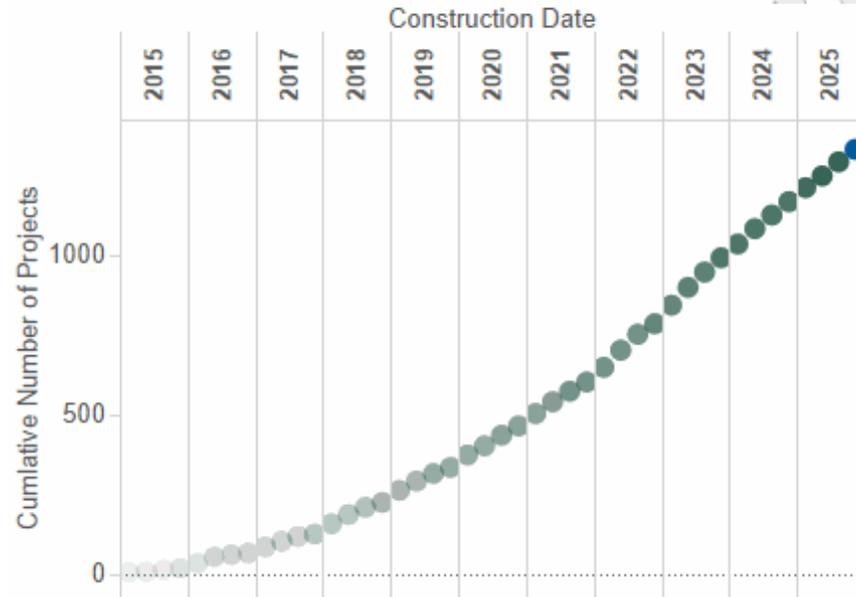
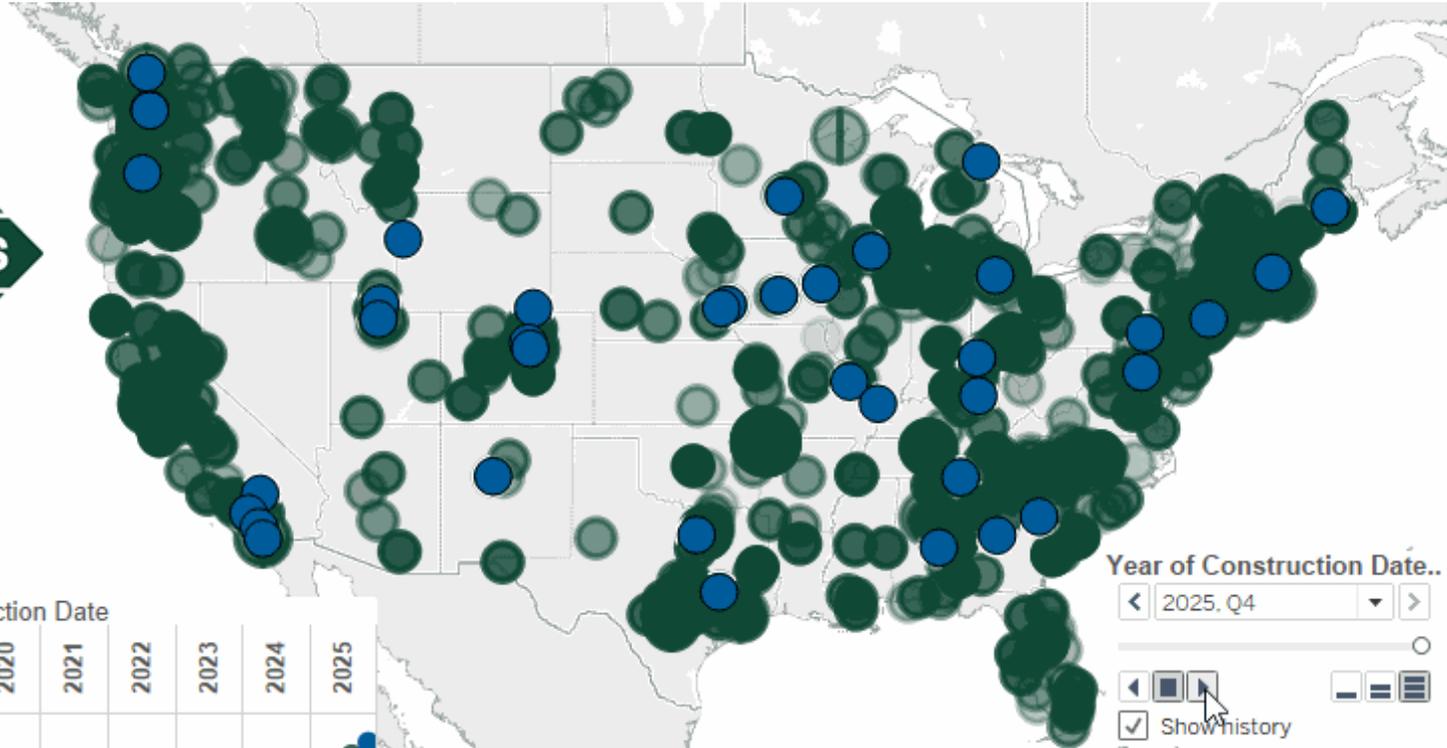
Scan this code or use the url to find the map and more details online.



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

Current State of Mass Timber Projects Over Time

US Market Q4 2025



MASS TIMBER DESIGN CONSIDERATIONS



Photo: Hacker Architects

Key Early Design Decisions

Early = Efficient

Realize Efficiency in:

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

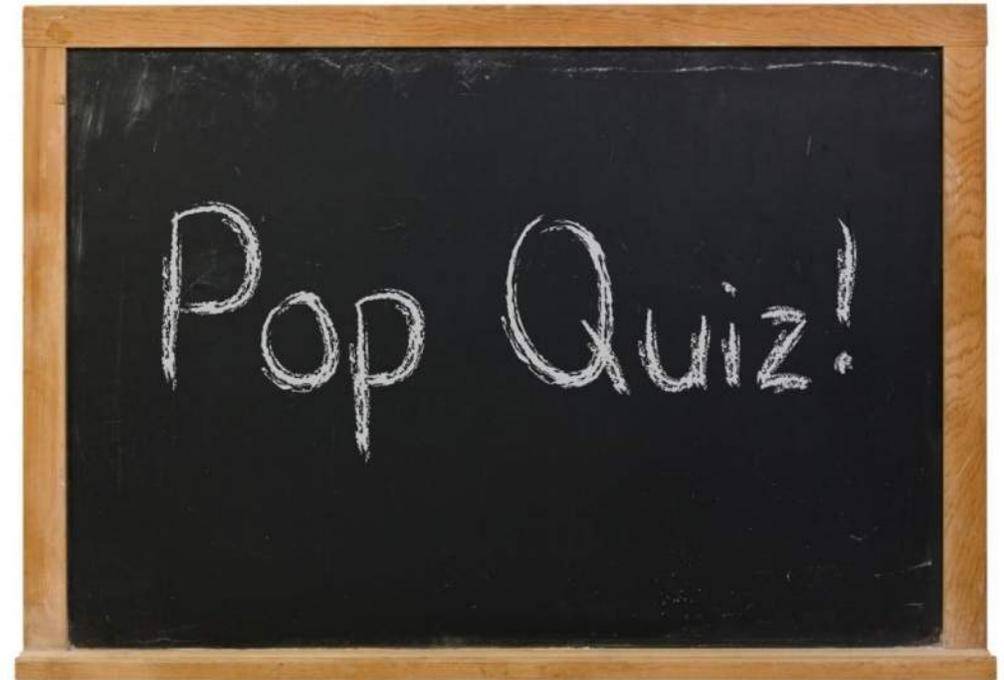
Commit to a mass timber design from the start



Construction Types

Question: Of the 5 construction types, which ones can mass timber be used in?

Answer: All 5!



Key Early Design Decisions

Construction Type – Primarily based on building size & occupancy

	Construction Type (All Sprinklered Values)							
	IV-A	IV-B	IV-C	IV-HT	III-A	III-B	V-A	V-B
Occupancies	Allowable Building Height above Grade Plane, Feet (IBC Table 504.3)							
A, B, R	270	180	85	85	85	75	70	60
	Allowable Number of Stories above Grade Plane (IBC Table 505.4)							
A-2, A-3, A-4	18	12	6	4	4	3	3	2
B	18	12	9	6	6	4	4	3
R-2	18	12	8	5	5	5	4	3
	Allowable Area Factor (At) for SM, Feet² (IBC Table 506.2)							
A-2, A-3, A-4	135,000	90,000	56,250	45,000	42,000	28,500	34,500	18,000
B	324,000	216,000	135,000	108,000	85,500	57,000	54,000	27,000
R-2	184,500	123,000	76,875	61,500	72,000	48,000	36,000	21,000

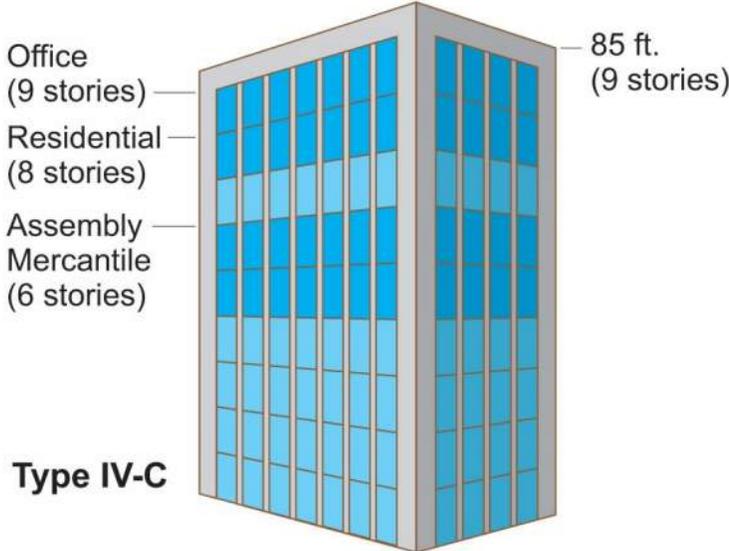
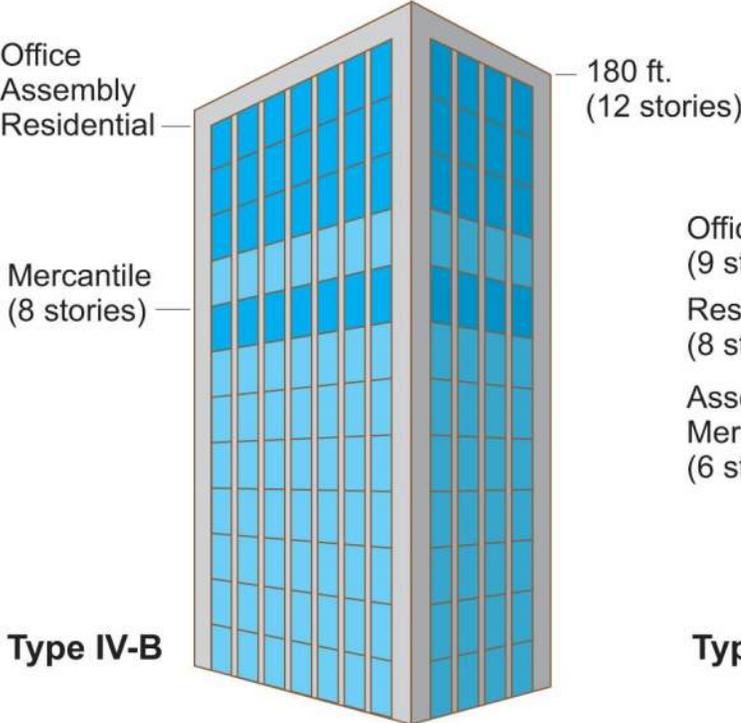
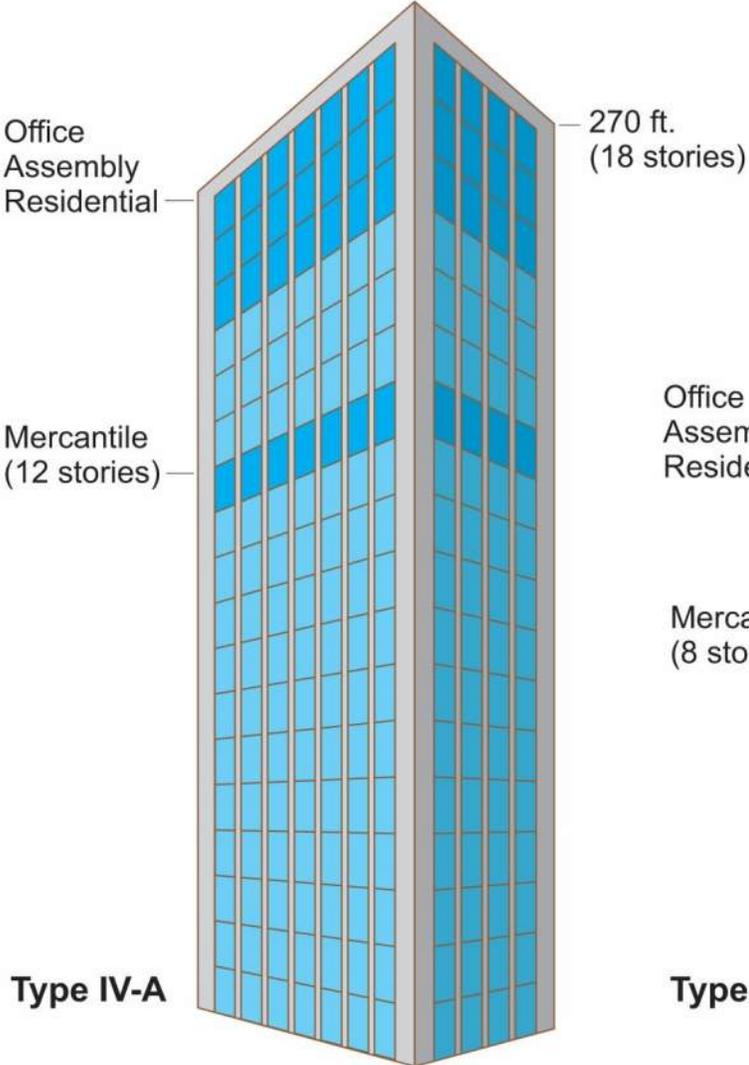
Key Early Design Decisions

Construction Type – Primarily based on building size & occupancy

	Construction Type (All Sprinklered Values)							
	IV-A	IV-B	IV-C	IV-HT	III-A	III-B	V-A	V-B
Occupancies	Allowable Building Height above Grade Plane, Feet (IBC Table 504.3)							
A, B, R	270	180	85	85	85	75	70	60
For low- to mid-rise mass timber buildings, there may be multiple options for construction type. There are pros and cons of each, don't assume that one type is always best.								
A-2, A-3, A-4	150	100	60	60	60	50	45	30
B	135	90	45	45	45	40	35	30
R-2	18	12	8	5	5	5	4	3
	Allowable Area Factor (At) for SM, Feet ² (IBC Table 506.2)							
A-2, A-3, A-4	135,000	90,000	56,250	45,000	42,000	28,500	34,500	18,000
B	324,000	216,000	135,000	108,000	85,500	57,000	54,000	27,000
R-2	184,500	123,000	76,875	61,500	72,000	48,000	36,000	21,000

Construction Types – Type IV-A, B, & C

2021 IBC: 3 New Tall Mass Timber Construction Types



Code Updates to Type IV-B

602.4.2.2.2 Protected Area

Interior faces of mass timber elements, including the inside face of exterior mass timber walls and mass timber roofs, shall be protected in accordance with Section 602.4.2.2.1.

2021 IBC

Exceptions: Unprotected portions of mass timber ceilings and walls complying with Section 602.4.2.2.4 and the following:

1. Unprotected portions of mass timber ceilings and walls comply with one of the following:
 - 1.1 Unprotected portions of mass timber ceilings, including attached beams, shall be permitted and shall be limited to an area equal to 20 percent of the floor area in any dwelling unit or fire area.
 - 1.2 ...

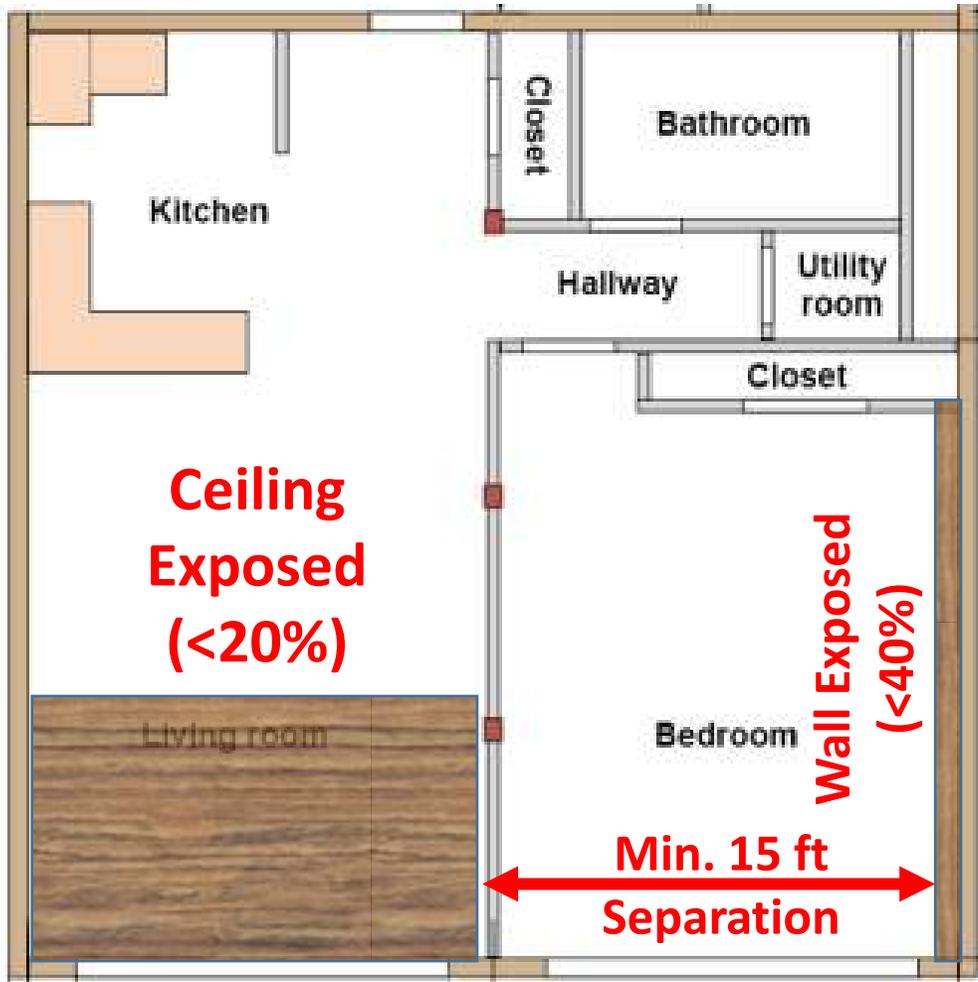
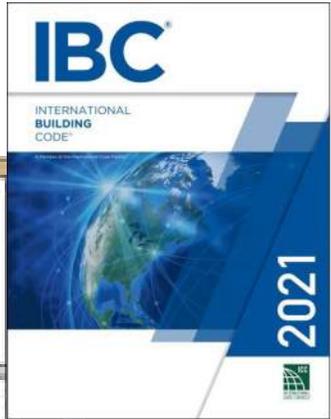
2024 IBC

Exceptions: Unprotected portions of mass timber ceilings and walls complying with Section 602.4.2.2.4 and the following:

1. Unprotected portions of mass timber ceilings and walls comply with one of the following:
 - 1.1 Unprotected portions of mass timber ceilings, including attached beams, limited to an area less than or equal to 100 percent of the floor area in any dwelling unit within a story or fire area within a story.
 - 1.2 ...

