General Contractor's Guide to Mass Timber Project Estimation

Presented by Jeff Chan,
Seagate Mass Timber
and Steve Whitcraft,
Turner Construction Company

August 12, 2022

Photo: INTRO Cleveland / Hartshorne Plunkard Architecture / photo WoodWorks

Resources

CASE STUDIES

Adidas East Village Expansion

Innovative mass timber designs meet ambitious construction timeline

Nez Perce-Clearwater National Forests Supervisor's Office

Mass timber project yields low profile exterior, spacious interior.

CAD/Revit tools

Free downloadable details in PDF, DWG, or Revit formats
www.woodworks.org/cad-revit/mass-timber/

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Upcoming Events

Common Challenges in Light Wood-Frame Gravity Structural Design | September 15

1.0 AIA/CES HSW LUs, 1.0 PDH credit, 0.10 ICC credit

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Planning | Design | Construction
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Boston, MA
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Building the Playbook for the Future of Taller, More Innovative Timber Structures
www.advancing-mass-timber.com

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Real financial information on real deals

- Prepared by WoodWorks and Conrad Investment Management
- Include qualitative influences + quantitative data to examine investment success

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For-Rent Institutional Housing • Institutional Offices • Industrial Buildings • Redevelopment/Additions • Purpose-Built Owner/Occupied (Student Housing)

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New for GCs and installers:

U.S. Mass Timber Construction Manual

PHOTO: MARCUS KAUFFMAN

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DEADLINE: OCT. 14, 2022

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Photo Jason O'Rear

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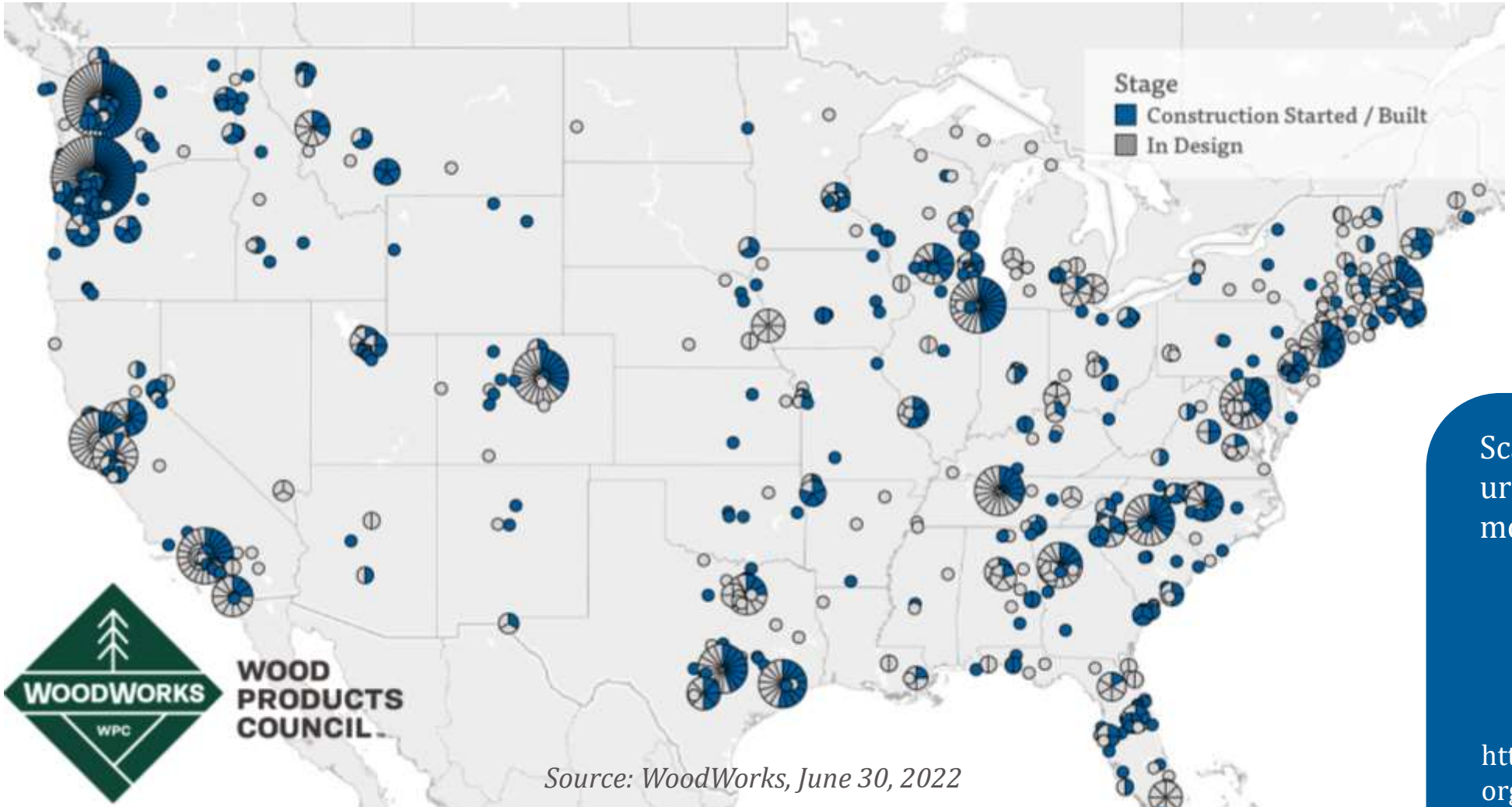
Current State of Mass Timber Projects

As of June 2022, in the US, **1,502** multi-family, commercial, or institutional projects have been constructed with, or are in design with, mass timber.



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Source: WoodWorks, June 30, 2022

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

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

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

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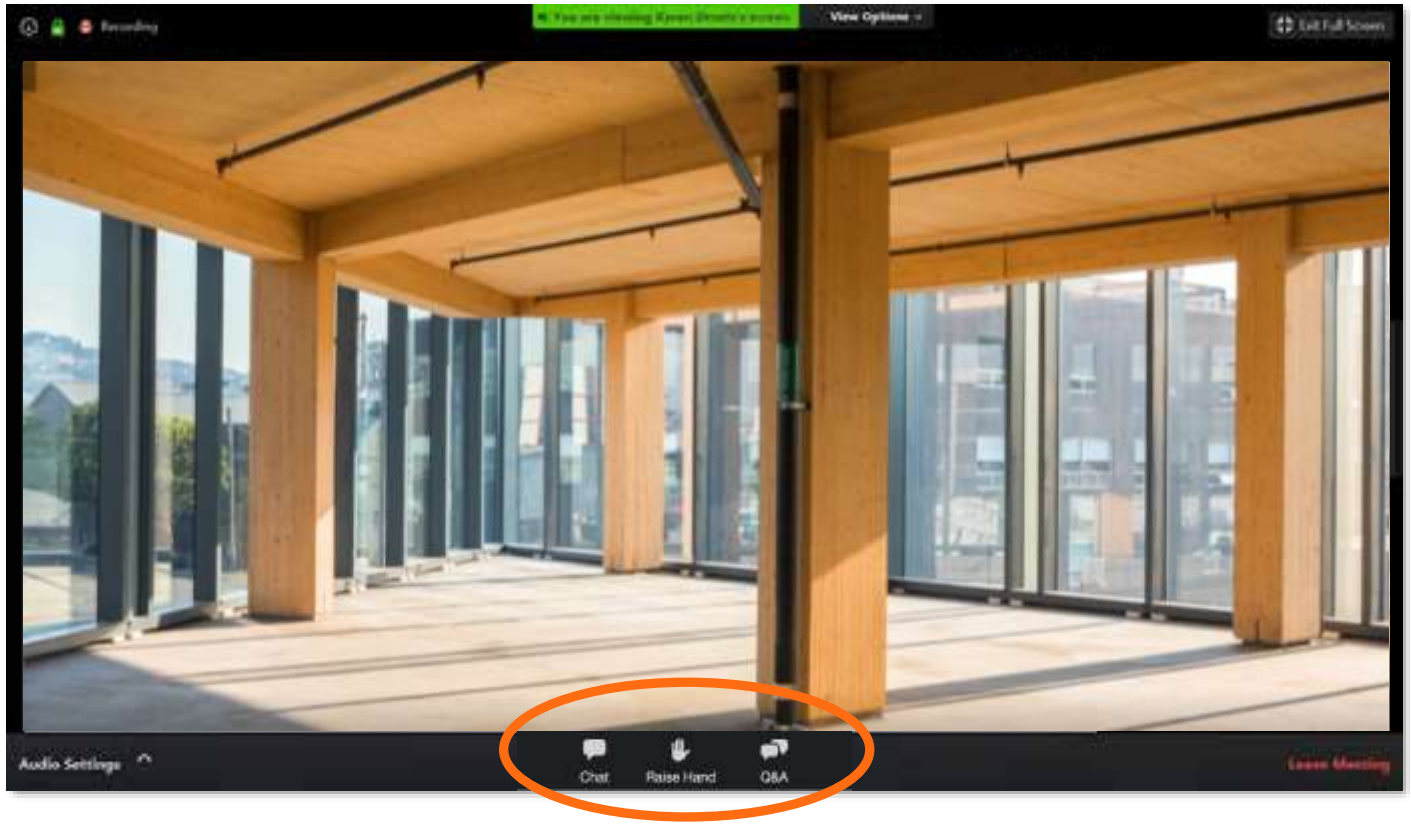
- Submit questions in the **Q&A** box at the bottom of your screen as they come up in the presentations. We will **get to as many questions as possible.**