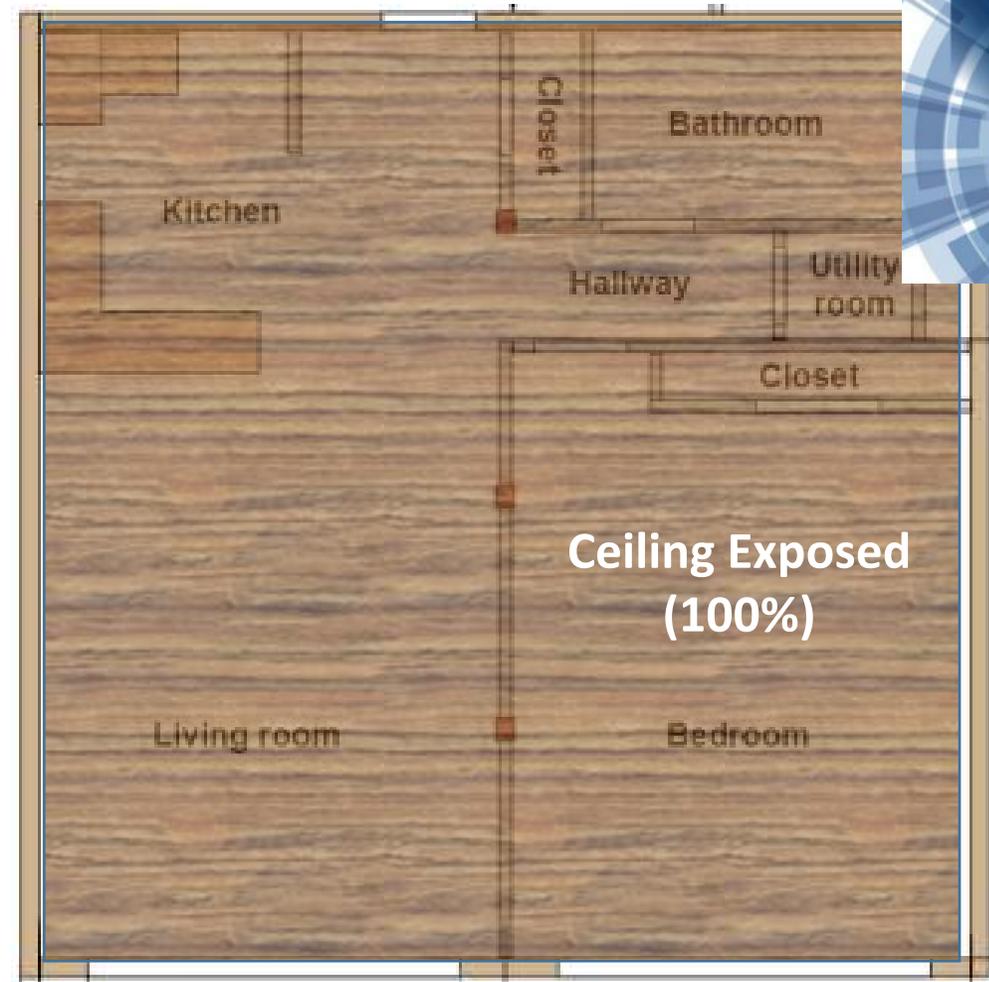
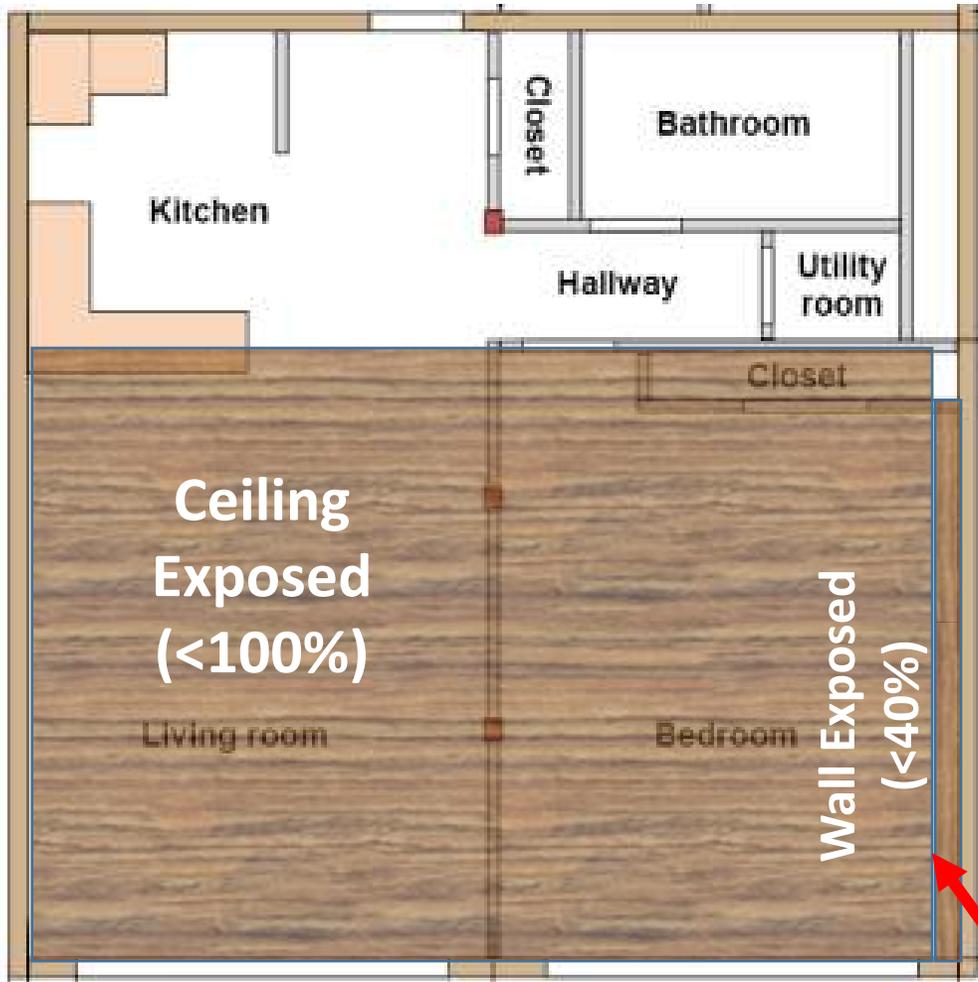
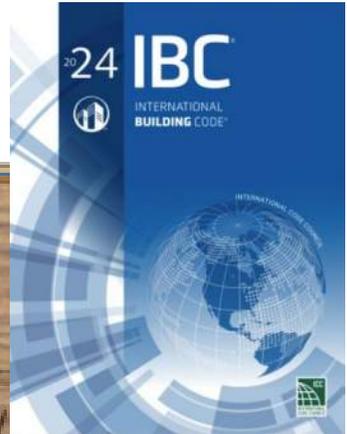
2019-2022: REFINING THE CODE ROADMAP

2021 IBC Allowances



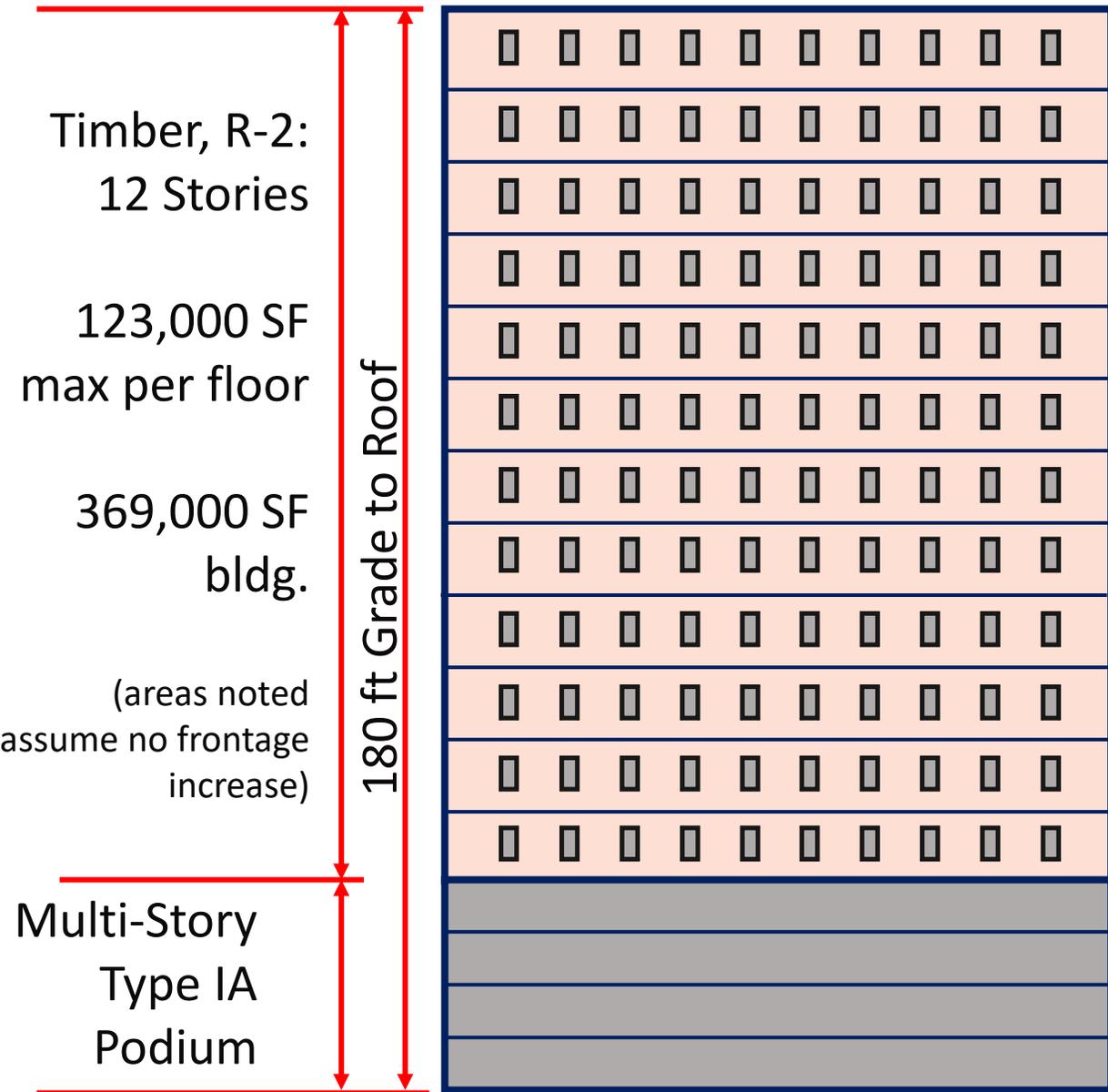
2019-2022: REFINING THE CODE ROADMAP

2024 IBC Allowances



No separation req'd between wall & ceiling

Type IV-B Tall Mass Timber



Example Mixed-Use, Type IV-B Building

Likely to Utilize Podium Due to Overall Building Height Limit (180 ft) Relative to # of Timber Stories (12)

Same Fire-Resistance Ratings Req'd as IV-C But Limitations on Timber Exposed

4 Additional Stories Permitted Compared to IV-C

Limited Timber Exposed

WoodWorks is supporting 236 tall wood projects in design and 20 projects under construction or built.

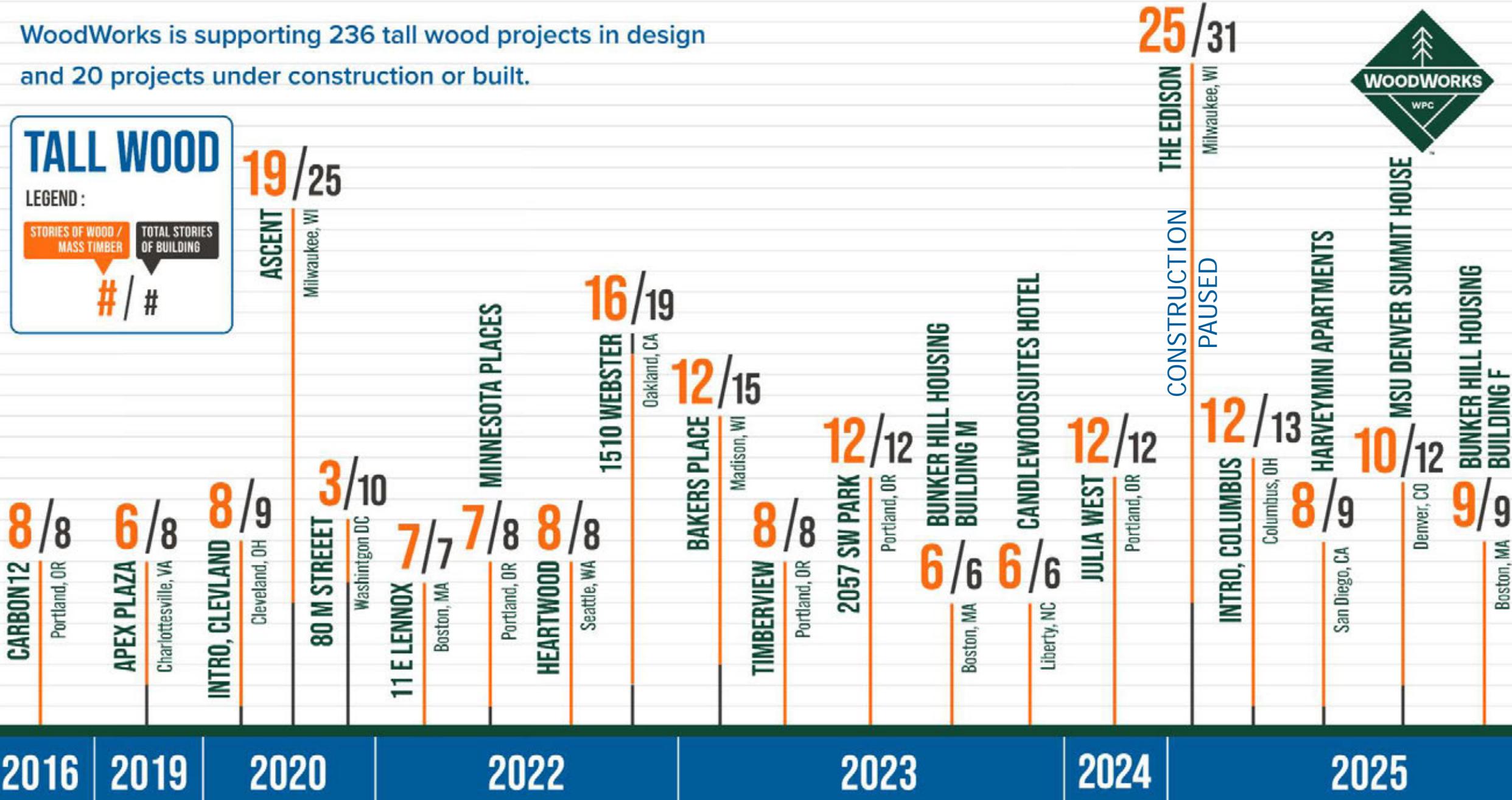
TALL WOOD

LEGEND:

STORIES OF WOOD / MASS TIMBER

TOTAL STORIES OF BUILDING

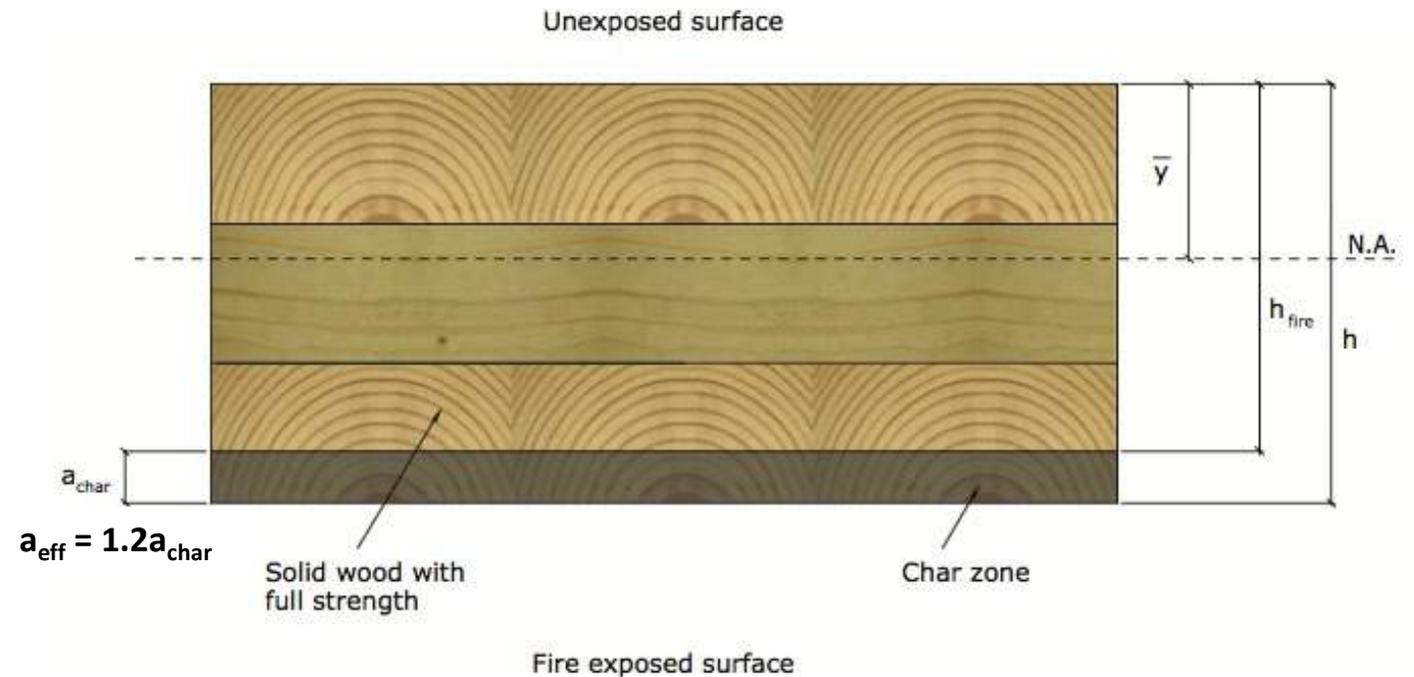
/



Construction type influences FRR

Which Method of Demonstrating FRR of MT is Being Used?

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



Structural Grid - Panels

» Cost and Construction Type – Panel selection

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

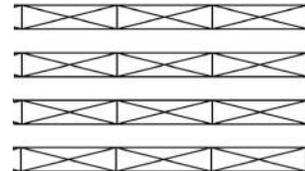
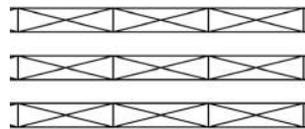
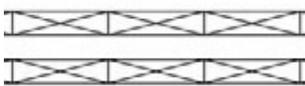
Building Element	I-A	I-B	III-A	III-B	IV-A	IV-B	IV-C	IV-HT	V-A	V-B
Primary Structural Frame	3*	2*	1	0	3*	2	2	HT	1	0
Ext. Bearing Walls	3*	2*	2	2	3*	2	2	2	1	0
Int. Bearing Walls	3*	2*	1	0	3*	2	2	1/HT	1	0
Floor Construction	2	2*	1	0	2	2	2	HT	1	0
Roof Construction	1.5*	1*	1	0	1.5	1	1	HT	1	0

None 20-40% Most All

Baseline
0hr & HT

+\$10/SF over 3-ply
1hr & maybe 2hr

+\$12-15/SF over 5-ply
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.

Value: Program

Level 1



Level 2



Concept Plan

Hillsboro Community Center at 53rd Ave.