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

AIA Continuing Education Provider

Course Description

How can general contractors meet the growing demand for mass timber buildings? While developers across the country are pursuing mass timber projects, knowledge among the general contractor community is not yet widespread. Companies have varying degrees of familiarity with both the products and practicalities of estimating, 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 estimation and bidding processes. We'll also discuss why some mass timber projects face resistance, and how to overcome value misconceptions to achieve success. With an emphasis on real projects, -these discussions will also include preconstruction coordination, BIM and Virtual Design and Construction, and incorporating MEPF subcontractors into a competitive bid.

Learning Objectives

1. Identify the value propositions that can inform a mass timber estimation process and translate into competitive bids.

2. Understand what drives estimating differences between general contractors and specialty installers.

3. Discuss perceived cost saving measures, the efficiencies gained or lost, and lessons identified from built projects.

4. Discuss estimates for project overhead, specifically cost analysis, BIM and VD&C requirements.

Mass Timber: *Commercial Considerations*

Estimating and Procurement

Steve Whitcraft, DBIA, AIA Assoc, CPC
Turner Construction Company

Disclaimer: This presentation was developed by a third party and is not funded by WoodWorks or the Softwood Lumber Board.

Outline

1. Motivation and Commitment of Owner
2. Basic Mass Timber Components
3. Early Decisions
4. Procurement Strategies
5. Comparison to Other Structural Systems
6. Summary Take-Aways
7. Questions

Owner Motivation/Commitment

1. What is Driving Owner to Consider MT?

   ESG – Doing the Right Thing

   Improved Employee/Tenant Environment (Amenity)

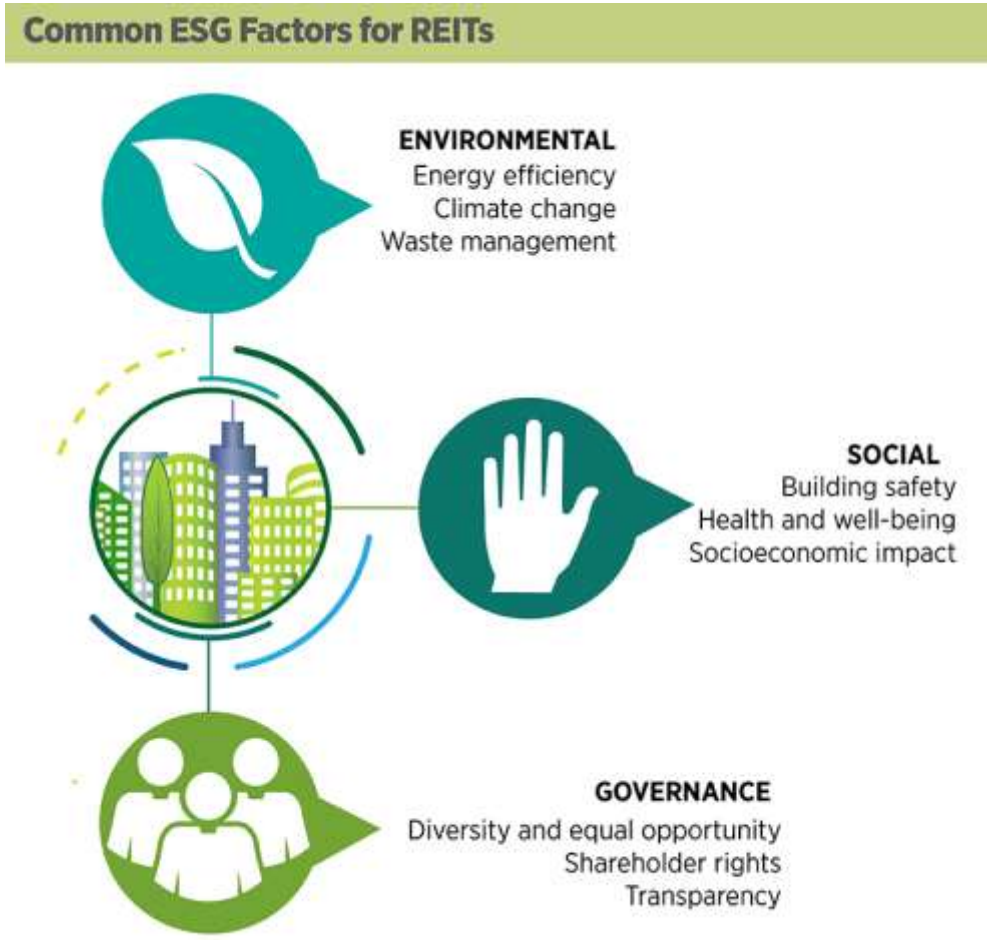
   Cost (First vs LCA vs Sale)

2. What Stage of Commitment?

   All-In Day One

   Compare at Concept – SD

   Bid at DD - CD



Components

1. Wall & Floor Panels

   CLT

   Glulam Panels

   NLT/DLT

   LVL/LSL/MP Panels

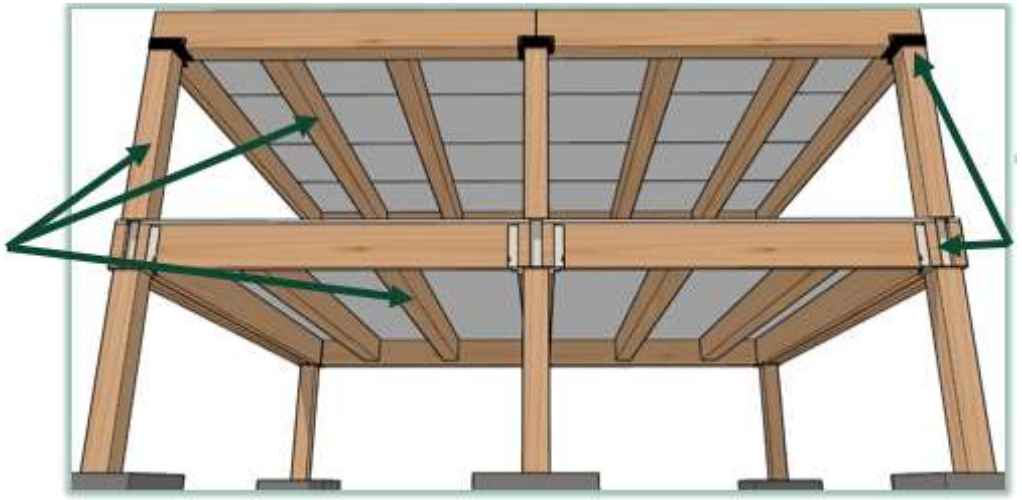
2. Columns/Purlins/Beams

   Glulam

   - Various Sizes/Layups for Required Loads
   - Shapes: Straight, Curved, or Cambered

Wall & Floor Panel Type Examples:

- NLT - Nail Laminated Timber
- GLT - Glued Laminated Timber
- CLT - Cross Laminated Timber
- DLT - Dowel Laminated Timber
- LSL - Laminated Strand Lumber
- LVL - Laminated Veneer Lumber
- TCC - Timber-Concrete Composites