May 03, 2016

opsis

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	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>



[Learn](#)[Tools](#)[Events](#)[Award Gallery](#)[Why Wood?](#)[About](#)[Need Project Support?](#)

Expert Tips

Key Design Considerations for Mass Timber Projects

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

Share 

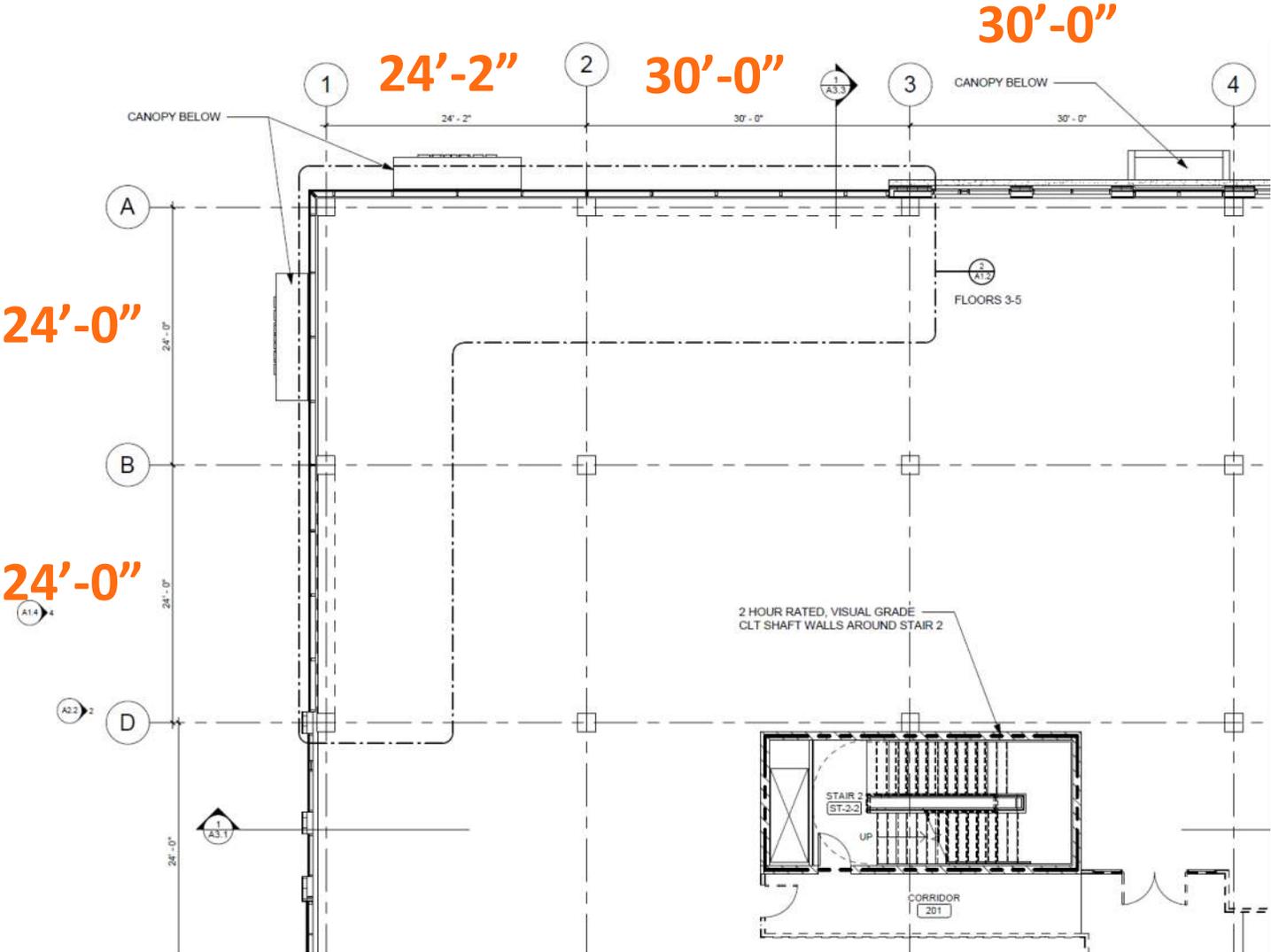
Selecting a Construction Type

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

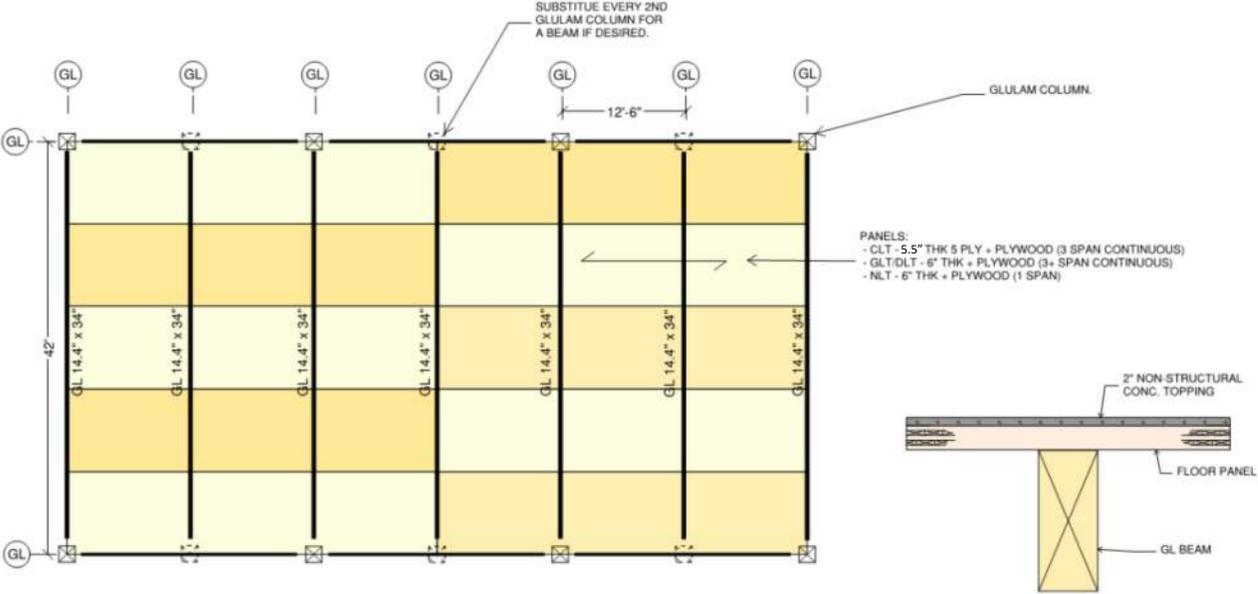
Structural Grid

Grids & Spans

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



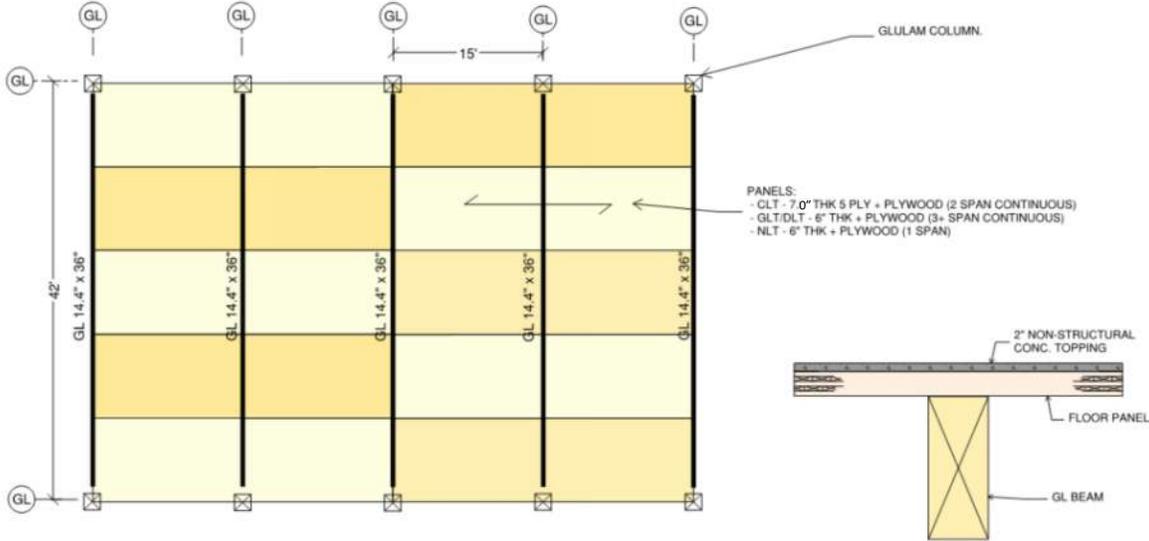
Cost: Structural System & Grid



Baseline

12'-6" Glulam Spacing

5.5" CLT



\$ +5%

15' Glulam Spacing

7" CLT



Photo: Swinerton

[Learn](#)[Tools](#)[Events](#)[Award Gallery](#)[Why Wood?](#)[About](#)[Need Project Support?](#)

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

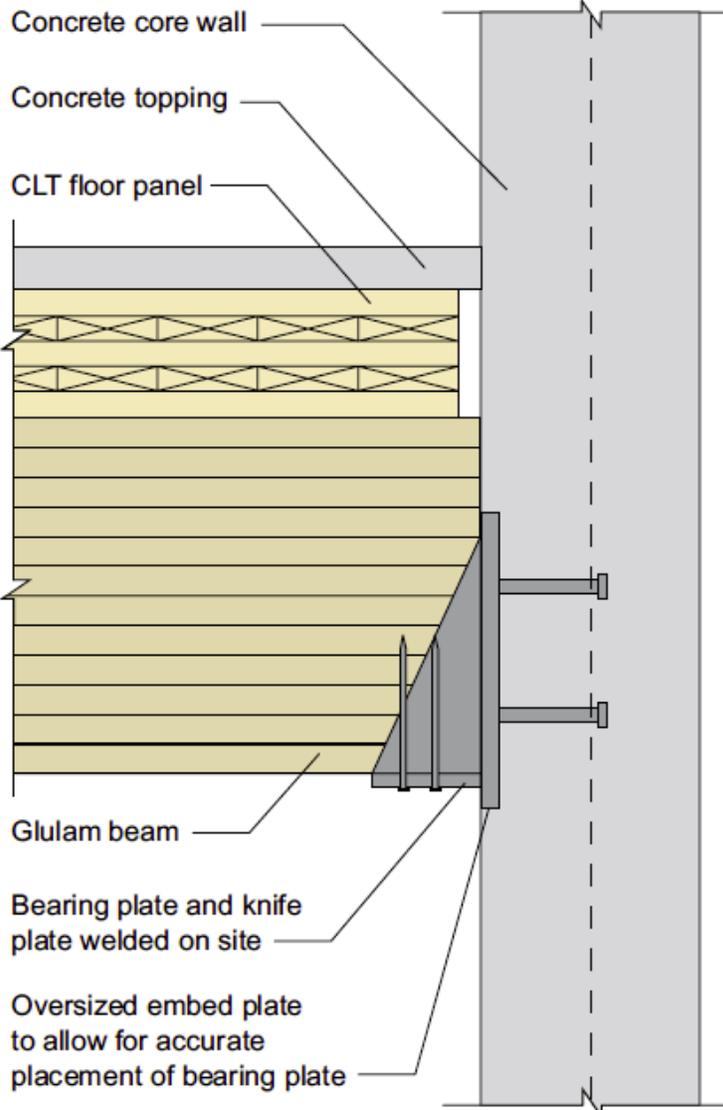
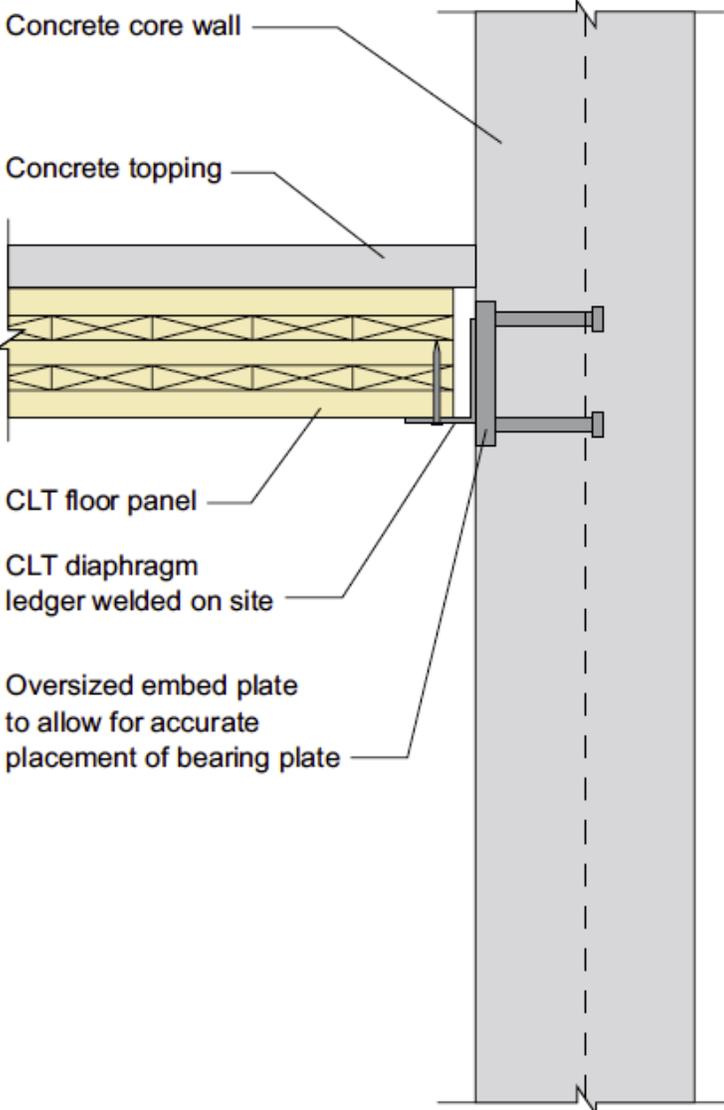
Connections

Other connection design considerations:

- » Structural capacity
- » Shrinkage
- » Constructability
- » Aesthetics
- » Cost



Options for accommodating differential movement



Mass Timber Connections Index

A library of commonly used mass timber connections with designer notes and information on fire resistance, relative cost and load-carrying capacity.

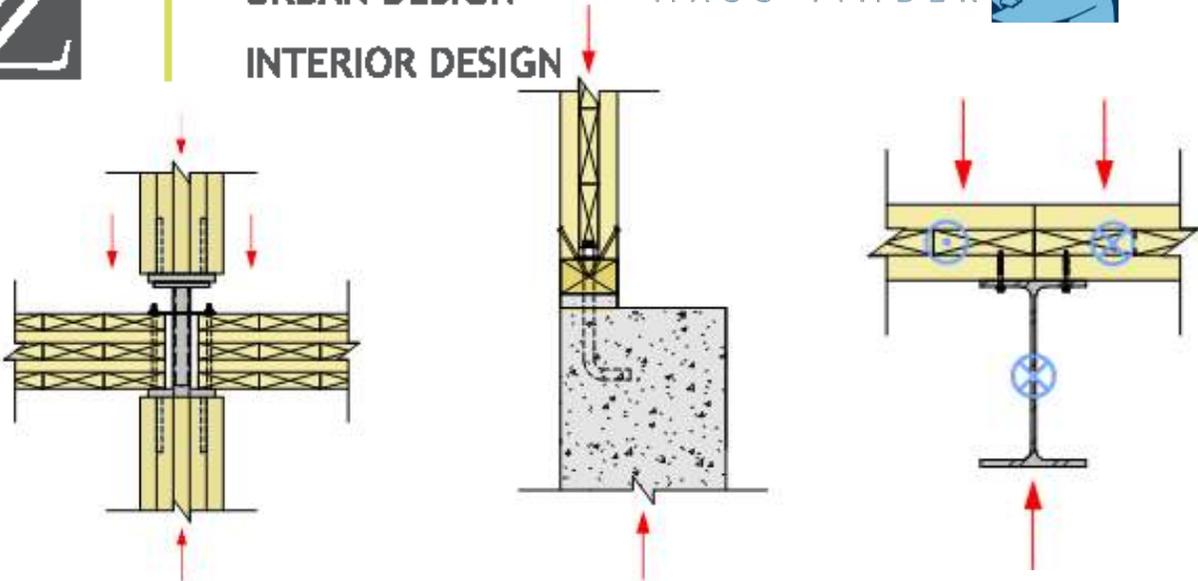


WOODWORKS
WOOD PRODUCTS COUNCIL

KL&A
Engineers & Builders

SWINERTON
MASS TIMBER

ARCHITECTURE
URBAN DESIGN
INTERIOR DESIGN



MEP Layout & Integration

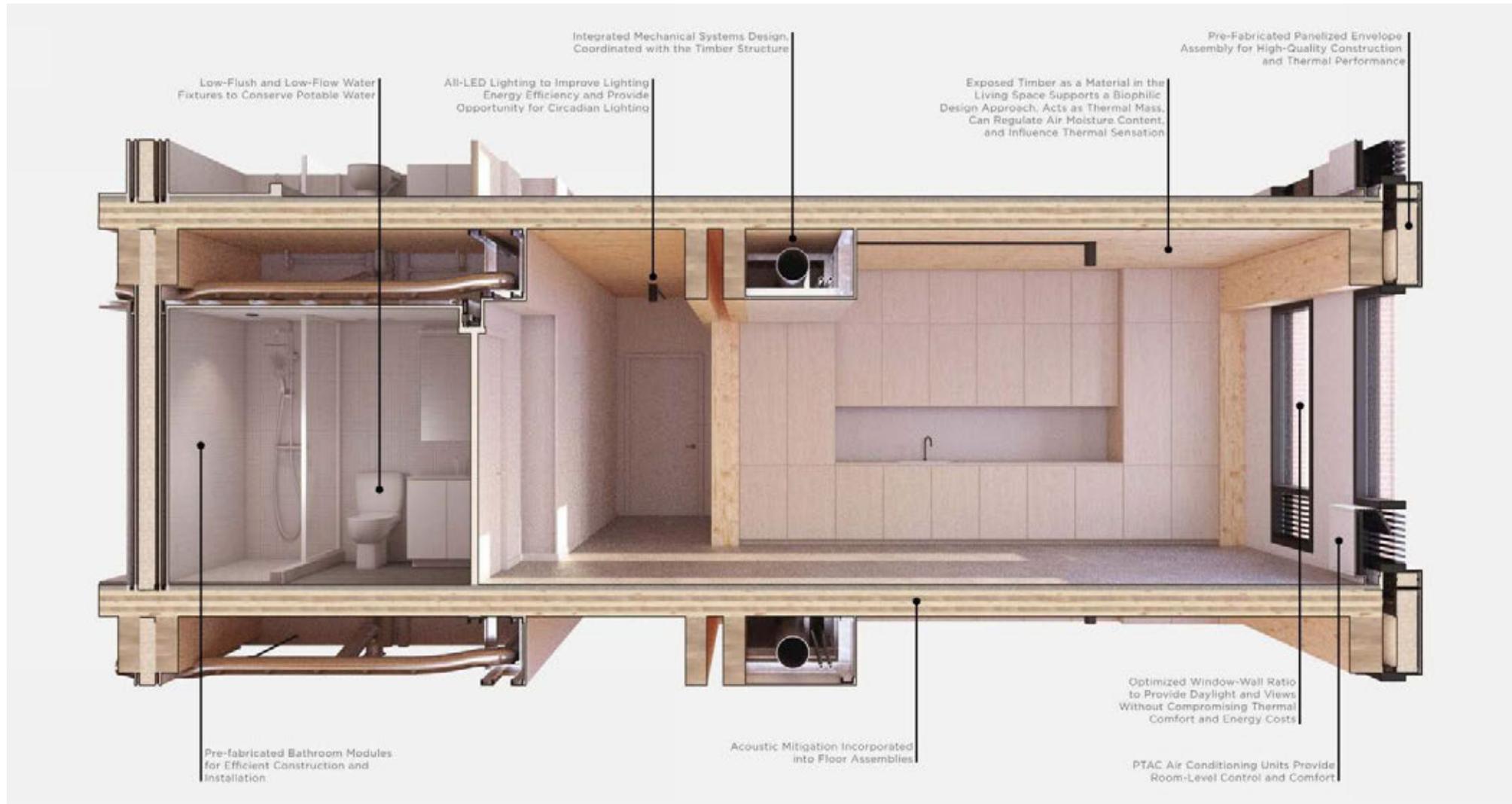
Key considerations:

- » Level of exposure desired
- » Floor to floor, structure depth & desired head height
- » Building occupancy and configuration (i.e. central core vs. double loaded corridor)
- » Grid layout and beam orientations
- » Need for future tenant reconfiguration
- » Impact on fire & structural design: concealed spaces, penetrations

Credit: WoodWorks



MEP SYSTEMS, ROUTING, INTEGRATION



INTEGRATED SYSTEMS

Credit: John Klein, Generate Architecture

The Tallhouse building system prioritizes the integration of design, engineering, and construction. This results in a high performance building finely tuned to meet energy, comfort, acoustic, and design criteria that has been vetted by constructability experts to ensure fast, efficient production.

Utilizing Pre-Fabricated Facade Panels and Bathroom Modules that are manufactured off-site in factories allows for reducing construction time on-site, higher quality control practices, and safer labor conditions for construction workers. Efficient routing of duct-work conserves material, and associated embodied carbon, allowing more exposed timber all while providing the air quality needed for healthy living. Water conserving fixtures reduce potable water use as a precious resource, while maintaining reliable performance.



Timber Lofts

Milwaukee, WI

68,400 sf, 4 stories

Type III-B

Multi-Family

Completed 2020



Enberg Anderson Architects
Pierce Engineers
Photo: Enberg Anderson Architects

Perimeter Glazing



Photo: Mark Bitterman



Acoustics & Sound Control



Images: Maxxon

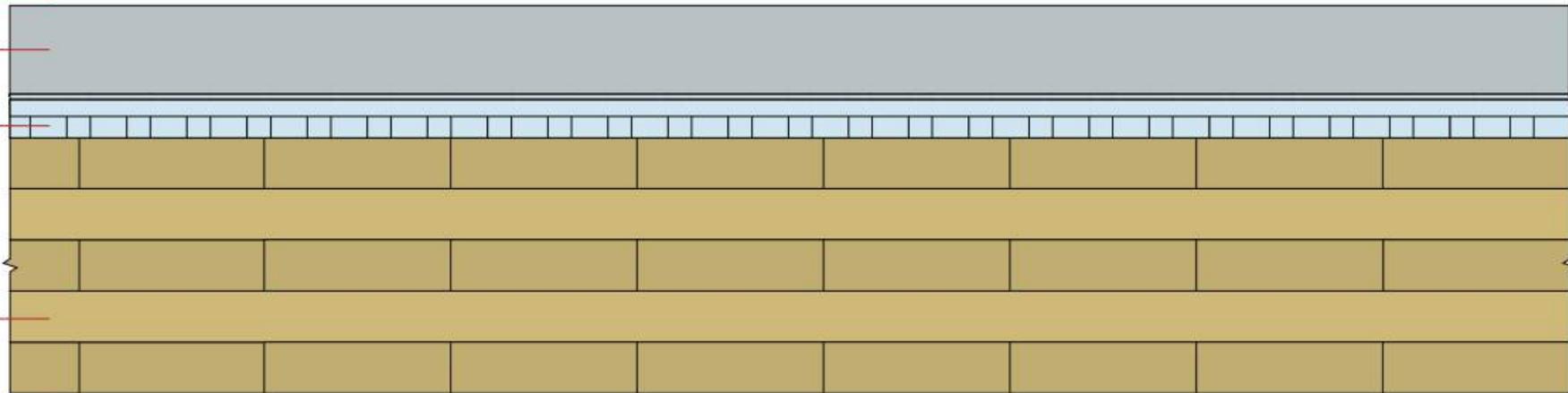
Finish Floor if Applicable _____

Concrete/Gypsum Topping _____

Acoustical Mat Product _____

CLT Panel _____

No direct applied or hung ceiling _____



Mass Timber Fire & Acoustic Database

Search tested and approved assemblies

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

< Back to Mass Timber Fire & Acoustic Database

Assembly Type

- Floor/Roof 532
- Wall 147

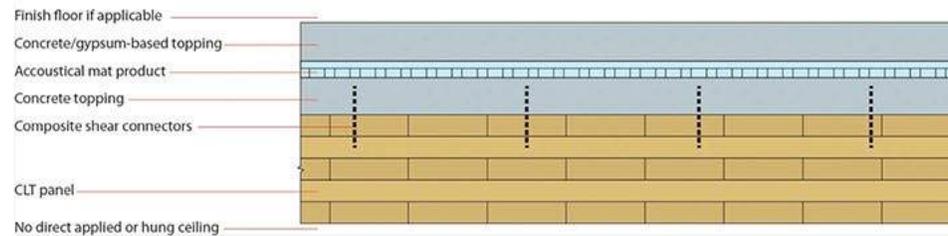
Application Type

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

Mass Timber Panel

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

CLT-Concrete Composite Floor Assemblies, Ceiling Side Exposed



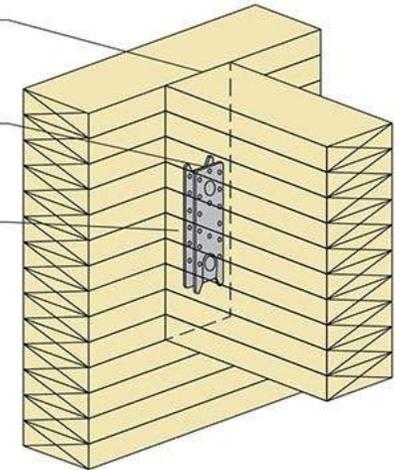
This illustration is for specific construction details.

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

Connection type

Assembly description and connection details

Connection style (concealed shown)

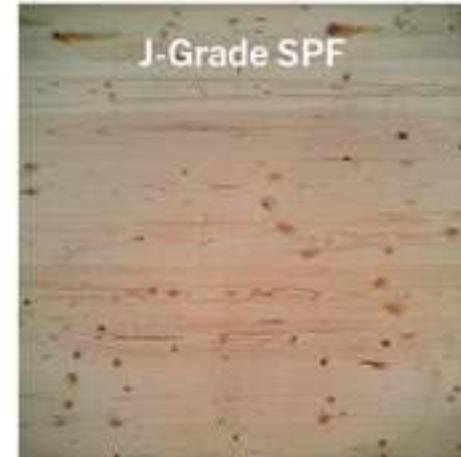


Cost Impacts of Finish/ Appearance Grade

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



MASS TIMBER CONSTRUCTION CONSIDERATIONS



Photo: Hacker Architects

Mass Timber Construction

What does a mass timber construction process look like?

- » Very similar to projects with steel or precast systems
 - » Shop drawings
 - » Erection drawings
 - » Prefabricated members/ connections

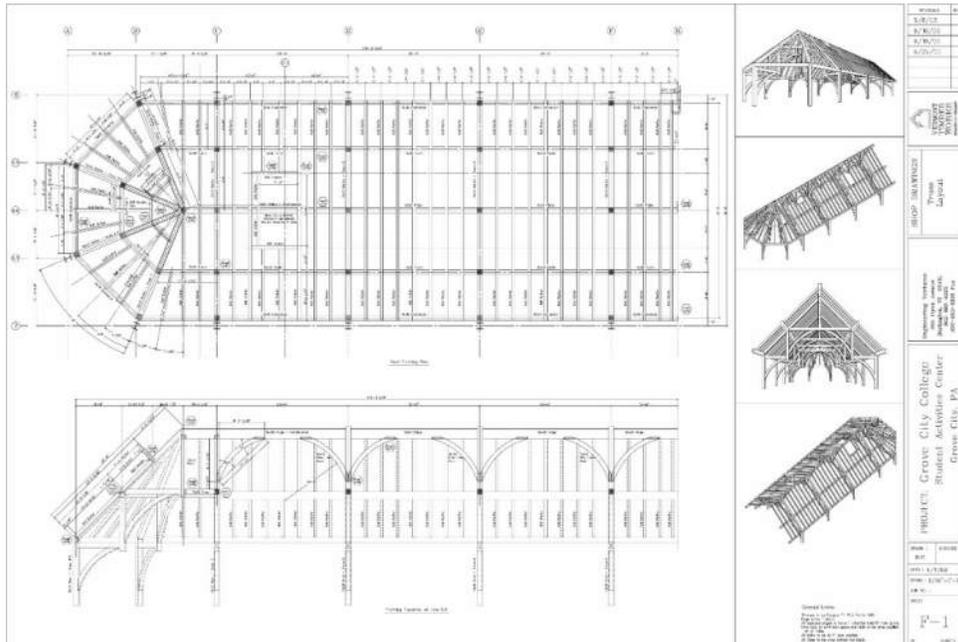


Photo Credit: Alex Schreyer

Holistic Costing



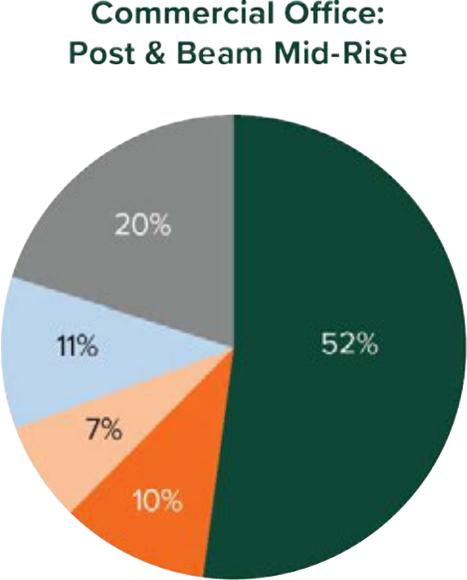
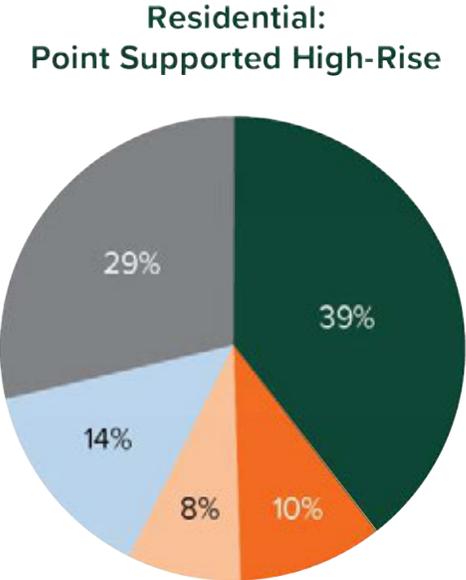
\$/SF



\$/SF

Establishing a Reliable Pre-Design Budget

Problem: Most GCs don't have access to enough benchmarking data to reliably provide a generic per square foot cost in the structure line item of a conceptual trade package build-up



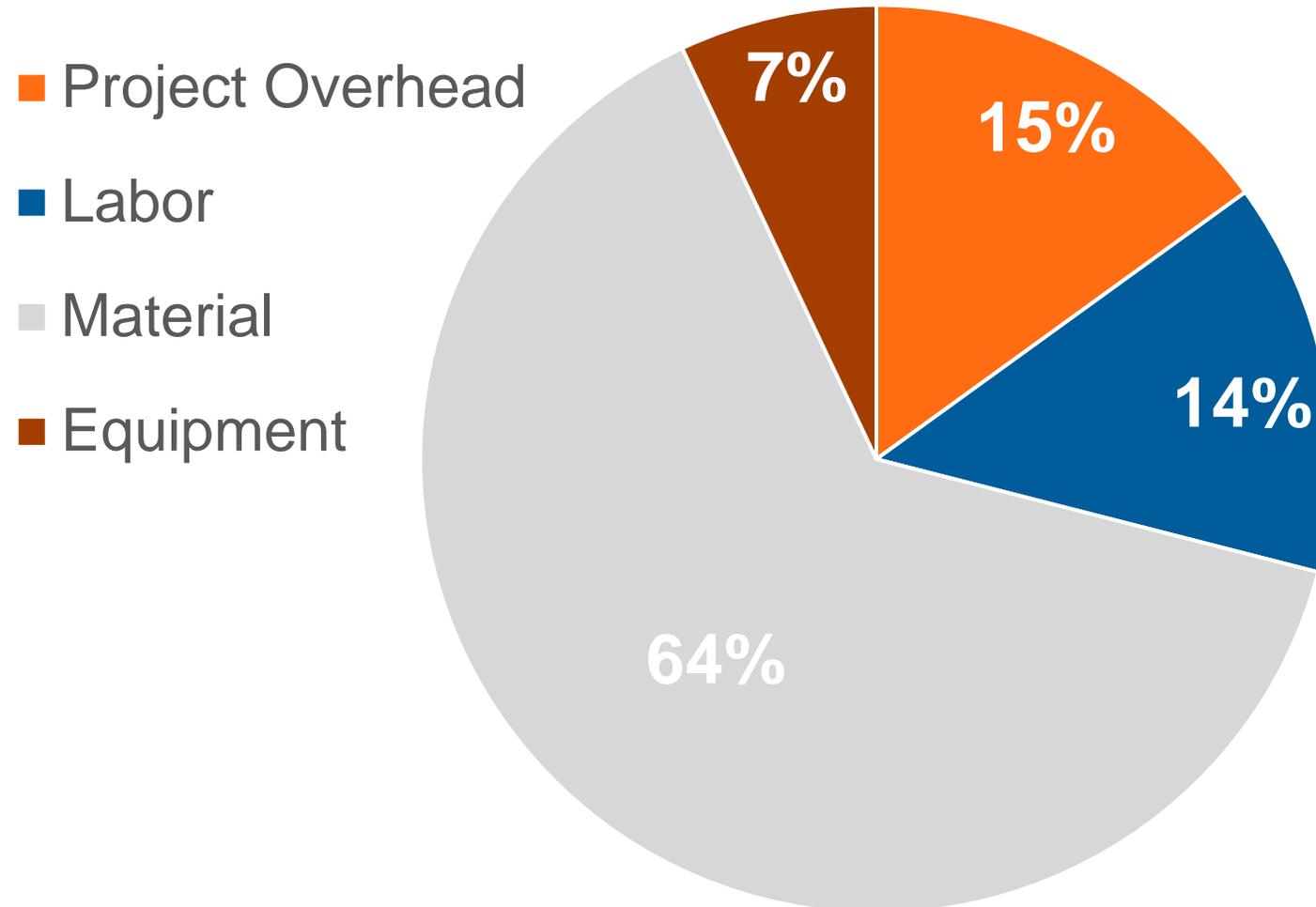
- Timber
- Hardware
- Shipping
- Other
- Installation

Build up costs using first principles based on an informed set of assumptions

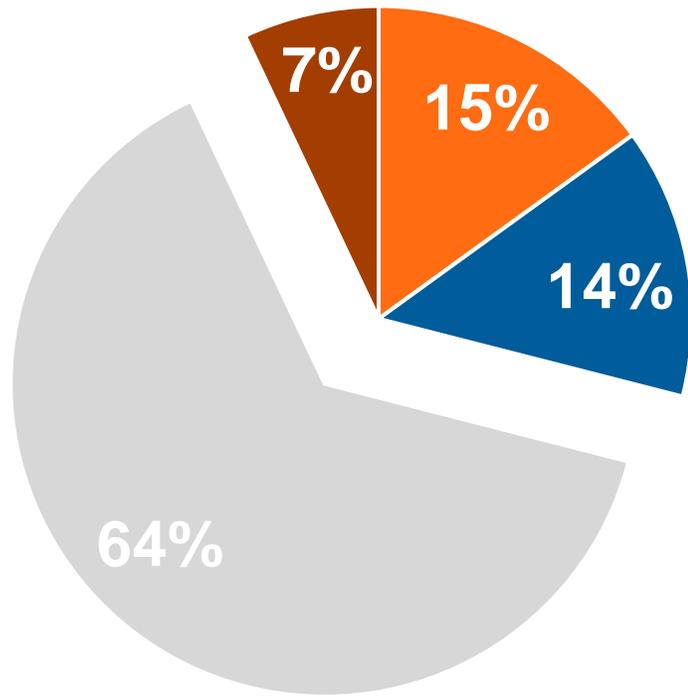
Pricing Breakdown		
Concept/ Schematic Design	Design Development	Bidding
Timber Supply Package	CLT	Floor/roof panels
		Wall panels
		Stair package
		Visual grade
		Temporary sealants
		Factory-applied membranes
		Predrilling/marking
	Glulam	Beams
		Columns
		Blocking/stair package
		Architectural finish
	Hardware	Certification premium
		Connectors
		Preassembly
		Fasteners and splines
	Logistics	Hardware shipping
		CLT shipping
		Glulam shipping
	Other	Temporary storage
		Project management/design assist
Installation	Labor and equipment	Fabrication model/shop drawings
		Schedule duration
		Crew size
	Crane	On-site moisture management
		Size
	Staging yard	Duration
Taxes		

Items in green are not typically included in early pricing; develop separate budgets if needed

Anatomy of a Turnkey Mass Timber Package



Material (Direct Cost)