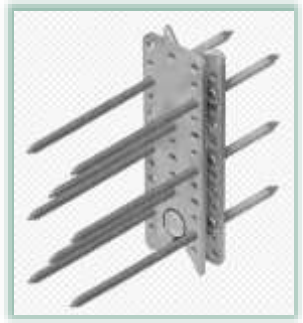


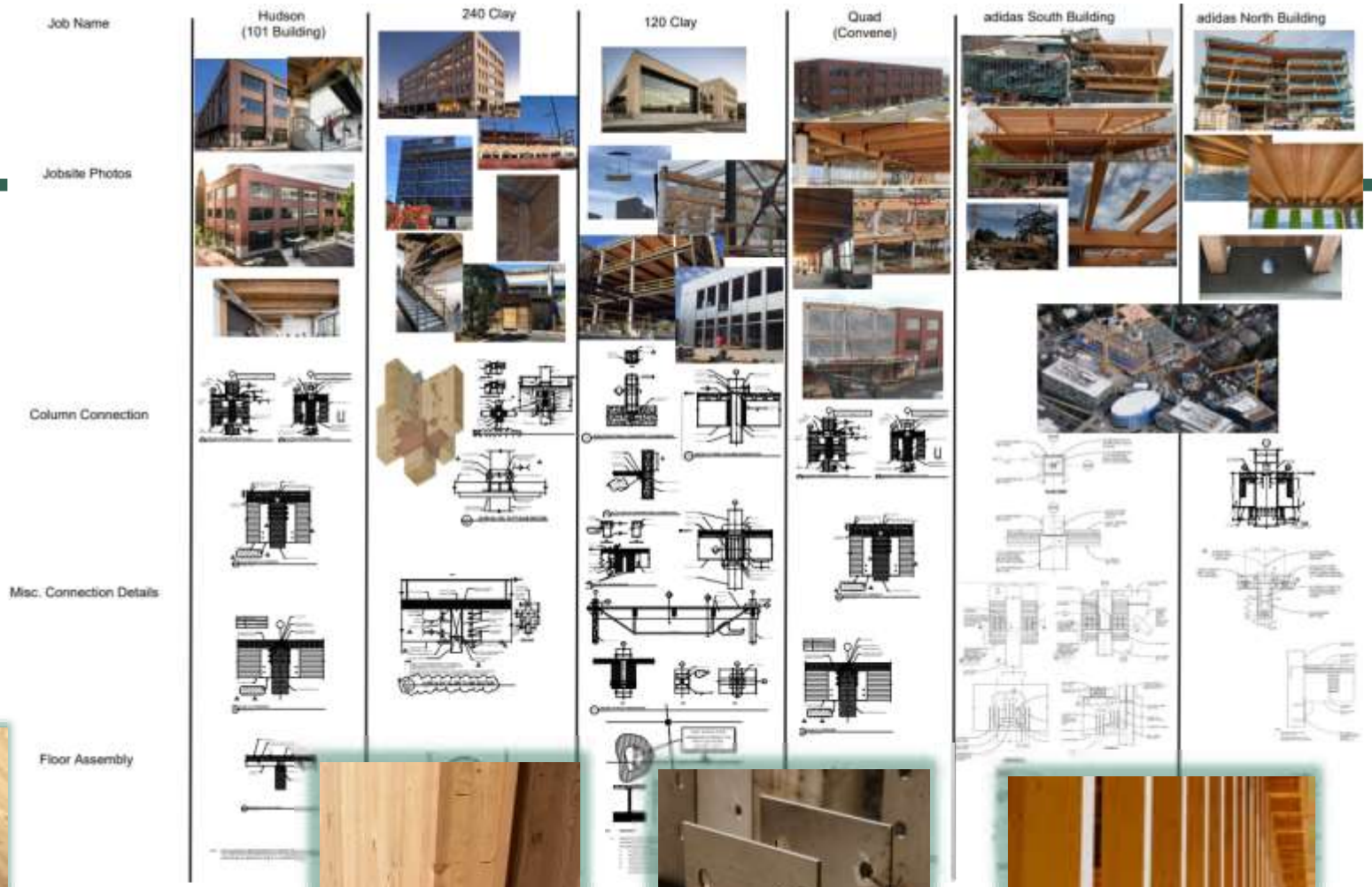
Connections

- Typically Steel
- Various Types
- Often Encased in FRR Layer

Components

3. Connection Hardware/Fasteners





Early Decisions

1. Lateral System

    Steel BRB Core

    Concrete Core

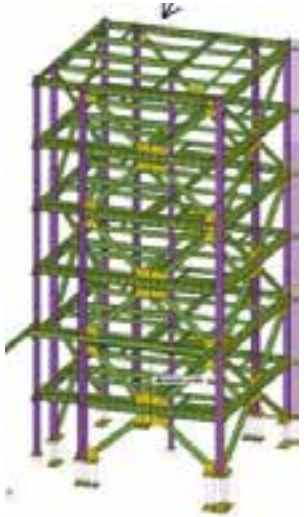
    Bracing Configuration

2. Floor Assembly (*Cf/Bf + Pcs*)

    Diaphragm Connection

    Lay-Up (Deck/Purlin/Beam config)

    Grid Spacing



Early Decisions

3. MEP System Routing

    Exposed/Covered/Through Beams

    UFAD/Radiant/Overhead HVAC

4. Façade Attachment

    Edge/Beam HDWE

    Prefab Panels

5. Acoustic Performance

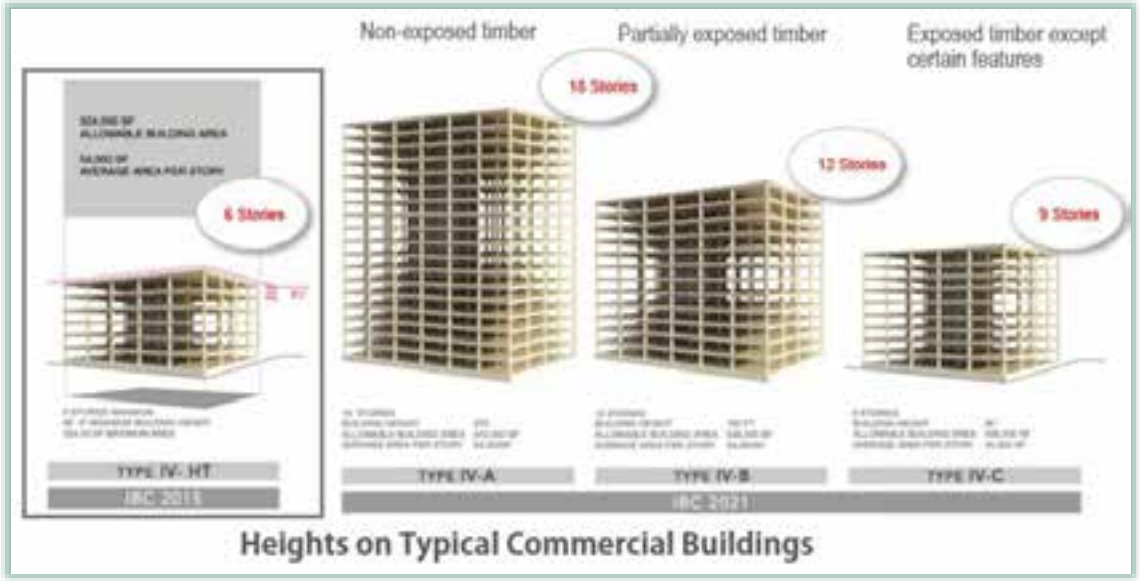
Early Decisions

6. Code Considerations

   Type IA/Type III/Type 4A,B,C,HT

   Future Tenant Flexibility

   Local Changes/Adoption



Heights on Typical Commercial Buildings

TABLE 4: Select Height and Area Limits by Construction Type

		I-A	I-B	IV-A	IV-B	IV-C	IV-HT
Occupancies	**Value**	**Allowable Building Height above Grade Plane, Feet (IBC Table 504.3)**					
A, B, R	S	Unlimited	180	270	180	85	85
		Allowable Number of Stories above Grade Plane (IBC Table 504.4)					
A-2, A-3, A-4	S	Unlimited	12	18	12	6	4
B	S	Unlimited	12	18	12	9	6
R-2	S	Unlimited	12	18	12	8	5
		Allowable Area Factor (At), Feet² (IBC Table 506.2)					
A-2, A-3, A-4	SM	Unlimited	Unlimited	135,000	90,000	56,250	45,000
B	SM	Unlimited	Unlimited	324,000	216,000	135,000	108,000
R-2	SM	Unlimited	Unlimited	184,500	123,000	76,875	61,500

S is sprinklered with NFPA 13 sprinklers. SM is the multi-story allowable area factor. Underlined entries are the new additions.

Fire-Resistance Rating Requirements for Building Elements (Hours)

Building Element	Type I		Type II		Type III		Type IV				Type V	
	A	B	A	B	A	B	HT	A	B	C	A	B
Primary structural frame[f] (see Section 202)	3[a,b]	2[a,b]	1[a]	0	1[a]	0	HT	3	2	2	1[a]	0
Bearing walls Exterior[e] Interior	3 3[a]	2 2[a]	1 1	0 0	2 1	2 0	2 1/HT	3	2	2	1 1	0 0
Nonbearing walls and partitions Exterior	See Table 602											
Nonbearing walls and partitions Interior[e]	0	0	0	0	0	0	See Section 2304.11.2	0*	0*	0*	0	0
Floor construction and associated secondary members (see Section 202)	2	2	1	0	1	0	HT	2	2	2	1	0
Roof construction and associated secondary members (see Section 202)	1-1/2[b]	1[b]	1[b]	0	1[b]	0	HT	1-1/2	1	1	1[b]	0

*Nonbearing interior wall partitions in Types IV-A, IV-B and IV-C must be of mass timber construction or of noncombustible materials per IBC 602.4

Source: IBC Table 601 / See IBC for footnotes

IBC 602.4 FRR comes from Mass Timber, added non-combustible protection or combination of both. IBC 703.5 and 722.7 give specifics.

Early Decisions

7. Sustainability Considerations

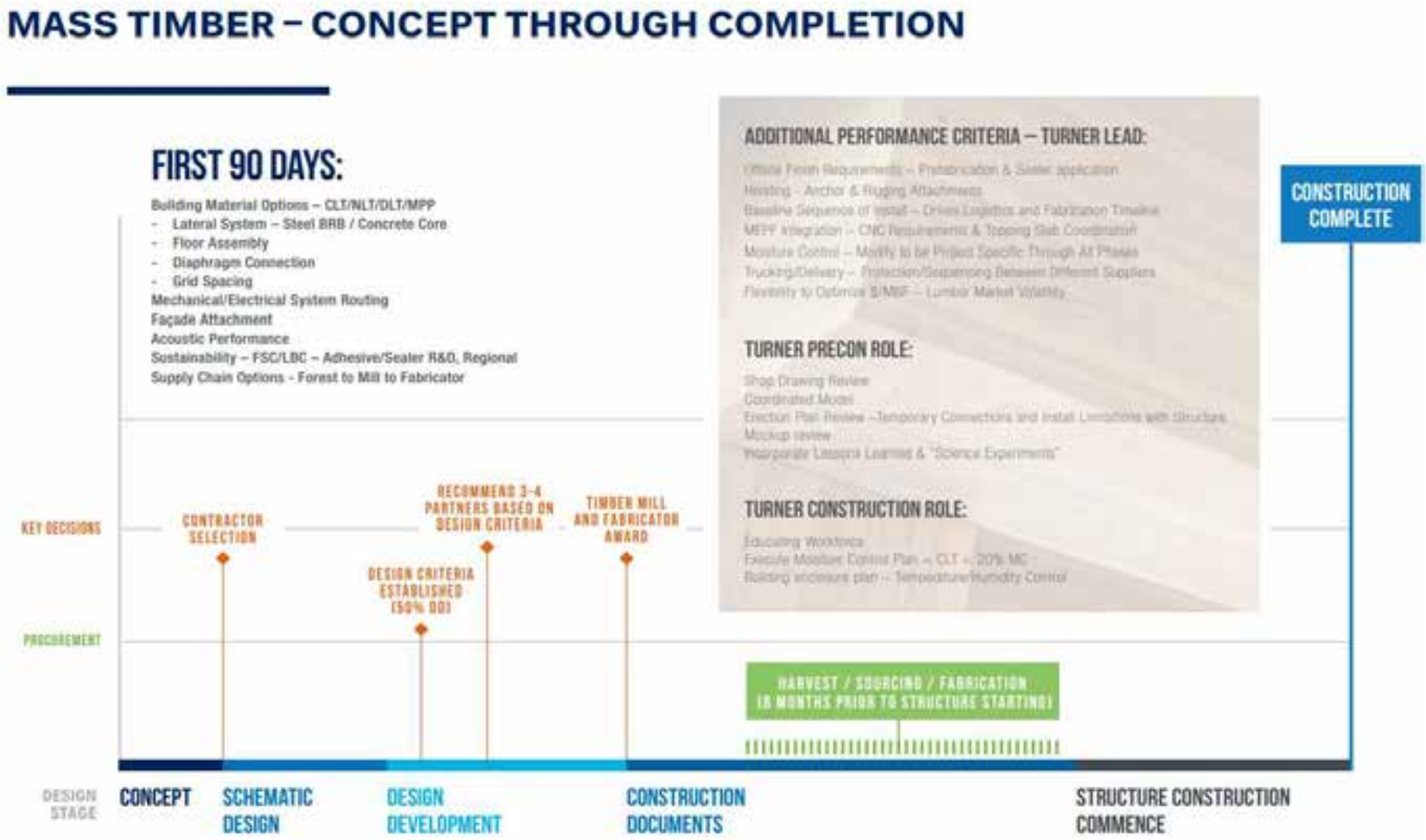
    Adhesive/Sealer

    Location/Transportation Sourcing Options

    Forest Certification
    FSC/SFI/PEFC/CSA

    Supply Chain Options – Forest to Mill to Fabricator

Schedule Example



Procurement Strategies

1. CM Turn-Key

    Vendor Design/Fab/Erect

    Vendor Design-Assist/Fab/Erect

2. GC Parts & Pieces

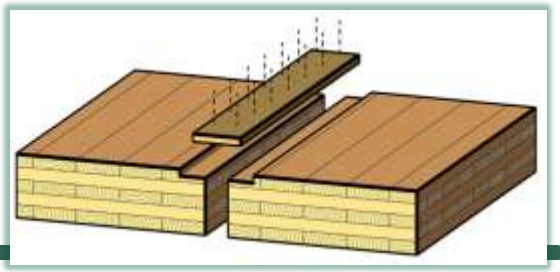
    Vendor Fab

    Vendor Erect

3. GC Self-Erect

    Vendor Fab

Procurement Strategies



4. Important Considerations

    Staging/Offloading

    Factory vs Field-Installed Hardware

    Factory vs Field-Applied Sealer

    Moisture Mgmt. Factory to Occupancy

    Safety Rails

    BIM Coord/Penetrations – Sign-Offs

    Field Conditions/Touch-Up

Structural System Comparison

1. Concrete/Steel vs Mass Timber

    Separate Designs

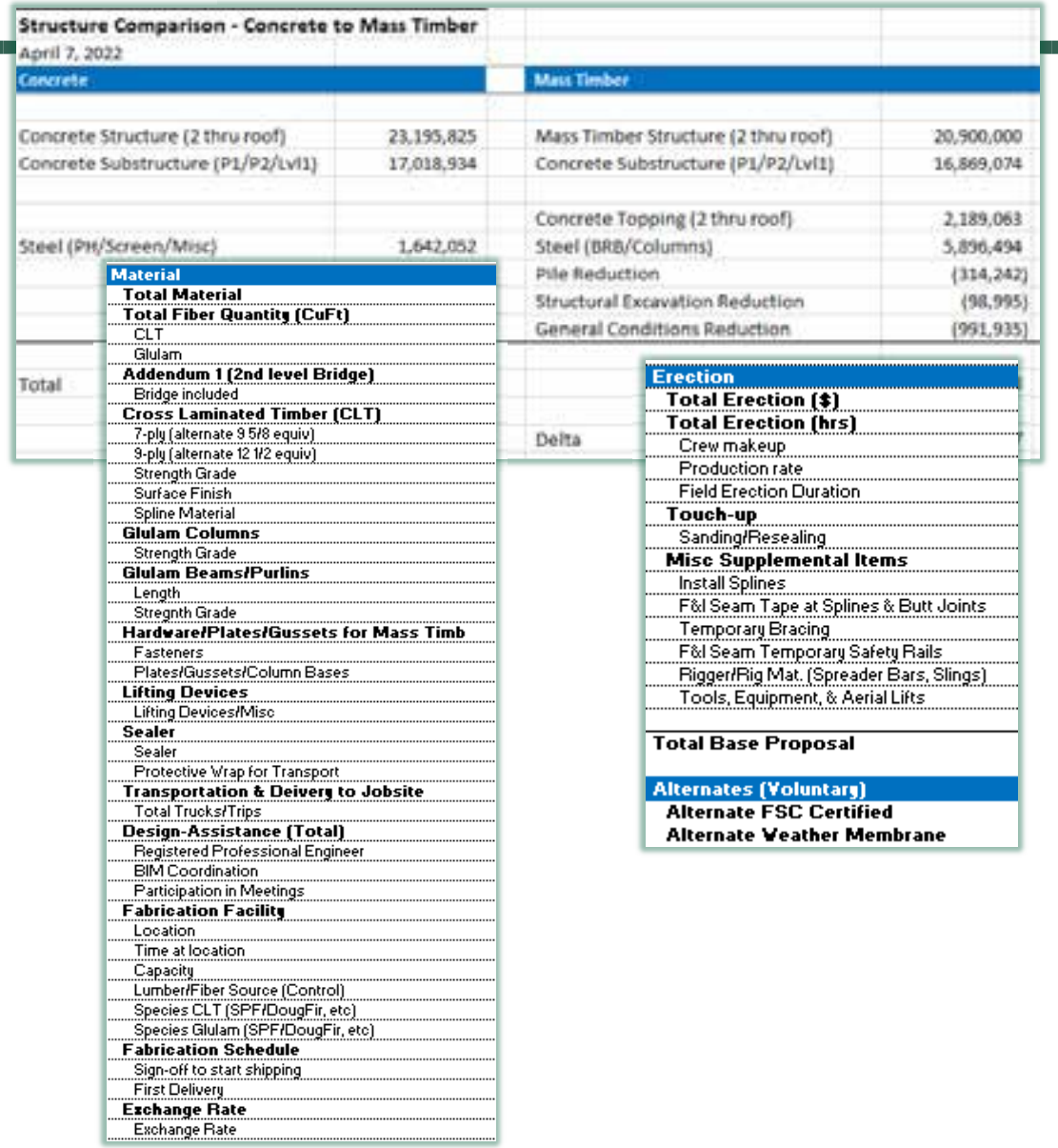
    Conceptual Deduct/Add

    Trade Input

    Fire Code/Building Type/AHJ/Design

    Owner Priorities (First Cost/Other)