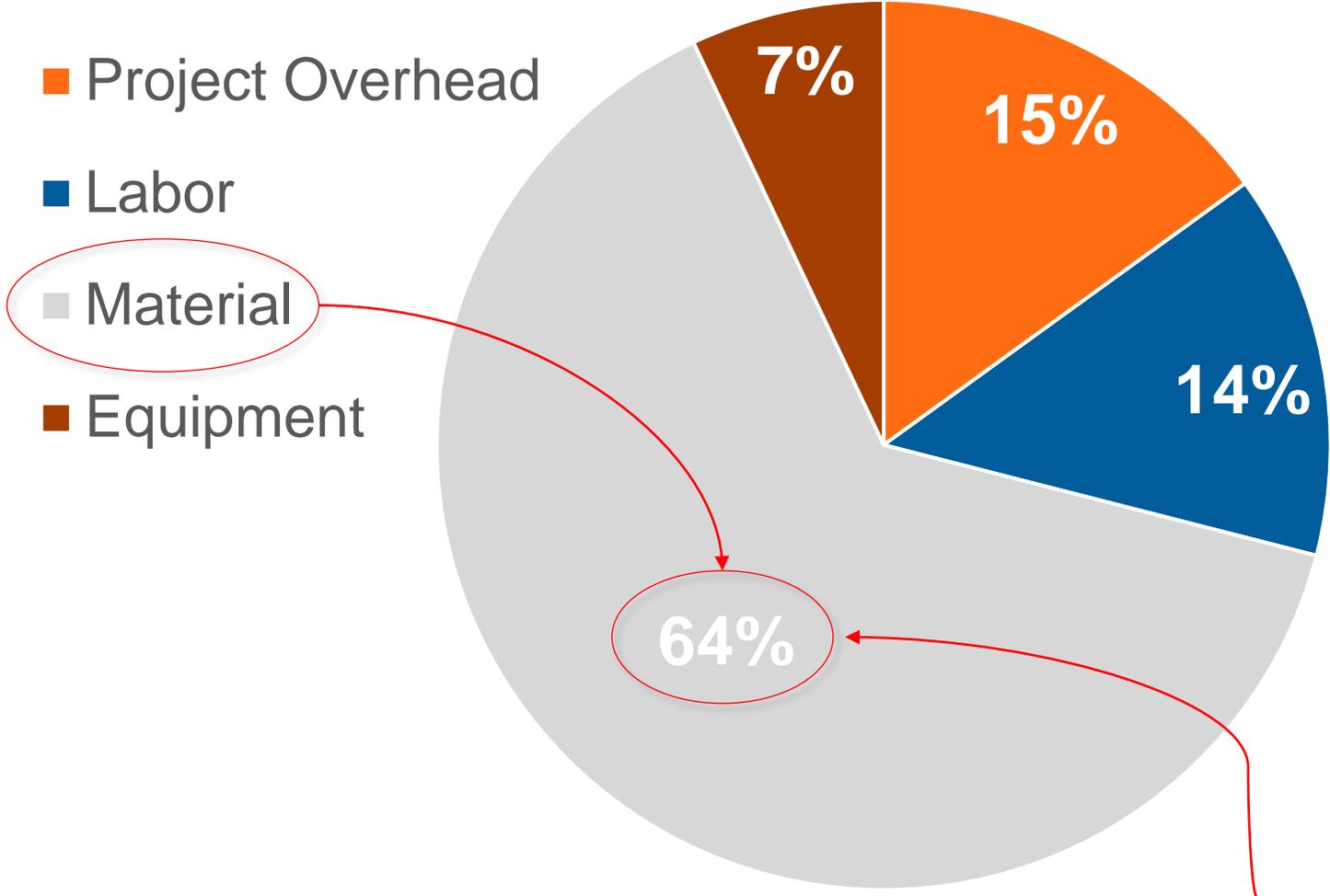
Turnkey Mass Timber Package



or



Mass Timber Package Costs



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

Understand the Supply Chain

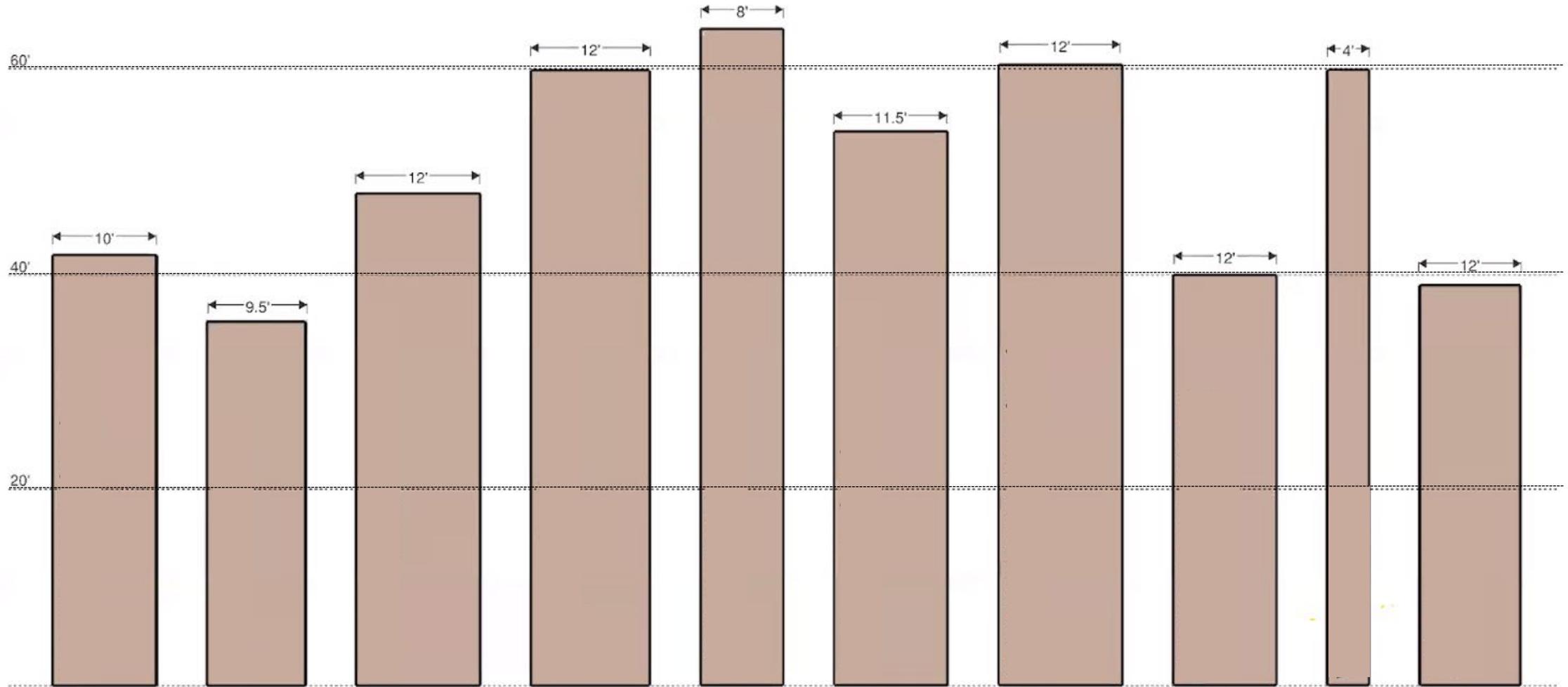


Photo: Swinerton

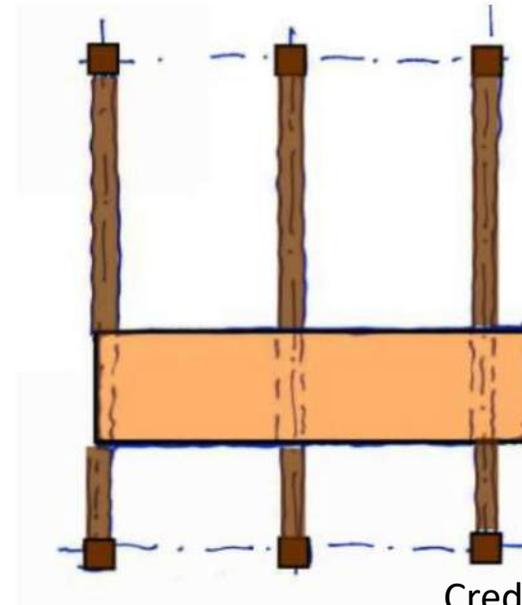
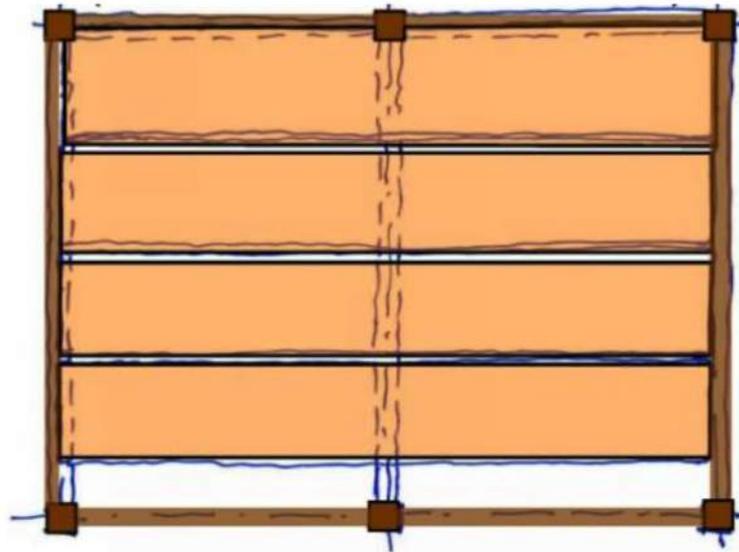
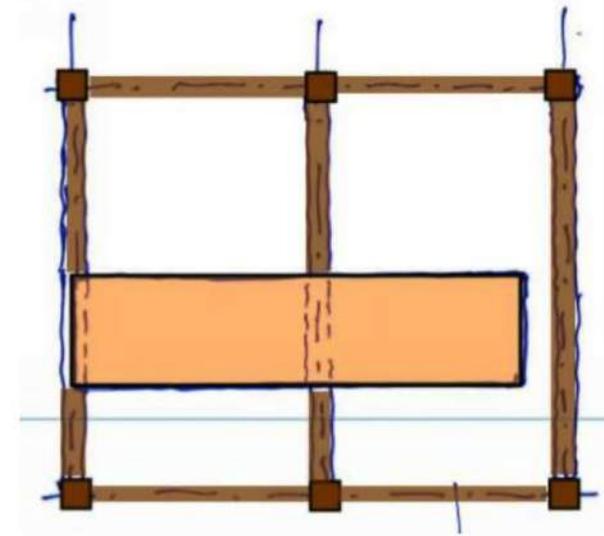
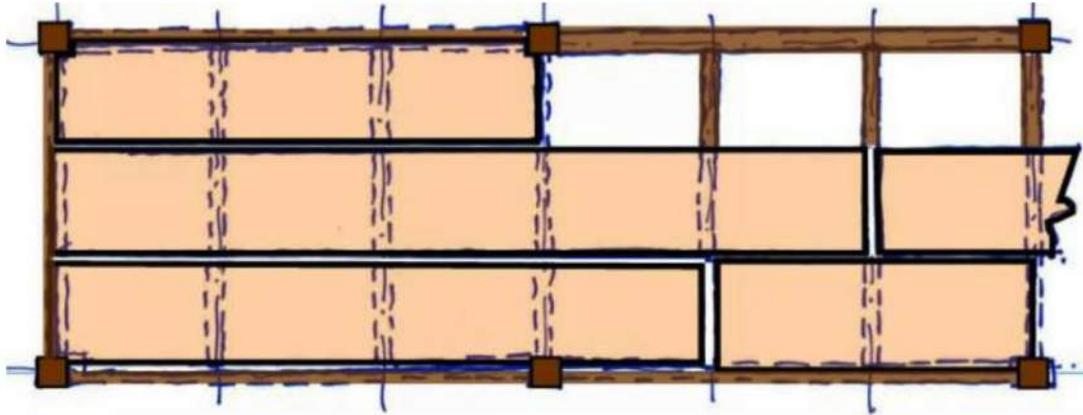
Material Fabrication Planning



Understand Manufacturer's Capabilities



Credit: TimberLab



Credit: Tanya Luthi, Entuitive

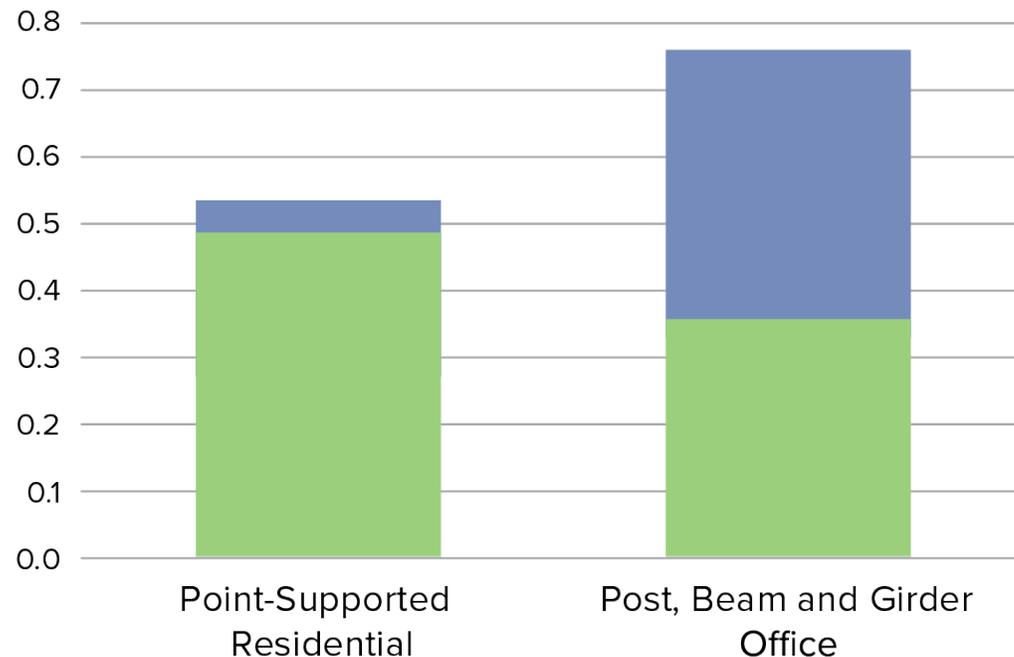
Understand Manufacturer's Capabilities

Manage Project Costs

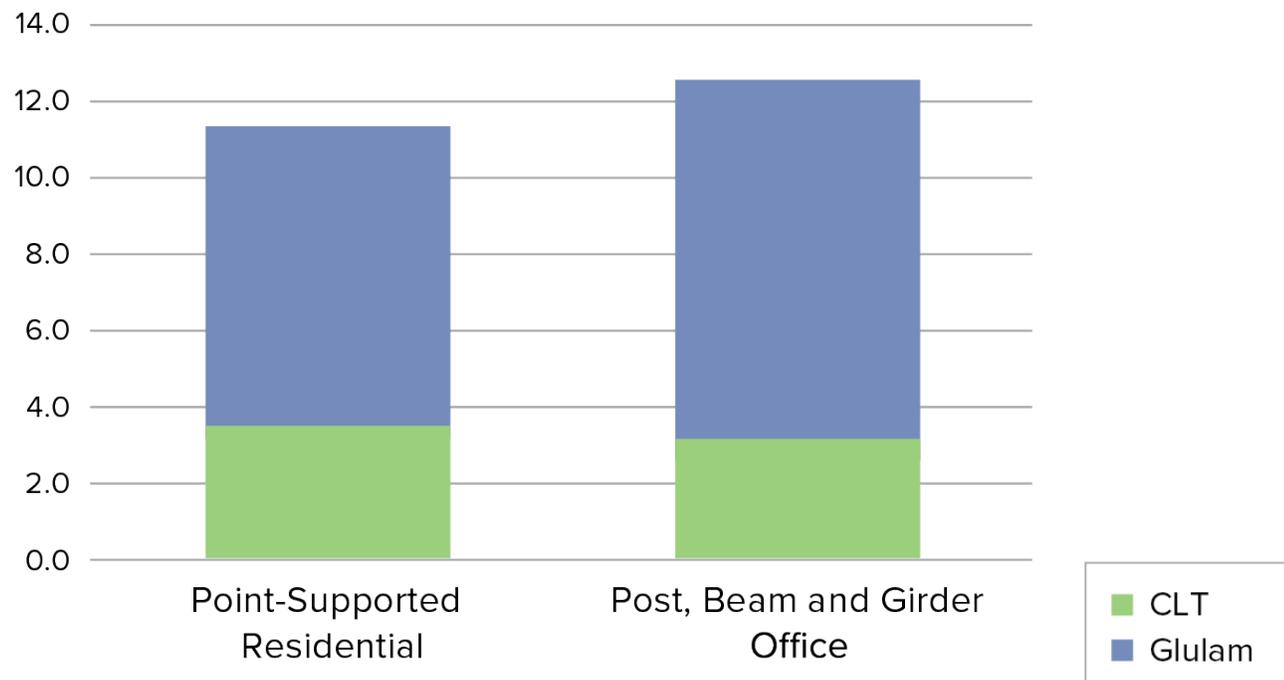
Cost Benchmarking

- Volume efficiency ratio: ft^3/ft^2 provides a simple rule of thumb for estimating future projects
- Piece count: cost/piece and piece count/nK ft^2 “What is the estimated number of pieces in relation to the installation cost?”
- Others

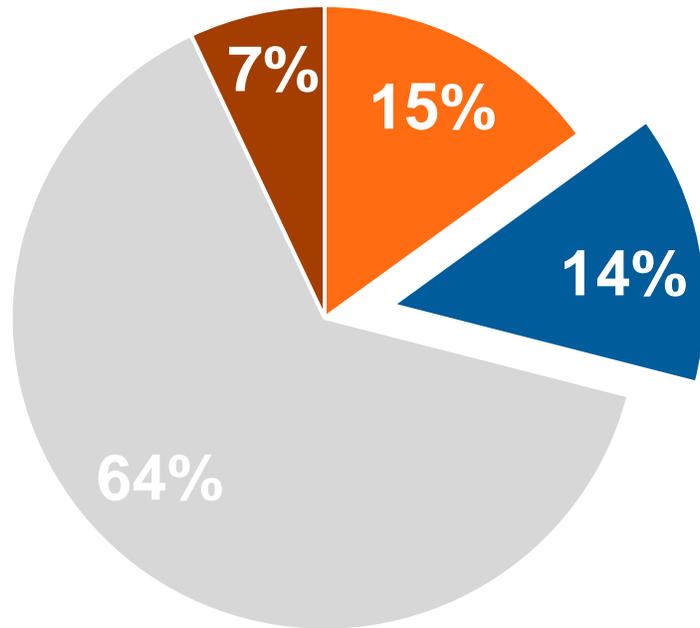
Volume Efficiency Ratio (ft^3/ft^2)



Piece Count Ratio (Piece/1000 ft^2)



Labor (Direct Cost)



Turnkey Mass Timber Package



Photo: Swinerton

Labor Benefits

- » Labor Shortage Solution
- » Small crews for timber frame installation
- » Utilize more entry-level laborers when MEPF systems fully designed, coordinated & pre-planned
- » Safer construction sites



Power Tools

Drill, nailer, screw gun, upright screw gun, circular saw with mortiser blade, chainsaw with channel cutter attachment, large-diameter hole saws....

Batteries and Mobile Charging Points

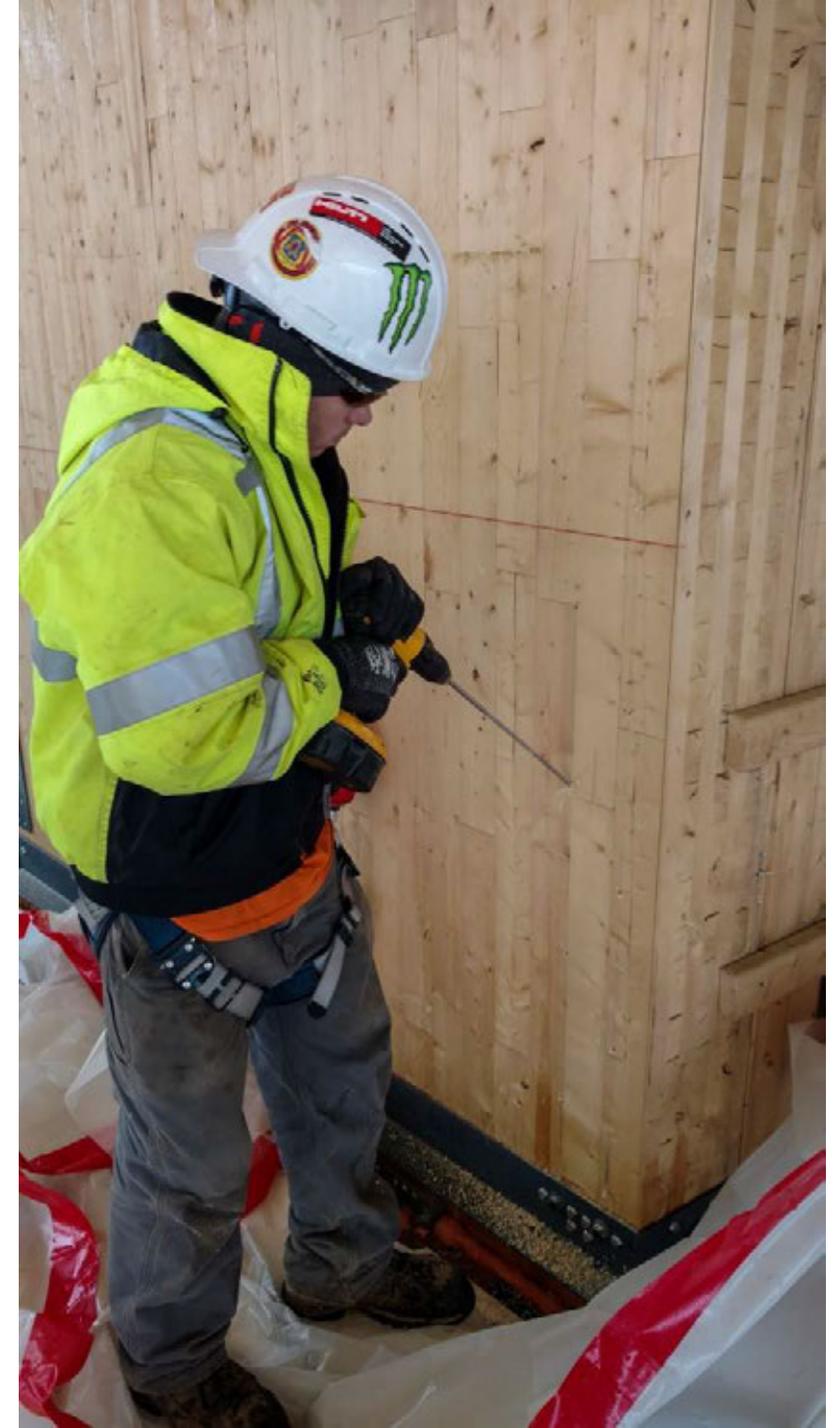


Photo Alex Schreyer

Field Fabrication and Penetrations

Holes, notches and other alterations should be made during fabrication to the greatest extent possible, but some may also be done in the field.