    Decision Matrix



Structure Comparison - Concrete to Mass Timber

April 7, 2022

Concrete		Mass Timber	
Concrete Structure (2 thru roof)	23,195,825	Mass Timber Structure (2 thru roof)	20,900,000
Concrete Substructure (P1/P2/Lvl1)	17,018,934	Concrete Substructure (P1/P2/Lvl1)	16,869,074
		Concrete Topping (2 thru roof)	2,189,063
Steel (PH/Screen/Misc)	1,642,052	Steel (BRB/Columns)	5,896,494
		Pile Reduction	(314,242)
		Structural Excavation Reduction	(98,995)
		General Conditions Reduction	(991,935)
Total		Delta	

Material
Total Material
Total Fiber Quantity (CuFt)
CLT
Glulam
Addendum 1 (2nd level Bridge)
Bridge included
Cross Laminated Timber (CLT)
7-ply (alternate 9 5/8 equiv)
9-ply (alternate 12 1/2 equiv)
Strength Grade
Surface Finish
Spline Material
Glulam Columns
Strength Grade
Glulam Beams/Purlins
Length
Stregnth Grade
Hardware/Plates/Gussets for Mass Timb
Fasteners
Plates/Gussets/Column Bases
Lifting Devices
Lifting Devices/Misc
Sealer
Sealer
Protective Wrap for Transport
Transportation & Deivery to Jobsite
Total Trucks/Trips
Design-Assistance (Total)
Registered Professional Engineer
BIM Coordination
Participation in Meetings
Fabrication Facility
Location
Time at location
Capacity
Lumber/Fiber Source (Control)
Species CLT (SPF/DougFir, etc)
Species Glulam (SPF/DougFir, etc)
Fabrication Schedule
Sign-off to start shipping
First Delivery
Exchange Rate
Exchange Rate

Erection
Total Erection ($)
Total Erection (hrs)
Crew makeup
Production rate
Field Erection Duration
Touch-up
Sanding/Resealing
Misc Supplemental Items
Install Splines
F&I Seam Tape at Splines & Butt Joints
Temporary Bracing
F&I Seam Temporary Safety Rails
Rigger/Rig Mat (Spreader Bars, Slings)
Tools, Equipment, & Aerial Lifts
Total Base Proposal
Alternates (Voluntary)
Alternate FSC Certified
Alternate Weather Membrane

Structural System Comparison

2. Mass Timber Hybrid Solutions

    Precast Beams/Columns – MT Decks

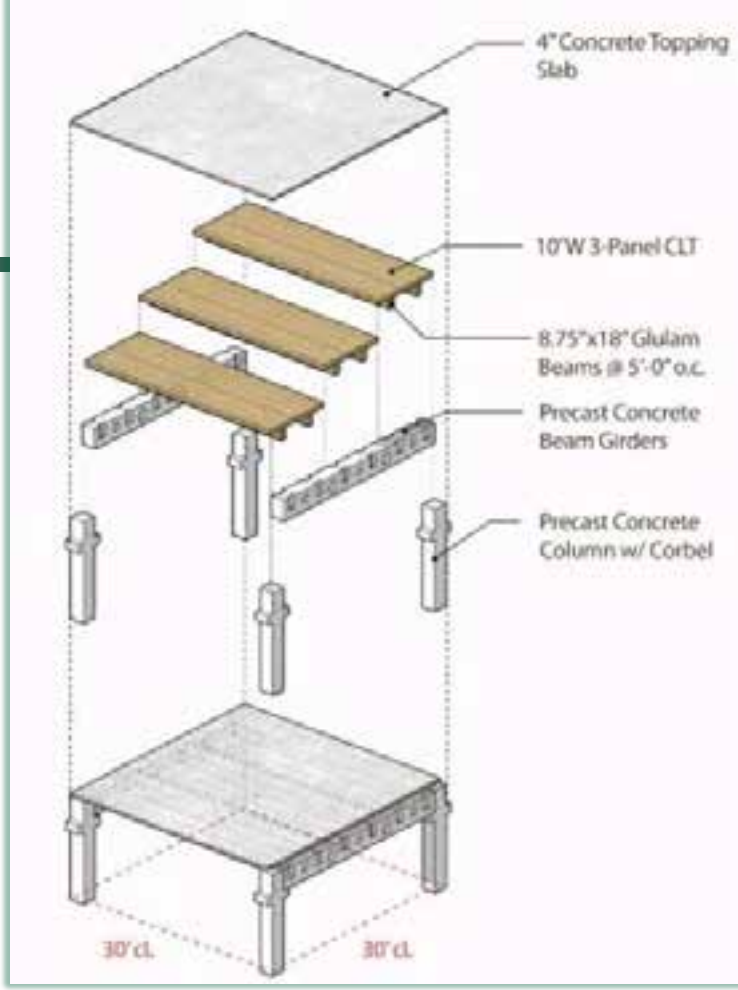
    Concrete Cores/Shafts – MT Decks

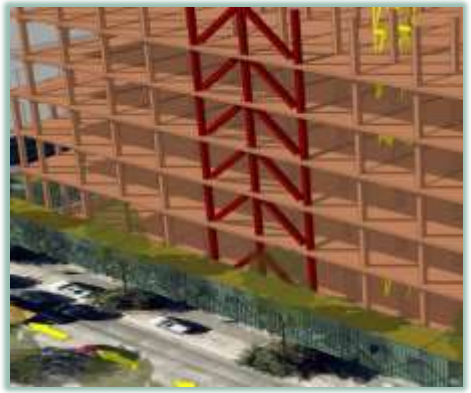
    BRB Shear – MT Decks

    Other Combos (Delta Beam)

    Relative Impacts to Other Trades

    Tradeoff Pure MT for Cost Savings





Structural System Comparison

3. Additional Comparative Considerations

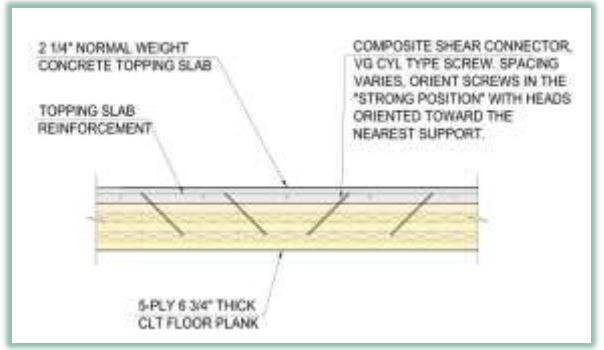
Foundation (Footing/Wall Sizing) Reduction

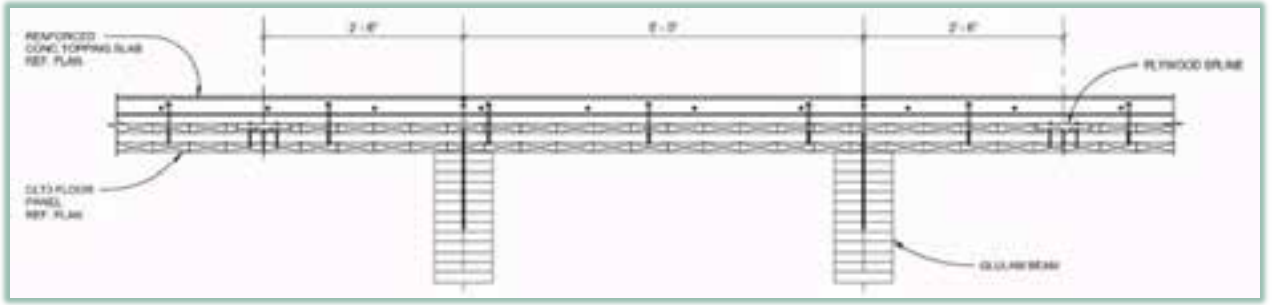
UFAD vs Exposed vs Topping vs Structural Diaphragm (Nail/Rebar/HBV)

MEP Exposed vs Traditional Ceilings (Owner Aesthetic)

Building Type Impacts/Restrictions (Type 1A vs III vs 4B/C vs 5)

Finishes Reduction (C/S and TI)



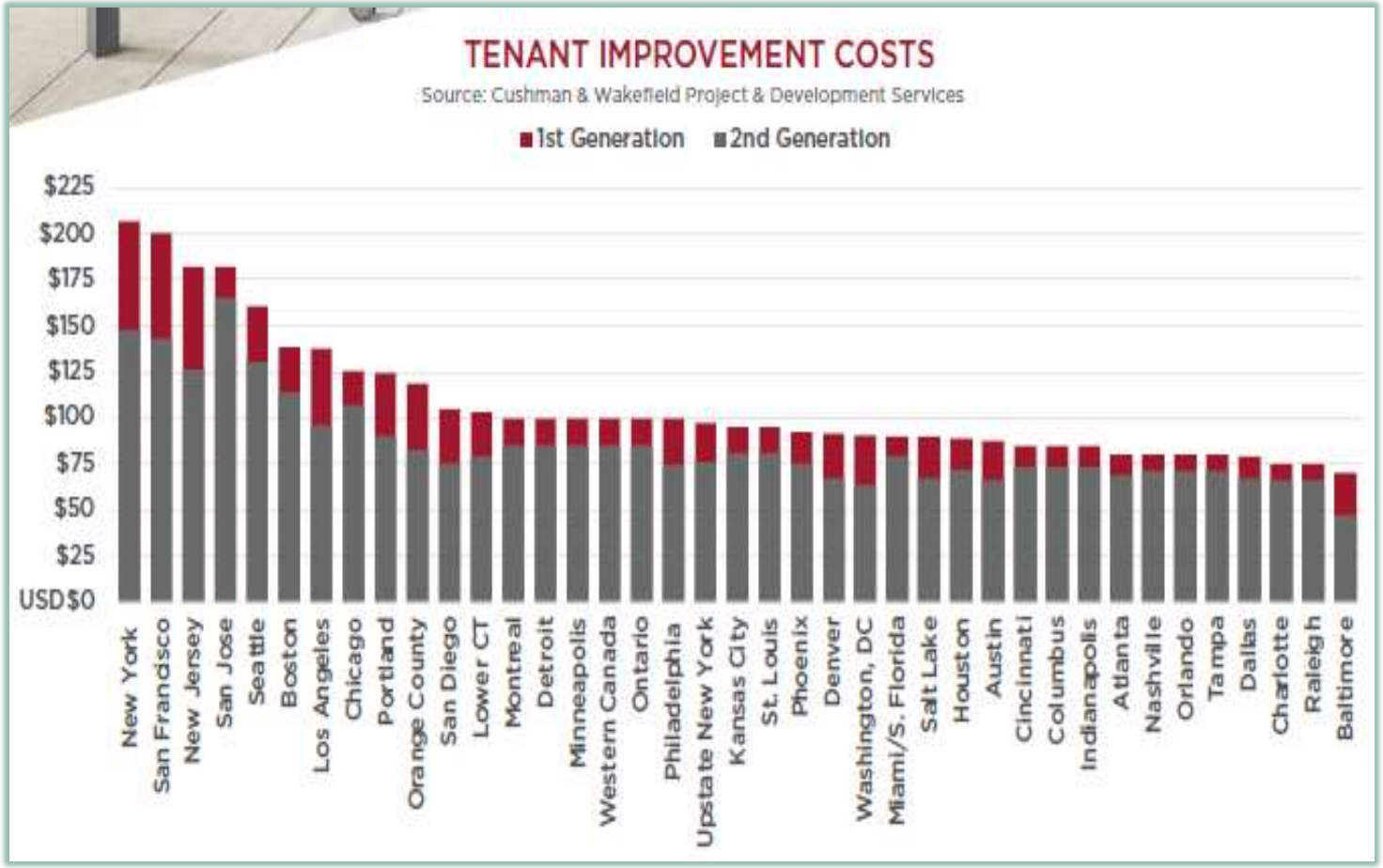


Benchmark Interiors Costs

OFFICE TENANT IMPROVEMENT COST GUIDE

PROJECT & DEVELOPMENT SERVICES
NORTH AMERICA 2021

CUSHMAN & WAKEFIELD



Benchmark Interiors Costs

OFFICE TENANT IMPROVEMENT COST GUIDE

PROJECT & DEVELOPMENT SERVICES
NORTH AMERICA 2021

Dallas "First Generation" Space Cost *(p. 18)*

CUSHMAN & WAKEFIELD

	1st Generation	Mass Timber Savings
General Requirements	$1.13	
Demo Existing	$1.00	
Final Cleaning	$0.25	
Architectural Woodwork	$3.37	$0.62
Thermal Insultaiton	$0.53	
Openings	$3.24	
Glazing	$3.31	
Metal Stud Framed Partitions	$10.05	$1.30
Tiling	$0.31	
Acoutical Ceilings	$3.14	$2.14
Resilient Flooring	$0.40	
Carpeting	$3.70	
Painting	$3.05	$1.55
Sigage	$0.42	
Fire Extinguishers	$0.13	
Appliances	$0.48	
Window Shades	$1.43	
Fire Protection	$2.47	
Domestic Water Piping	$0.62	
HVAC	$11.54	
Electrical	$13.59	
Subtotal	**$64.16**	**$5.61**
General Conditions	$4.20	
GL Insurance	$1.05	
GL Contingency		
GC Fee	$2.21	
Total	**$71.62**	**$5.61**
Sales Tax Total		
Contingency (10% of Total)	$7.16	$0.56
Total with Tax and Contingency	**$78.78**	**$6.17***

**1st Generation Tenant Space Cost Reduced by $6.17*

Potential Reductions in TI Cost Using Mass Timber – ROM **$6.17/sf**

Lessons/Good Practices

1. **Exchange Rates and Material Pricing** (*tie to Index/Allowance*)

2. **Moisture Management Plan** – *Wrap/Seal/Touch-Up*

   Splines/Tape for Spline Joints

3. **Transportation/Unload-Staging** - *JIT Efficiency*

4. **Hardware/Fasteners/Plates/Bracing** (*Weight/Who Designs*)

5. **Lay-up Combinations** (*Fabricator Standards & Erector Efficiency*)

6. **Target Fiber Density** (*BF/SF or CF/SF*) - Potential Cost/Design Optimization

7. **Erection Production Goals** *(% of Material or Pieces/Day*) - Potential Cost/Design Optimization

Summary Take-Aways

1. Choose a Reliable, Experienced GC/CM
2. Establish Priorities/Goals with Owner & Design Team
3. Determine Appropriate Procurement Strategy
4. Confirm Comparison/Determine MT Early
5. Bring In MT Team As Soon As Reasonable
6. Coordinate MT Details with Overall Design
7. Watch for Key Considerations
8. Learn from Trade Partners