INTRO

Harbor Bay Ventures / Hartshorne Plunkard
Architecture / Forefront Structural Engineers /
Fast + Epp / Panzica Construction
Photo WoodWorks



Candlewood Suites Fort Bragg

Fayetteville, NC

Building Facts 122,212 sf, 6 stories

Type IV-C

Hotel / Motel

Expected Completion 2025

Developer Rest Easy, LLC

Architect LK Architecture

Engineer SCA Consulting Engineers

General Contractor Lendlease



Candlewood Suites Fort Bragg

Fayetteville, NC

- » Sixth CLT structure in the Privatized Army Lodging (PAL) Program
- » Meets Anti-Terrorism and Force Protection Requirements



Candlewood Suites Project Savings

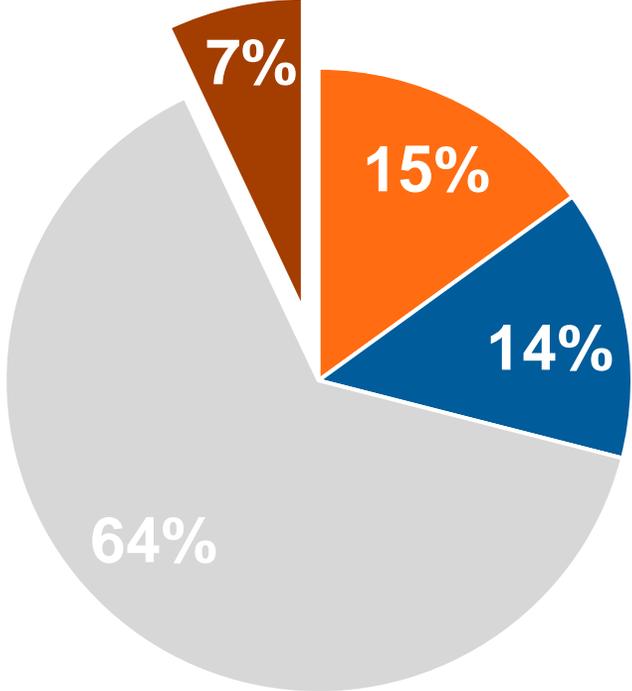
Savings on this CLT project vs. light gauge steel construction

PAL Portfolio	Typical New PAL Hotel (Actual*)	Redstone Arsenal (Actual)	Difference
Gross square feet (sf)	54,891	62,688	+14%
Average # of employees	18 (peak 26)	10 (peak 11)	-43%
Structural duration (days)	123	78	-37%
Structural person hours	14,735	8,203	-44%
Structural production rate/day	460 sf	803 sf	+75%
Overall schedule	15 months	12 months	-20%



* PAL New Build Hotel Historical Average
 Source: Lendlease

Equipment (Direct Cost)



Turnkey Mass Timber Package

Source: Swinerton



Photo: Swinerton



Photo: Alex Schreyer

PICK PLAN



Photo: Swinerton

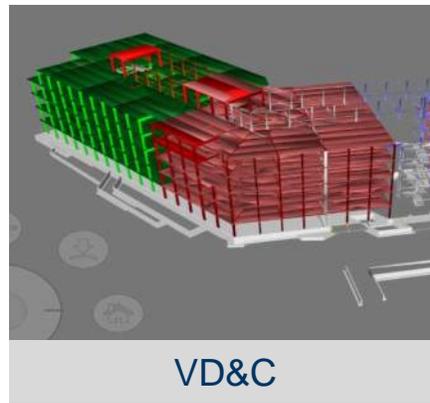
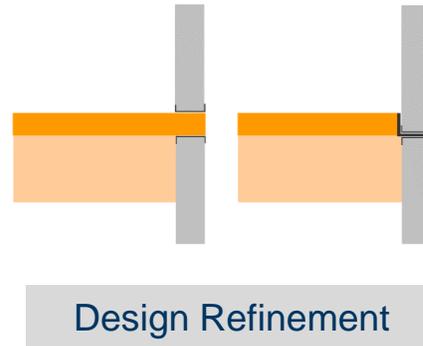
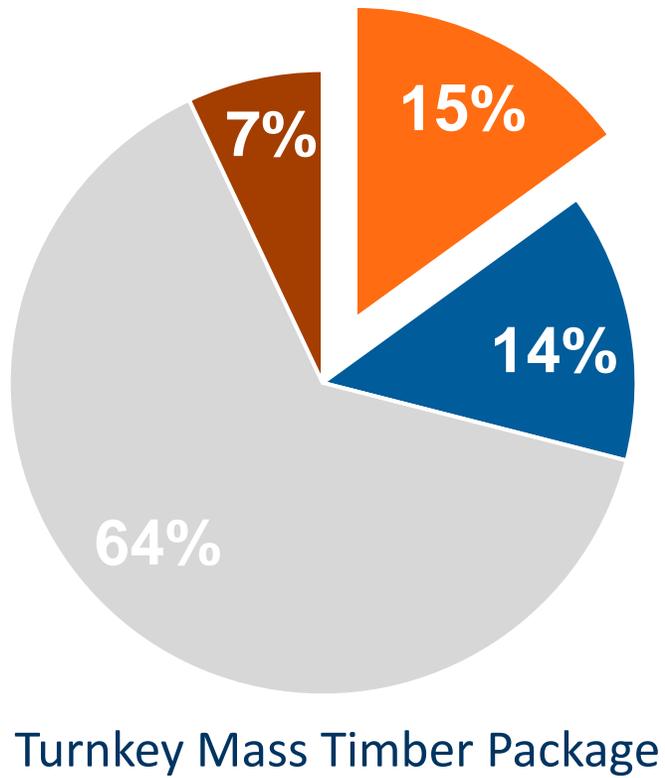
MATERIAL DELIVERY



Photo: Swinerton

SOLD & SERVICED BY
Ocean
TRAILER RENTALS
(604) 945-3718

Project Overhead



Photos: Swinerton

Do Your Homework

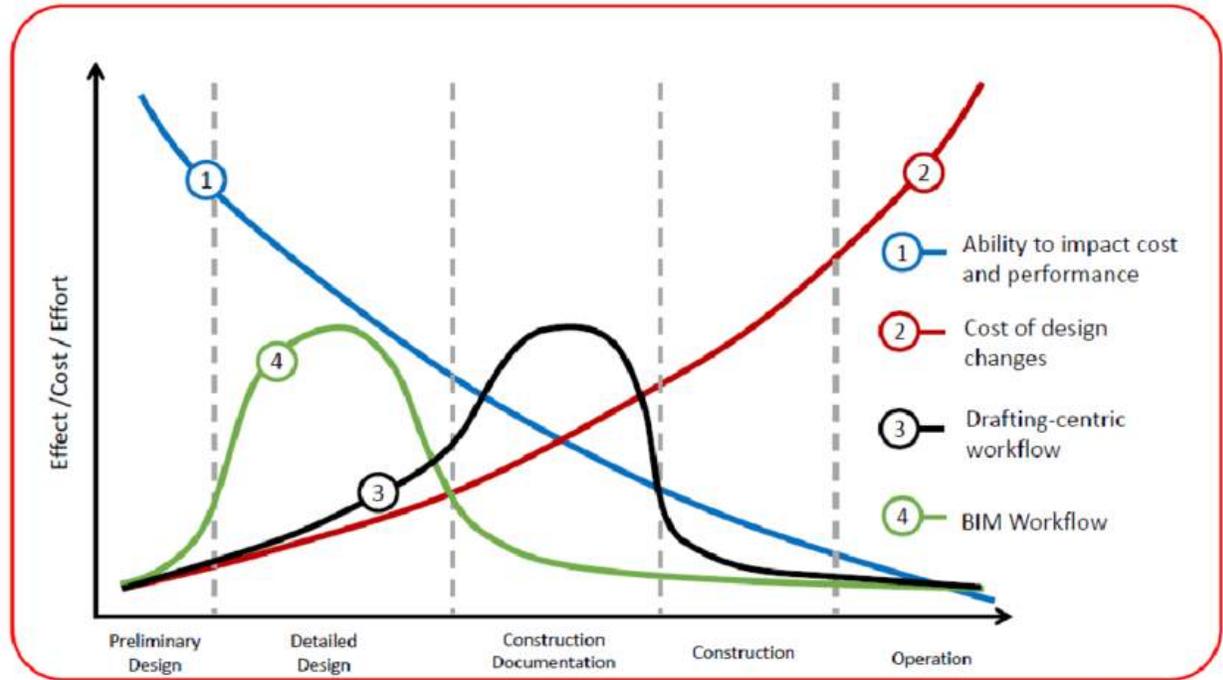
Factors Influencing Cost Estimation

Design Complexity: High impact on material and labor costs

Material Availability:

- Regional differences in availability and pricing
- Understand which suppliers and subcontractors are appropriate for your project and how best to use them

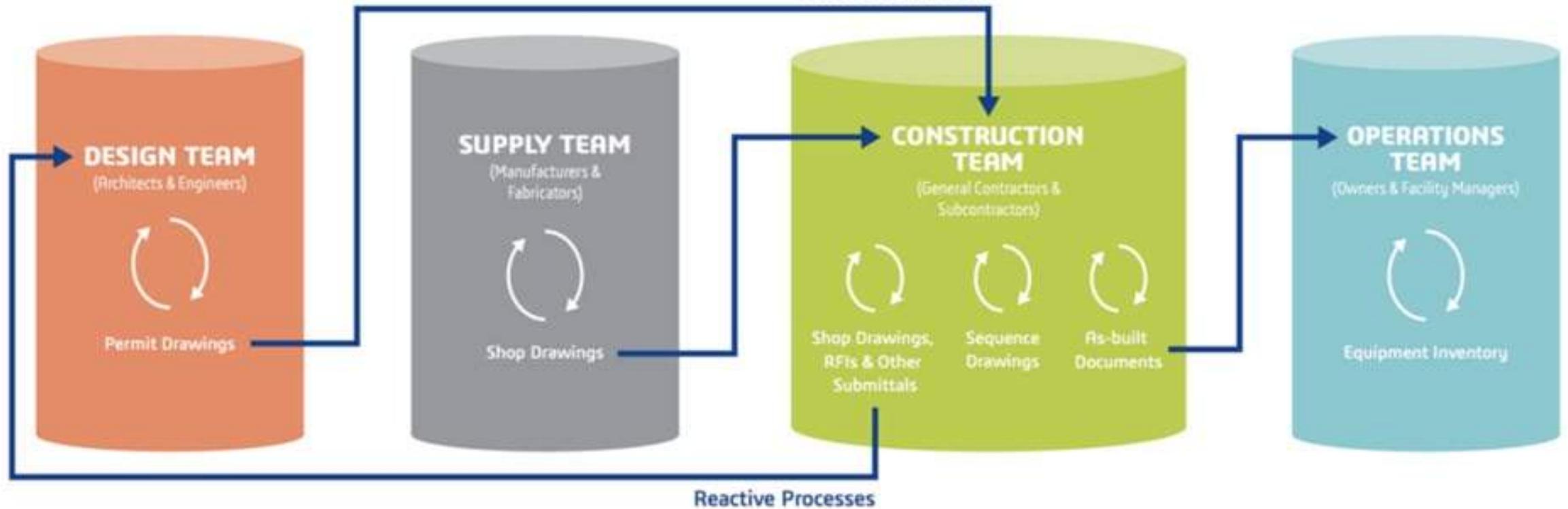
Procurement Model: Can impact the timber package price by as much as 30%—or more than 5% of total project hard costs



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

Potential Cost Impacts: Design-Bid-Build Procurement



Procurement Strategy is Key to Success



5% Savings

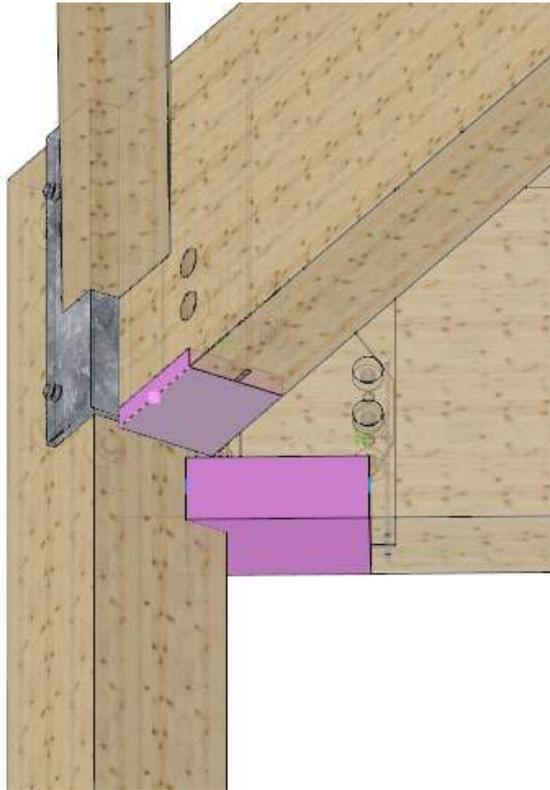
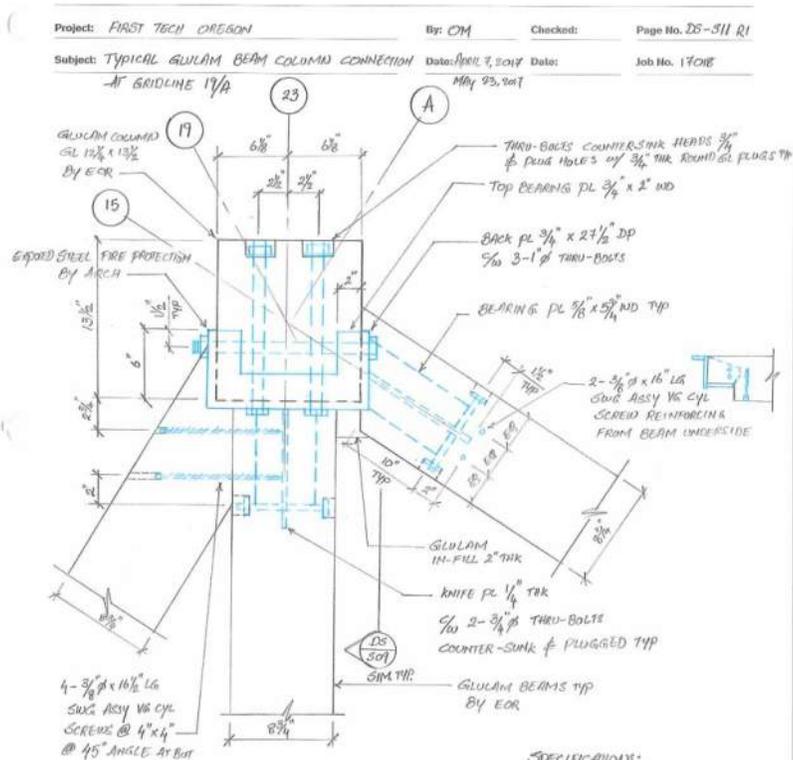
Neutrality

10% Premium



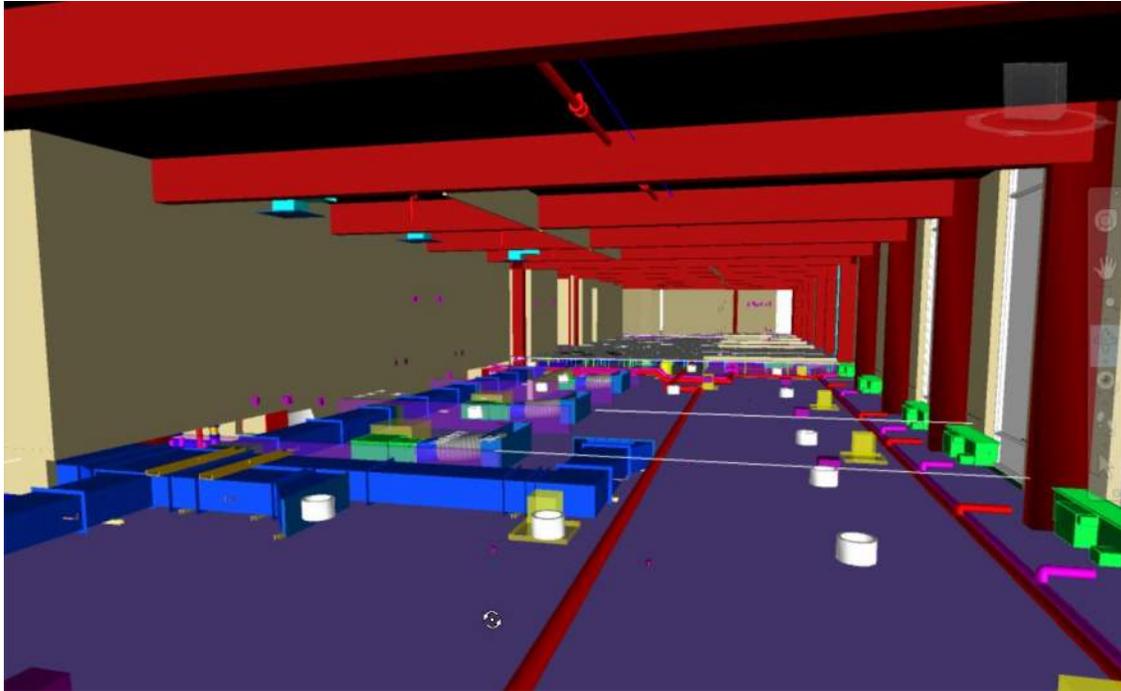
Embrace the
Prefab Advantage

BIM/Digital Twins



Photos: Swinerton

Embracing BIM for Fabrication

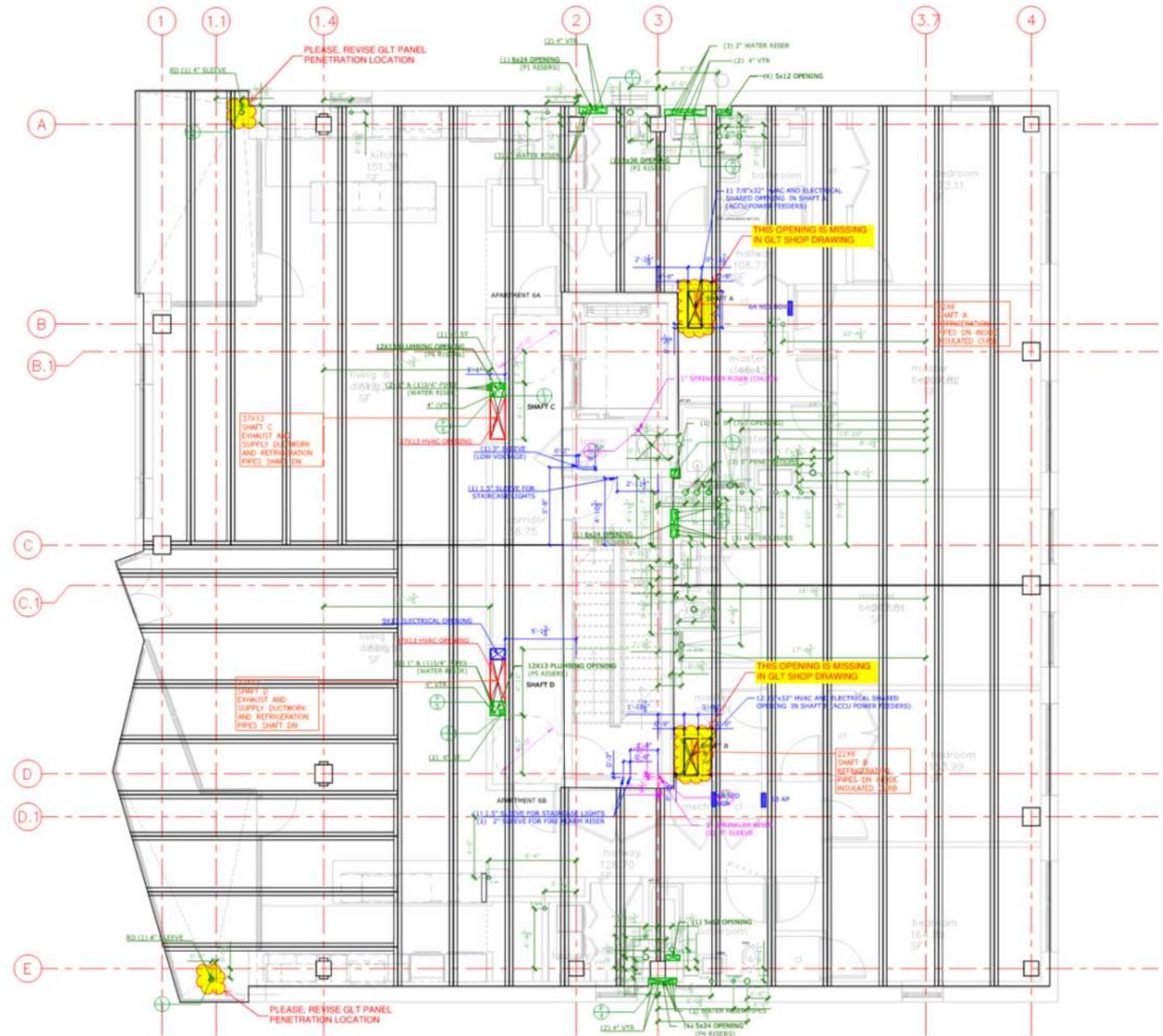


Photos: Swinerton

Penetrations

These drawings are:

- » Used by the manufacturer to pre-cut holes
- » Coordinated by the GC with input from the:
 - » Architect
 - » Engineer
 - » Mass timber manufacturer(s)
 - » Specialty subs
 - » Digital drafting crew (if different from the manufacturer)



Strategies for Success

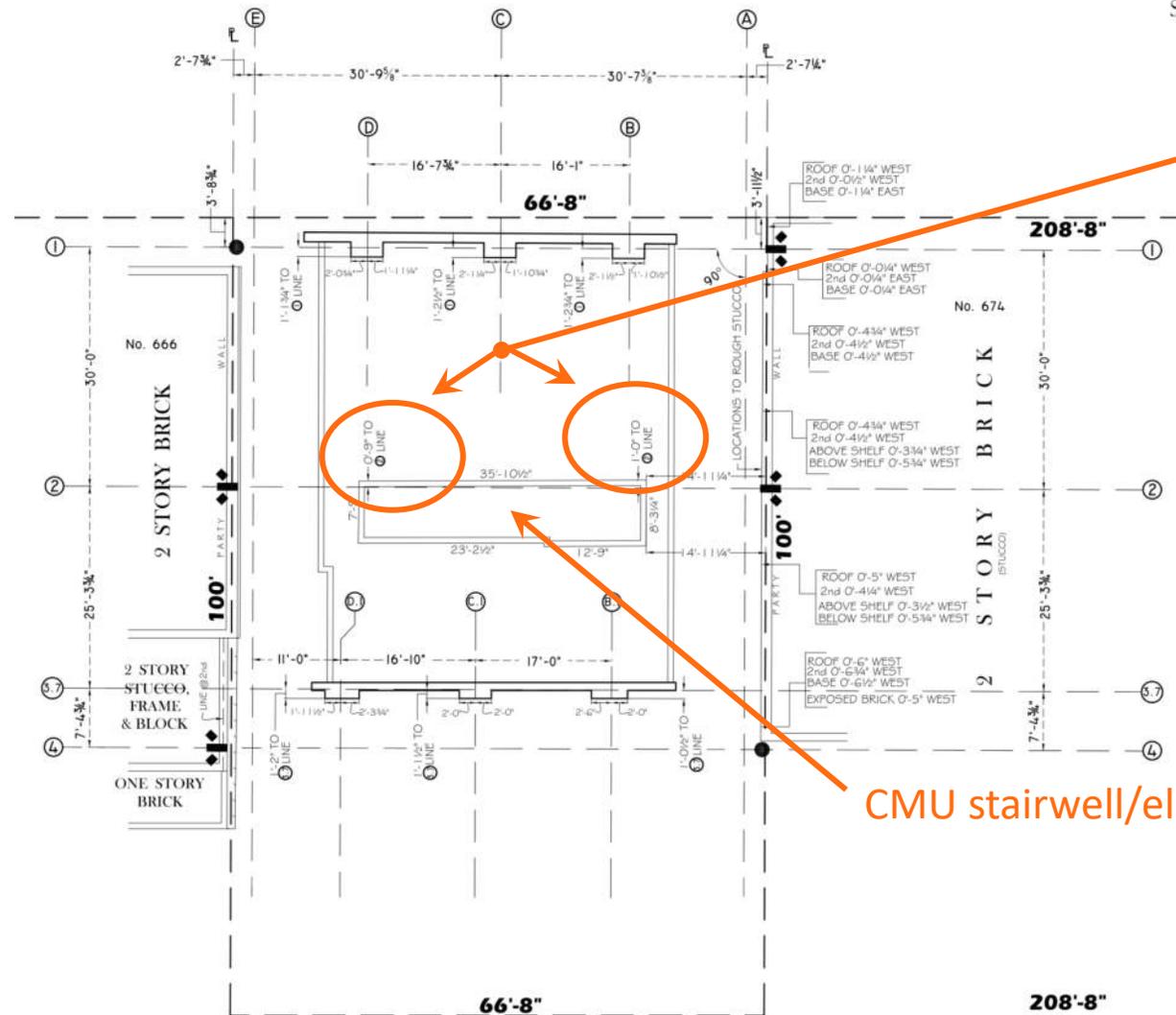
Plan as-builts from the start

Collect good data



Idaho Central Credit Union Arena
Opsis Architecture / Hastings+Chvetta /
KPFF / StructureCraft
Photo University of Idaho

As-Designed vs. As-Built Elevator Core at Timber House – Example



3" deviation between the **as-designed** dimensions and **as-built** foundation dimensions

CMU stairwell/elevator core

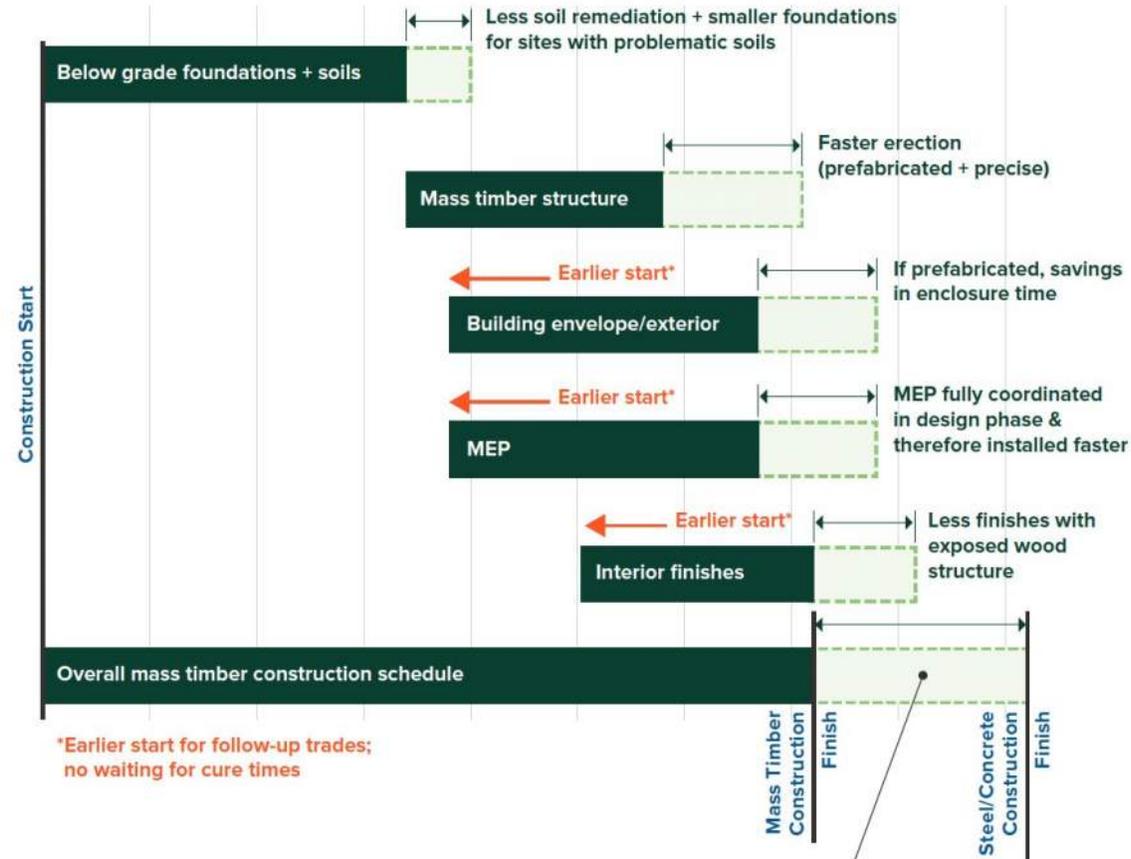
Schedule Drivers



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



Up to 25% schedule savings

- = Less carrying costs
- + Less GC overhead
- + Ability to lease/occupy sooner

Procurement Approach Determines Schedule

Example 6 Story Type IIIA Project



2019

2020

2021

2021

Source: Swinerton

Design-Bid-Build Procurement

Procurement Approach Determines Schedule

Example 6 Story Type IIIA Project



2019

2020

2021

2021

Source: Swinerton

Design-Build/Design-Assist Procurement

Procurement Logic for Scheduling

Shop drawings, Planning, Fabrication, Delivery

Mass Timber
Installation

Nov Dec Jan Feb Mar Apr May Jun Jul Aug Sep

Source: Swinerton

Example 6 Story Type IIIA Project



Bunker Hill Housing Redevelopment – Stellata

Boston, MA

Architect: Stantec

Engineer: McNamara • Salvia

Photo: Bryan Maltais with McNamara • Salvia

119,600 sf, 6 stories

Type IV-C

Multi-Family

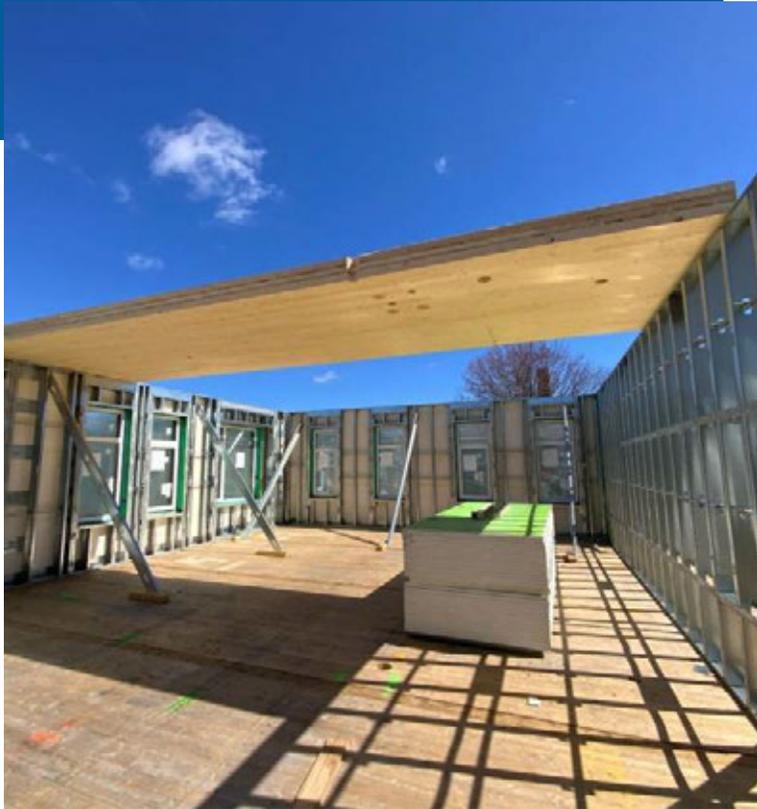
Mass Timber / Light Gauge Hybrid

Completed 2025

Bunker Hill Housing Redevelopment – Stellata

Boston, MA

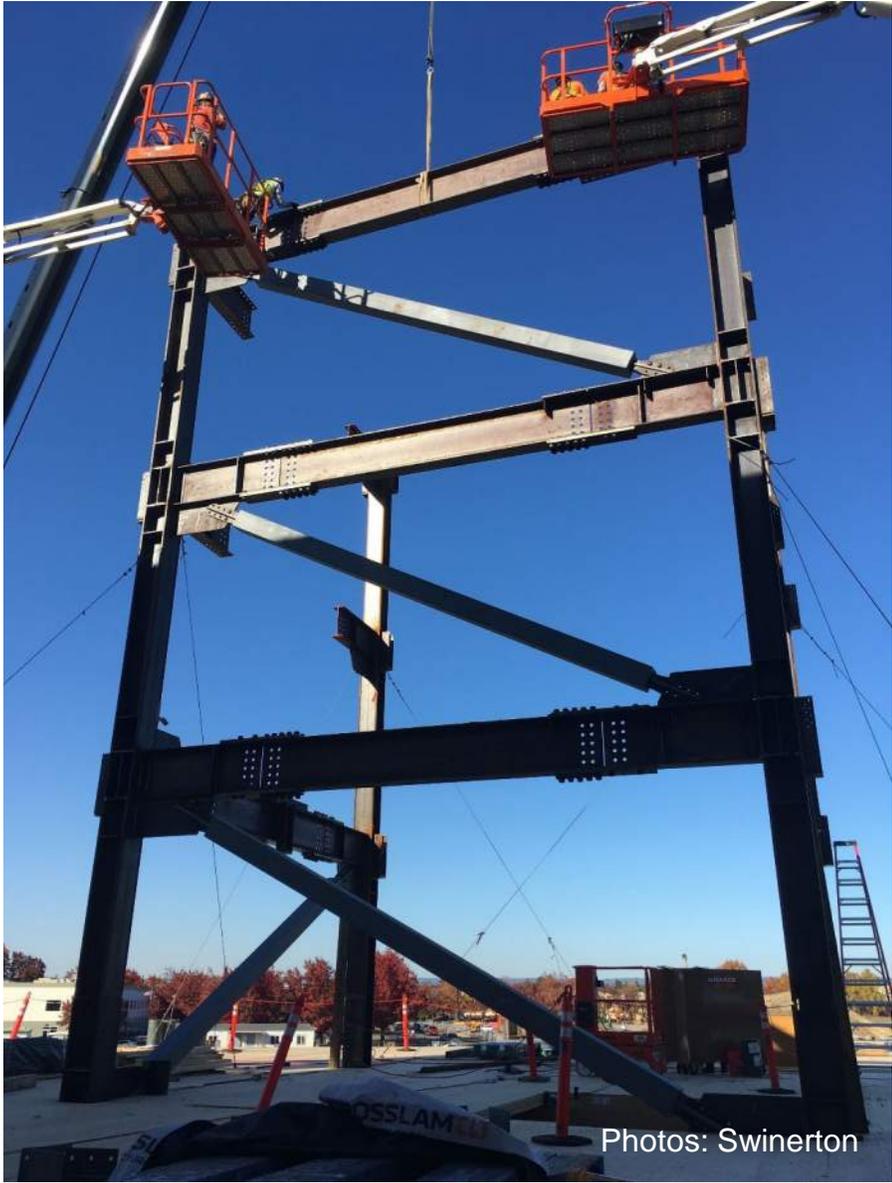
- » First of 15 residential buildings offering 2,699 units
- » All buildings designed to Passive House standards
- » Prefabricated Light Gauge metal and CLT panels



Photos: Courtesy Stantec

Architect: Stantec
Engineer: McNamara • Salvia

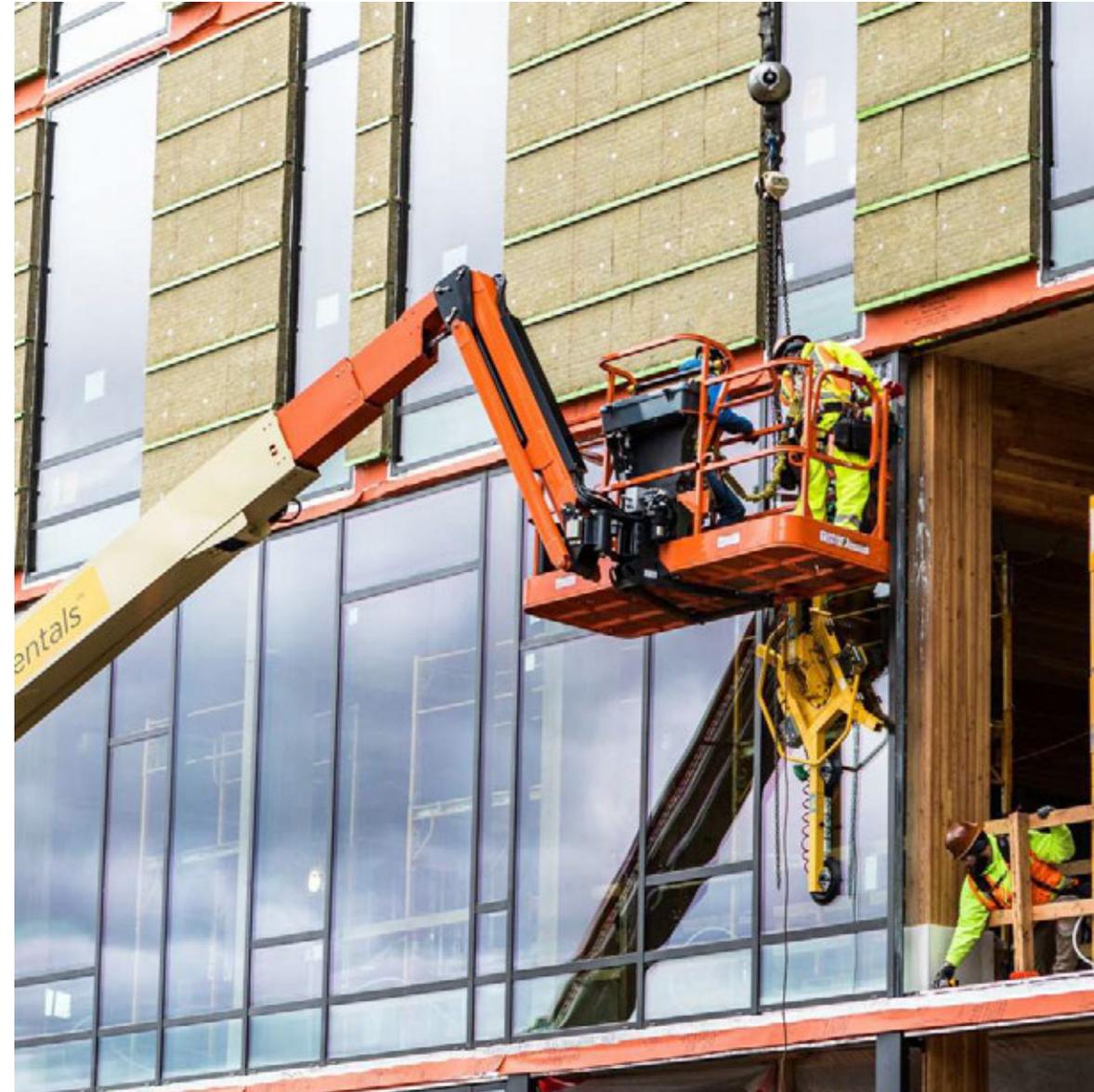
Schedule Impacts: Hybrid Structures



Early Move-In for Rough-In Trades.