MASS TIMBER PROJECT ESTIMATION

Presented by: Jeff Chan
Pre-Construction Manager

SEAGATE STRUCTURES (USA), INC.
QUALITY + INTEGRITY

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LEARNING OBJECTIVES

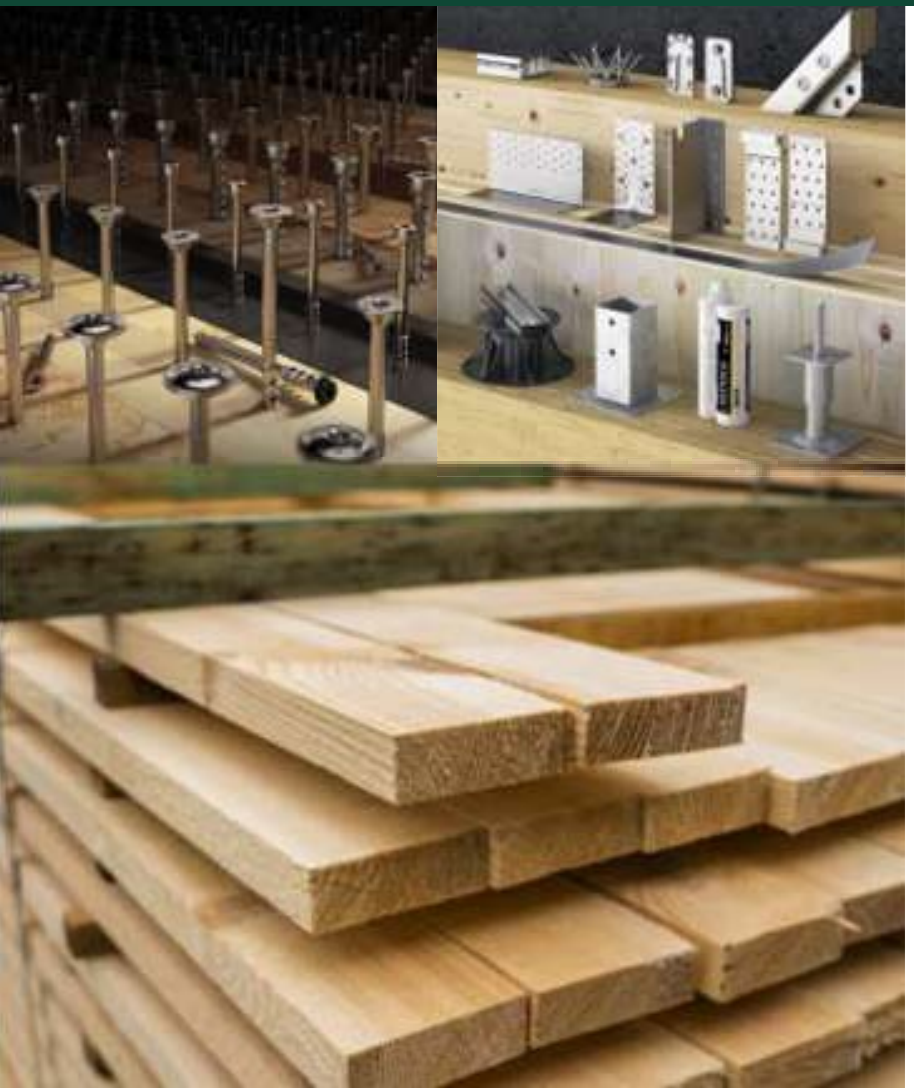
- Identify Unique Factors of Mass Timber Projects
- Account for the Complete Scope, Comparing Apples to Apples
- Mitigating Risk

MAIN PRICING COMPONENTS OF A SCOPE

- **Supply**
- **Install**
- **Other Cost Considerations**
- **Design Assist & Value Engineering**

**** Important to consider how you want to structure the contract for the mass timber scope***

SUPPLY



- Understanding and Defining the Supply Scope
- Options for Supply Packages
- Understanding your suppliers / options
- Fabrication
- Logistics and Timelines
- Understanding Risks

DEFINING THE SUPPLY SCOPE

- **Type of Mass Timber Build**
  - Post & Panel
  - Post Beam & Panel
  - Hybrid
- **Related Scope Items**
  - Drag Struts, L-angle, Embeds
- **Coatings and/or Membranes**
- **Components**
  - Glulam
  - CLT
  - GLT
  - DLT
  - Steel Columns
  - Connections
  - Hardware

OPTIONS FOR SUPPLY PACKAGE

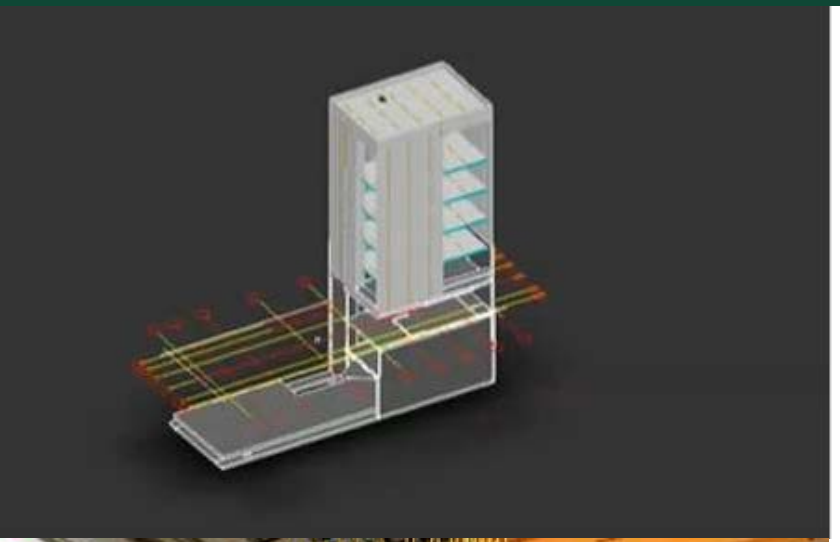
- **Single Source Supply**
- **Multiple Timber Suppliers**
  - Procure Glulam and CLT separately
- **Separate Steel Supplier for connections**
  - Would require offsite or onsite pre-assembly by installer

**** Ultimately depends on comfort level of GC to manage scope***

SUPPLIER CONSIDERATIONS

- **North American & European**
- **Capabilities & Availability**
  - Products & Sizes
  - Wood Species
  - Capacity
  - Certification
- **3D Modeling & Value Engineering**
- **Pricing Factors**
  - Lumber Procurement & Availability
  - Pricing Stability

FABRICATION



- 3D Modeling & MEP Coordination
- Shop Drawings
- Manufacturing
- Machining
- Pre-Assembly requirement
- Coatings & Membranes

SUPPLY DELIVERY & SCHEDULE

- **Freight & Shipping**
  - Offsite Storage / Staging
  - Duty & Taxes
  - Logistics

- **Schedule & Timelines**
  - Shop Drawings
  - Fabrication
  - Shipping

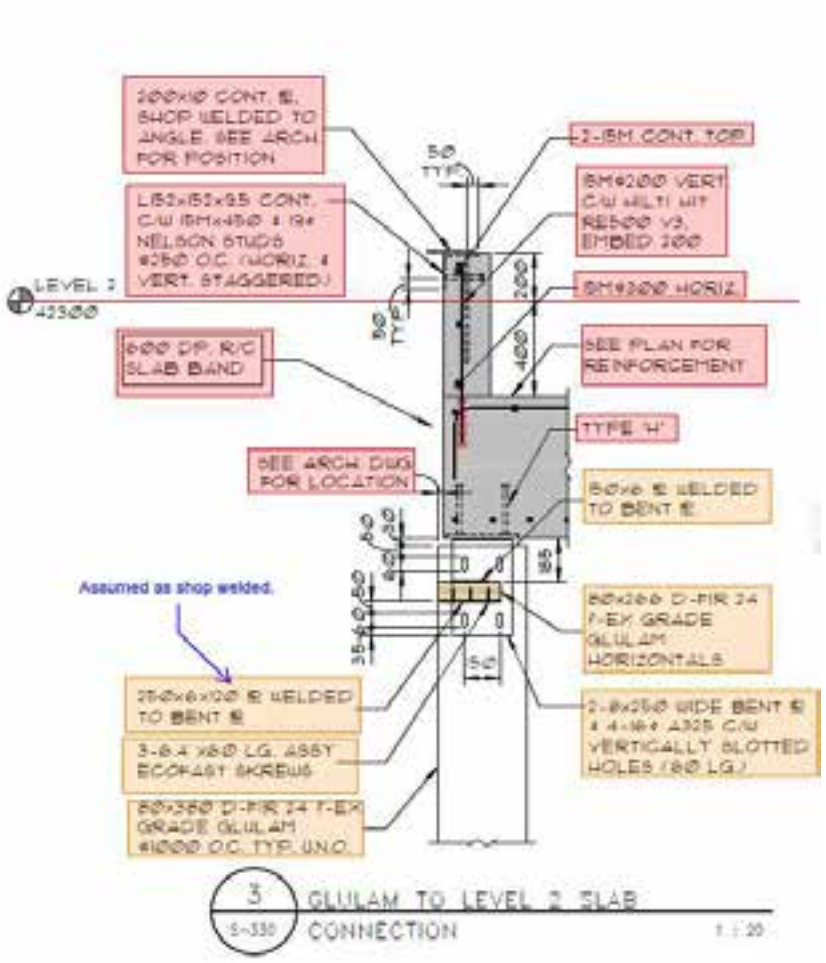
UNDERSTANDING RISKS

- **Pricing Stability**
- **Capacity and availability of Supplier**
- **Lead times** (from design assist phase if required through to delivery to site)
- **Logistics & Shipping**
  - Shipping from Europe
- **Missing Cost Factors**
- **Trade Coordination**
  - MEP Penetrations

INSTALL

- Defining your Scope
- Site Logistics
- Pre-Assembly Requirements
- Crane & Equipment
- Scheduling & Manpower
- Additional Cost Considerations
- Additional Miscellaneous Items
- Understanding Risks