Photos: Swinerton



Return To Form

Comparative Life Cycle Assessment Study

Author: KL&A Engineers & Builders



Return to Form / Katz Development
/ tres birds / KL&A Engineers & Builders

Manage Project Costs

Other Non-Timber Design Cost Levers

- Cost saving opportunities can be offset by increases in other areas of the construction budget.
- Compensating for these incremental increases and achieving real savings requires a focused effort to both actively leverage opportunities and minimize (in order of effect);

Lateral systems

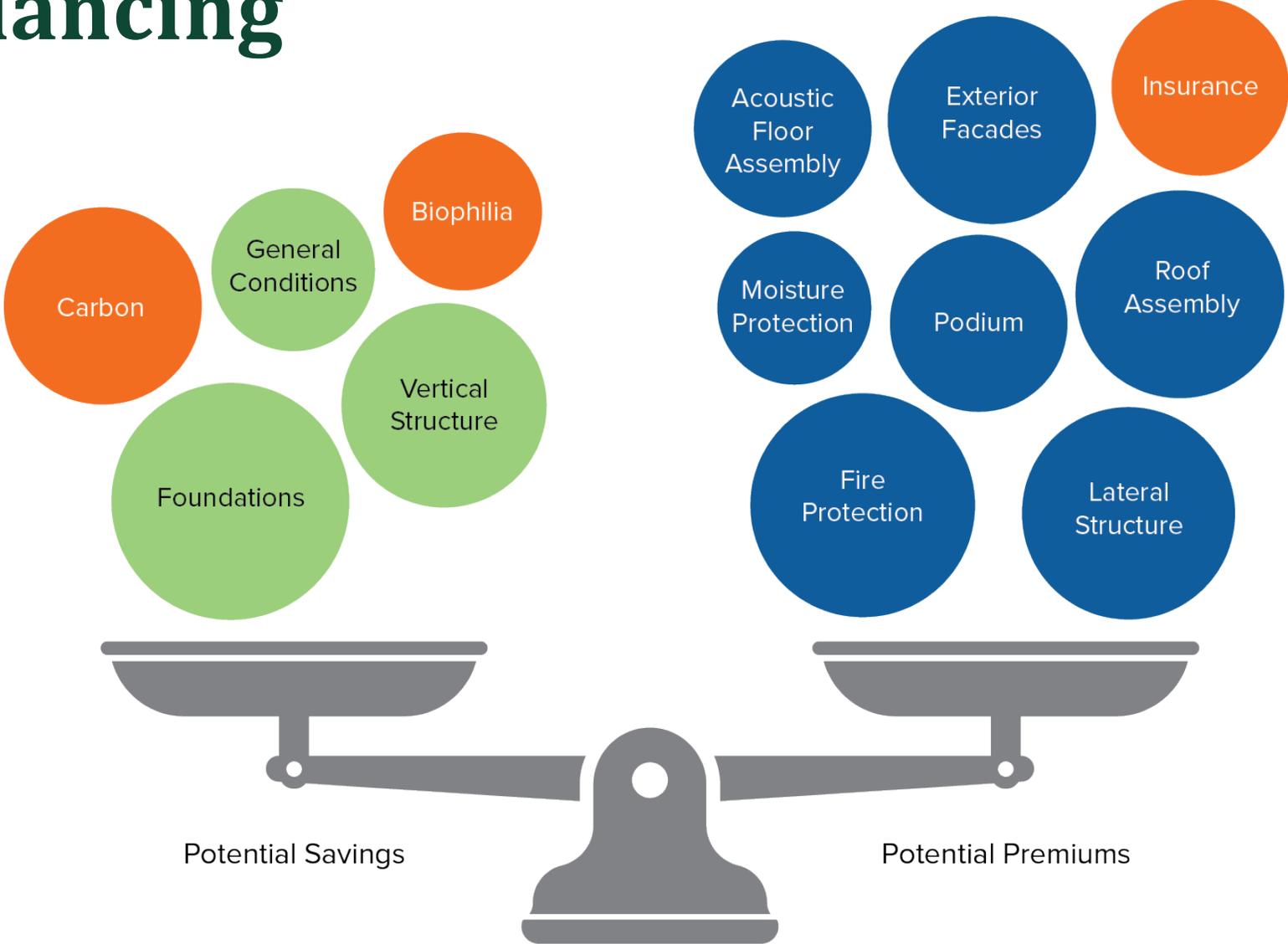
Fire protection

Acoustic floor assemblies

Exterior facades



Mass Timber Construction Cost Balancing



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



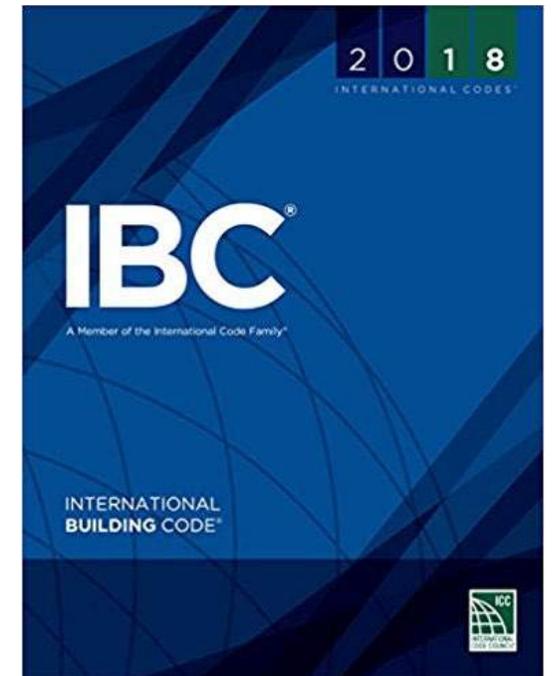
Photo Credit: StructureCraft



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





11 E Lenox / Monte French Design Studio / H+O Structural Engineering
Photo H+O Structural Engineering

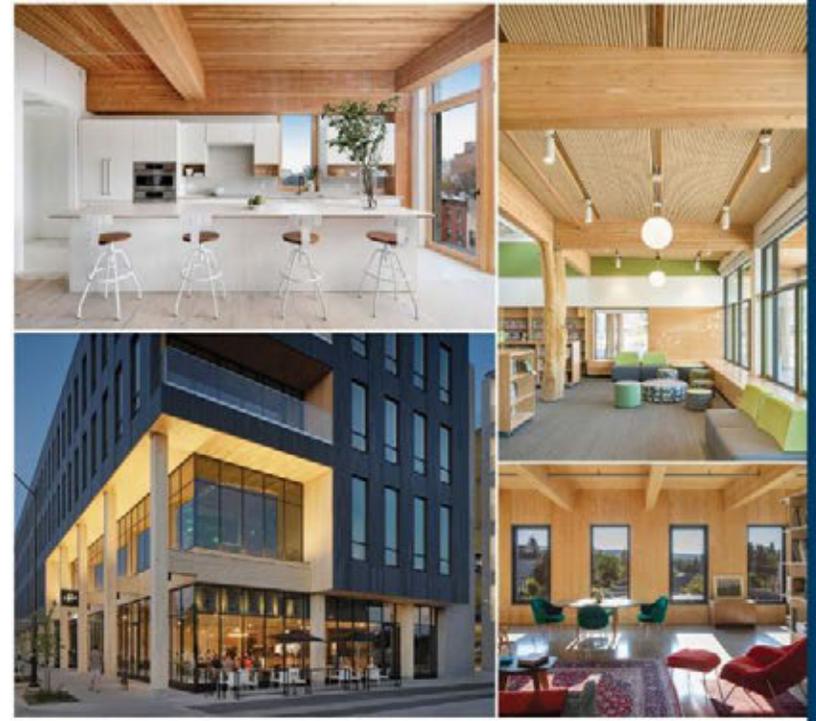
The Mass Timber Insurance Playbook

U.S. Edition



A guide to insuring mass timber buildings

Co-authored by Phillip Cellow and Jim Grockling
Adapted for the United States by Mike Hastings in collaboration with WoodWorks - Wood Products Council
U.S. Edition published by WoodWorks



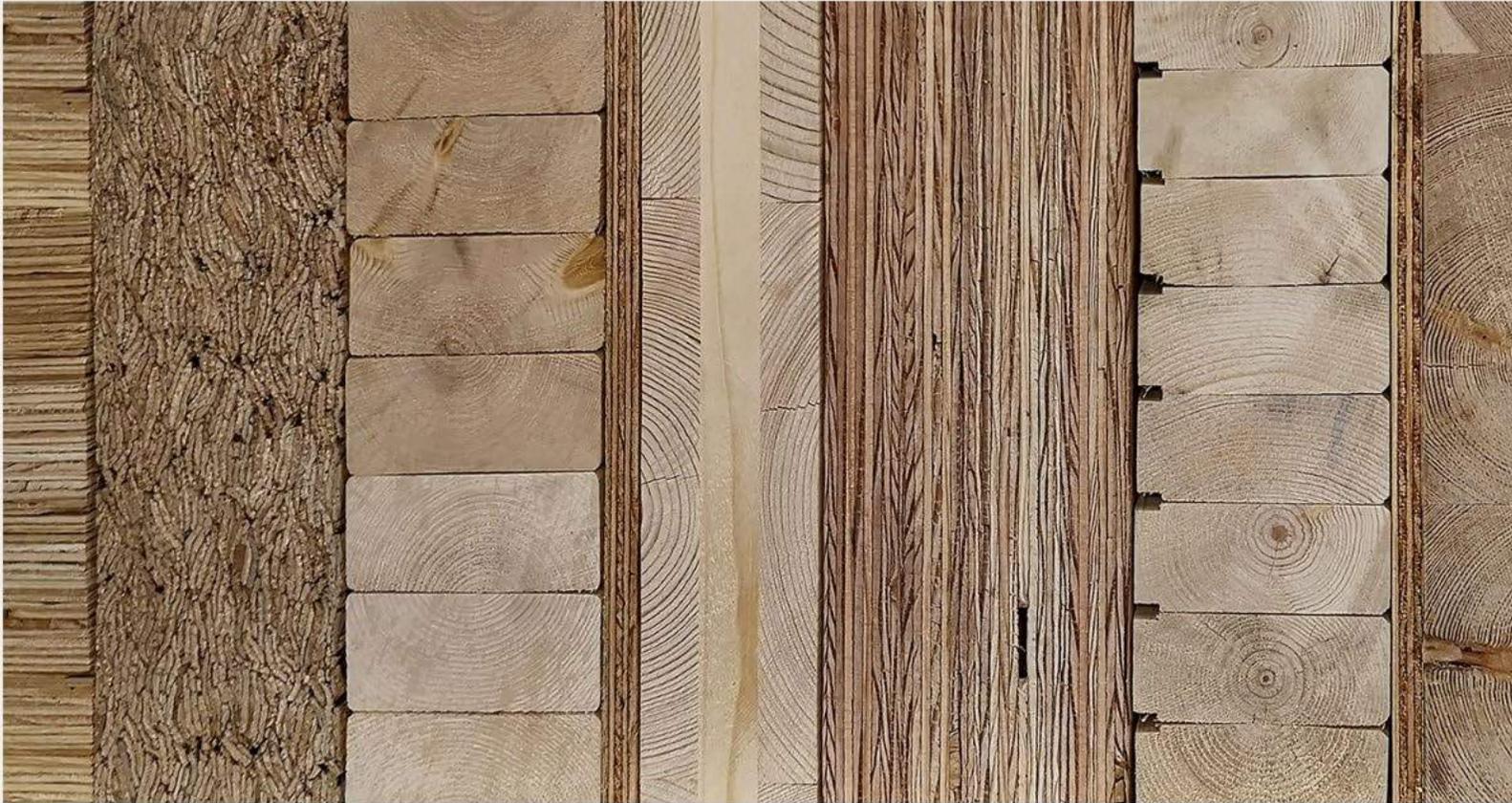
Planning for Environmental Exposures



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

RDH Moisture
Management Guide 1st Ed

Mass Timber Moisture Management for Construction



*Strategies for
managing the
unique moisture
risks of mass timber
building projects*

Photo RDH Building Science

Total Project Cost Analysis

CONSIDERATIONS:

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





How to Successfully Cost Manage a Mass Timber Project

Cost-Estimating Considerations for General Contractors



Apex Plaza
William McDonough + Partners / Hourigan

A determining factor in the success of a mass timber project—and whether it goes forward at all—is the general contractor's ability to provide informed cost estimates from the earliest stage of design. However, unlike other materials, there isn't a hundred years of tradition and shared experience to guide budgeting, cost management, and competitive procurement, or readily available cost benchmarking.

This paper is intended to bridge that gap with guidance for minimizing whole project costs and maximizing the value of mass timber projects. It has been written with an emphasis on cross-laminated timber (CLT) and glue-laminated timber (glulam), but applies generally to all mass timber materials. Follow these steps to more confidently cost plan your next wood building.

This paper was developed collaboratively with a design and construction professional who specializes in mass timber construction and has worked on multiple projects for general contractors. Costs, percentages and other values are based on their experience and may differ for other projects.

Step 1: Do Your Homework

- Vetting potential subcontractors
- Determining the procurement model (with details on common models used in the U.S.)

Step 2: Establish a Reliable Pre-Design Budget

- Basic timber pricing dynamics
 - Example of increasing detail recommended at different phases of project planning
 - Information to supply for better pricing
 - Insights for better budgeting
- Choosing your list of bidders
- Adjusting budgets for trades impacted by timber

Step 3: Manage Project Costs

- Establishing cost benchmarking
- Understanding the largest non-timber design cost levers

Mass Timber Comparative Life Cycle Assessment Series



Rendering tres birds



Mosaic Architecture / Morrison-Maierle / Photo Heidi Long, Longview Studios

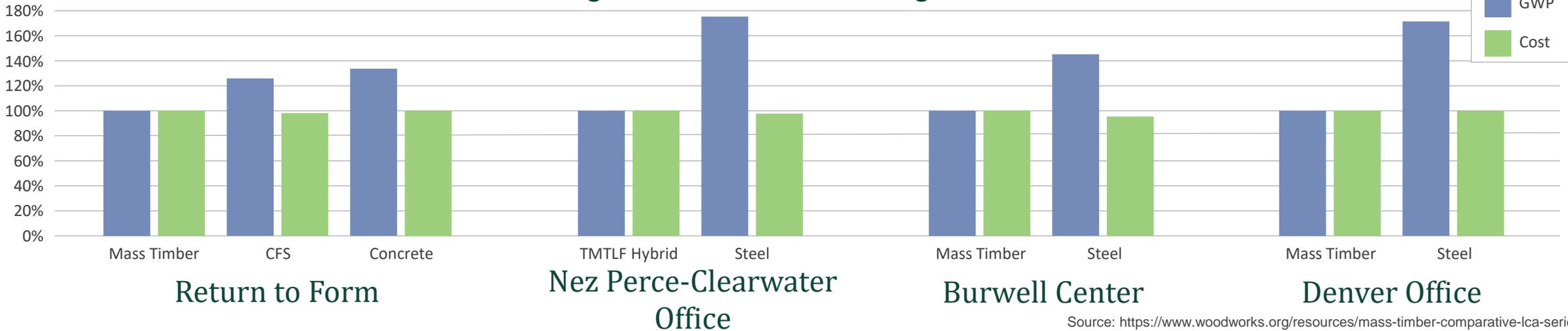


University of Denver Burwell Center for Career Achievement / Lake|Flato Architects / Shears Adkins Rockmore / KL&A Engineers and Builders / Photo © Frank Ooms



Rendering Shears Adkins Rockmore

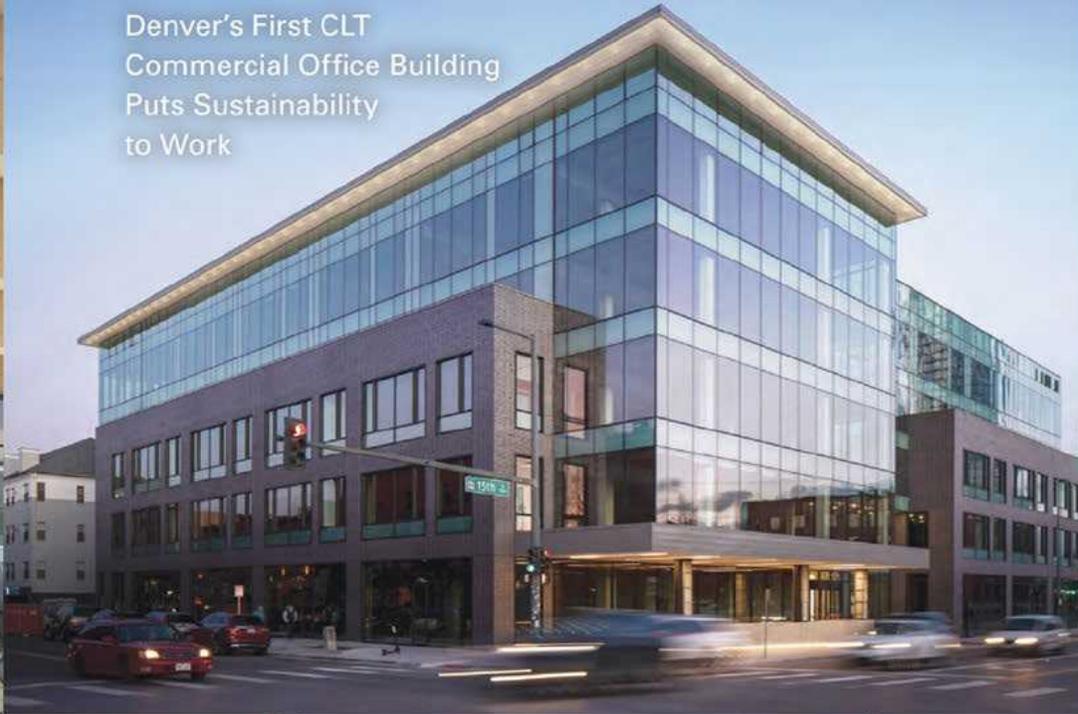
Whole Building GWP and Whole Building Construction Cost



Source: <https://www.woodworks.org/resources/mass-timber-comparative-lca-series/>

Platte Fifteen

Denver's First CLT
Commercial Office Building
Puts Sustainability
to Work

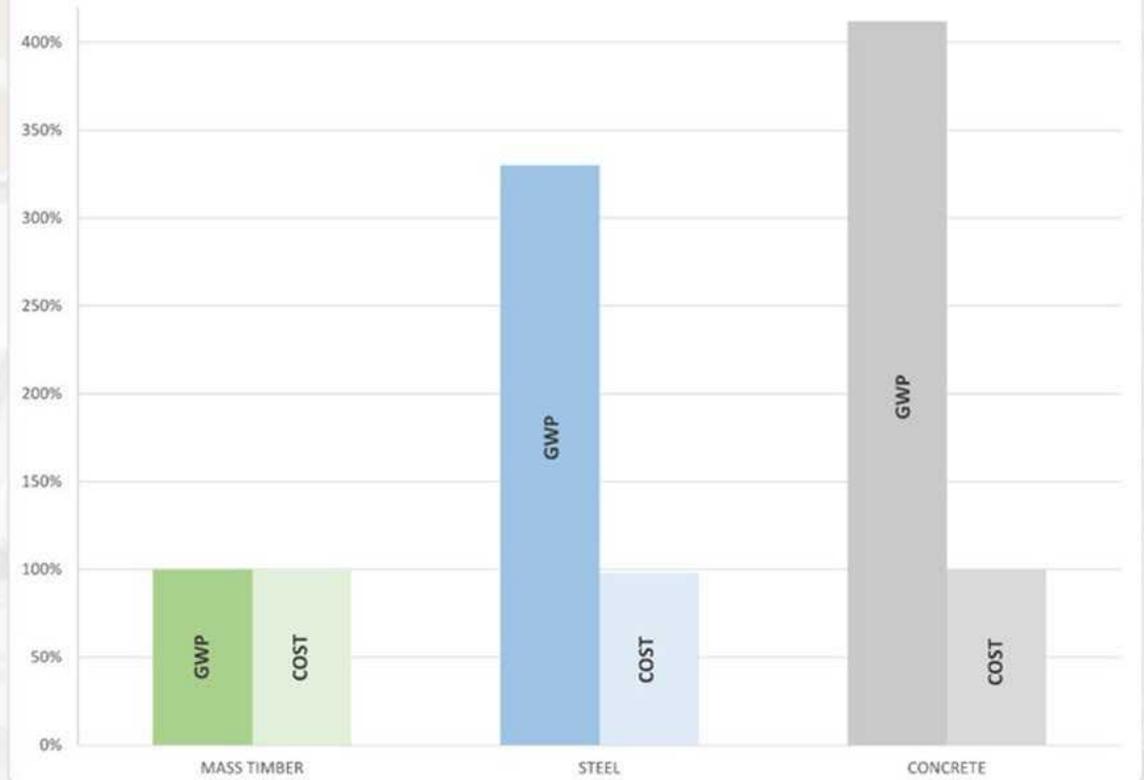


PROJECT DETAILS

LOCATION:
Denver, Colorado

SIZE:
Five stories; 150,418 square feet

STRUCTURAL SYSTEM GWP AND WHOLE BUILDING COST (%)



Source: Platte Fifteen Life Cycle Assessment
<https://www.woodworks.org/resources/platte-fifteen-life-cycle-assessment/>

Mass Timber in Three Regions

Comparative Life Cycle Assessment Study

Author: LeMessurier



Rendering: SCB

Mass Timber Business Case Studies: Value Creation Analysis



Scan to download



Questions? Ask us anything.



John O'Donald II, PE

Regional Director – DC, DE, MD, VA, WV
(814) 880-5636

john.odonald@woodworks.org