IDENTIFYING & DEFINING THE INSTALL SCOPE



- **Installation of Mass Timber Components**
- **Connection between Timber & Other Structural Components**
- **Related Scope Items**
  - Embeds
  - Perimeter Angles
  - Drag Struts
  - Ledgers
  - Brace Frames
- **Guardrails** (# of Floors)
- **Temporary Bracing**

SITE LOGISTICS

- **Sequencing & Conditions**
  - Truck Routes
  - Pick points & Strategy
  - Laydown & Storage Area
  - Site Conditions
  - Crane Location

PRE-ASSEMBLY REQUIREMENTS

- **Pre-Assembly Offsite**
  - Facility & Storage Requirements
  - Trucking & Shipping Logistics
- **Pre-Assembly Onsite**
  - Designated Onsite Location or Active Deck
- **Additional Time Requirements & Schedule Impact**
- **Equipment & Staging Requirements**

CRANE & EQUIPMENT

- **Hoisting /Crane**
  - Time allocation / Accessibility
  - Other hoisting methods
  - Crane Location, Reach & Capacity

- **Other Equipment**
  - Aerial equipment
  - Telehandlers

SCHEDULING & MANPOWER REQUIREMENTS

- **Schedule & Sequencing**

- **Strategic planning**
  - Mobilization
  - Itemize Scope
  - Establish Sequencing & Productivity
    - Driven by Crane and Pick Times
  - Allocate Manpower & Durations

SCHEDULING & MANPOWER REQUIREMENTS

- **Number of Mobilizations**
- **Travel Costs & Live Out Allowance**
- **Labor Requirements**

ADDITIONAL COST CONSIDERATIONS

- **Moisture Management Plan**
  - Mitigating Damage during Storage & Handling
  - What is the Final Finish
  - Weather & Building Conditions

- **Material Protection, Damage & Repairs**
  - Defining Scope & Responsibilities
  - Allocating Time
  - Cost

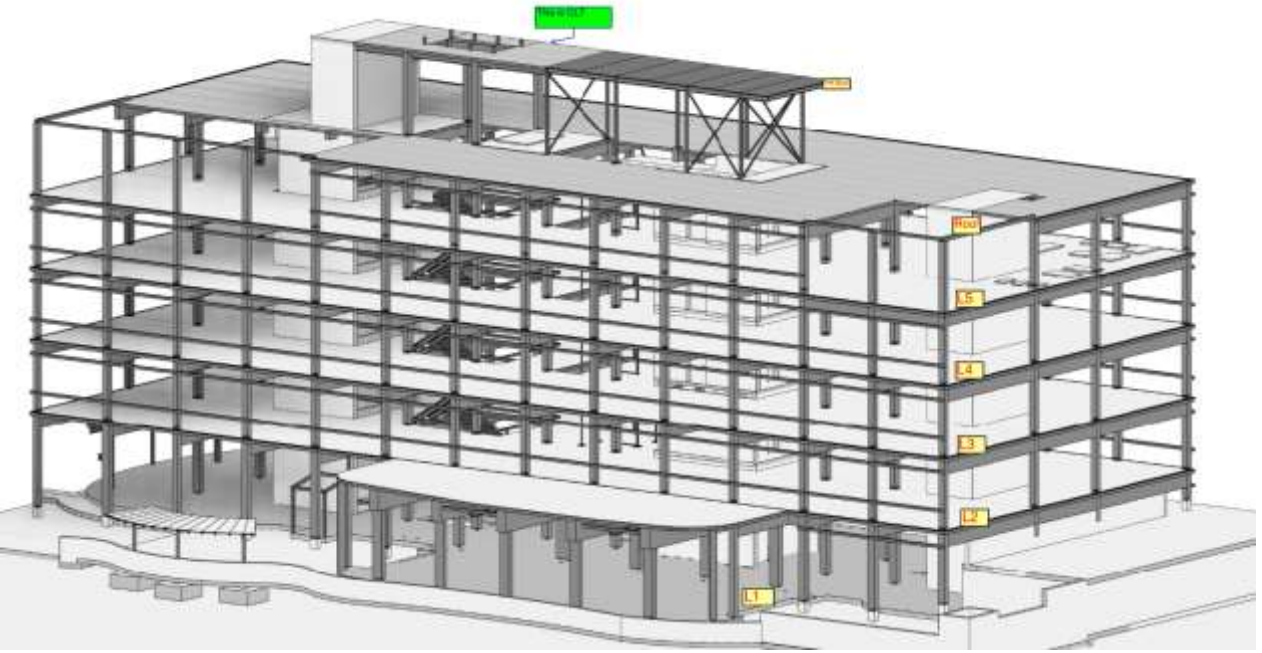
ADDITIONAL MISCELLANEOUS ITEMS

- **Lifting & Bracing Engineering Plan**
- **Fall Protection Plan**
- **Layout & Surveying**
- **Welding**
- **Regulatory Requirements**
  - City/County/State/Country Requirements

UNDERSTANDING RISKS

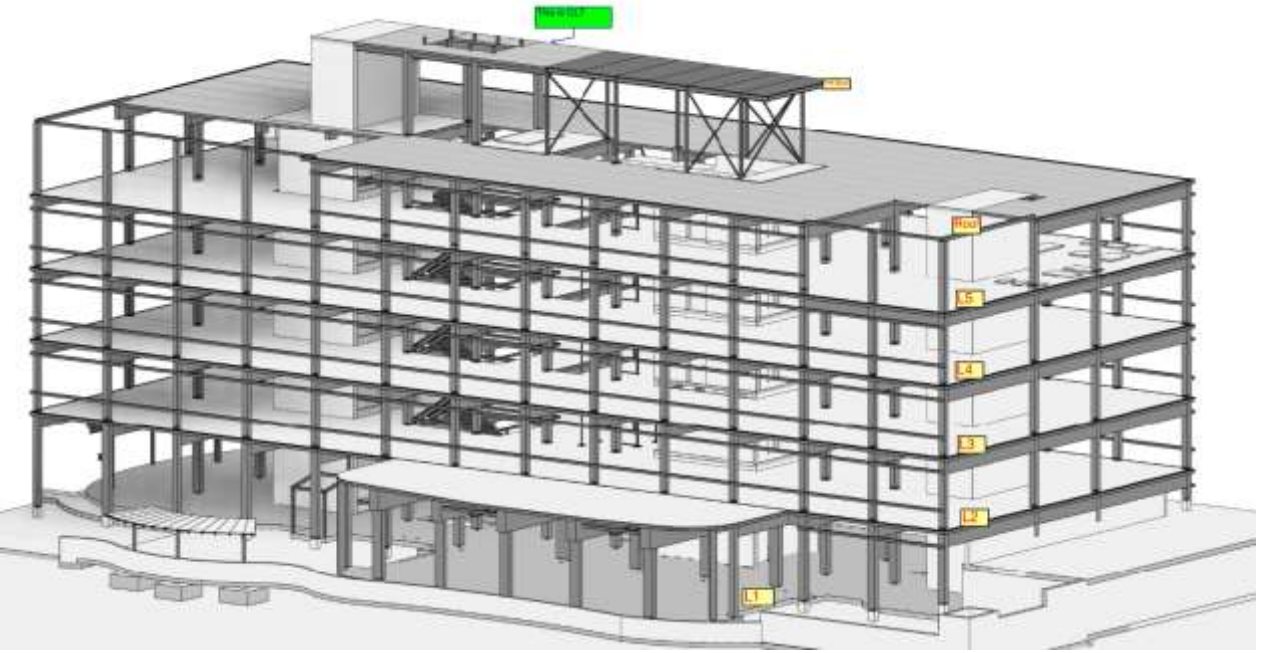
- **Crane Schedule and Allocation**
- **Scope Gaps**
- **Connection Details & Interaction with Trades**
- **Tolerances and Mitigating Re-Work**
- **Coordination between Supplier and Installer** (if separated)

CASE STUDY SCENARIO



- **5 Storey Mass Timber Office with Concrete Core**
  - 91,000 SF GFA (approx. 16,000 SF per Floor)
  - Post, Beam & Panel
  - Half Lap CLT Joints
- **Invited to Provide Turnkey Supply and Install Proposal and Install Only**
  - Hard bid to multiple GCs
  - Different GCs had their own approach

CASE STUDY SCENARIO



- **Supply Scope**
  - Mass Timber Components (Glulam & CLT)
  - Timber Connections
  - Steel (Diaphragm Straps, Drag Plates, Perimeter Channel and CLT Bearing Ledgers @ Concrete Core)
  - Timber Fasteners
  - Shop Applied Membrane for Moisture Protection
  - Shop Applied Sealers for CLT & Glulam
  - Delegated Connection Design

CASE STUDY SCENARIO

Project Considerations

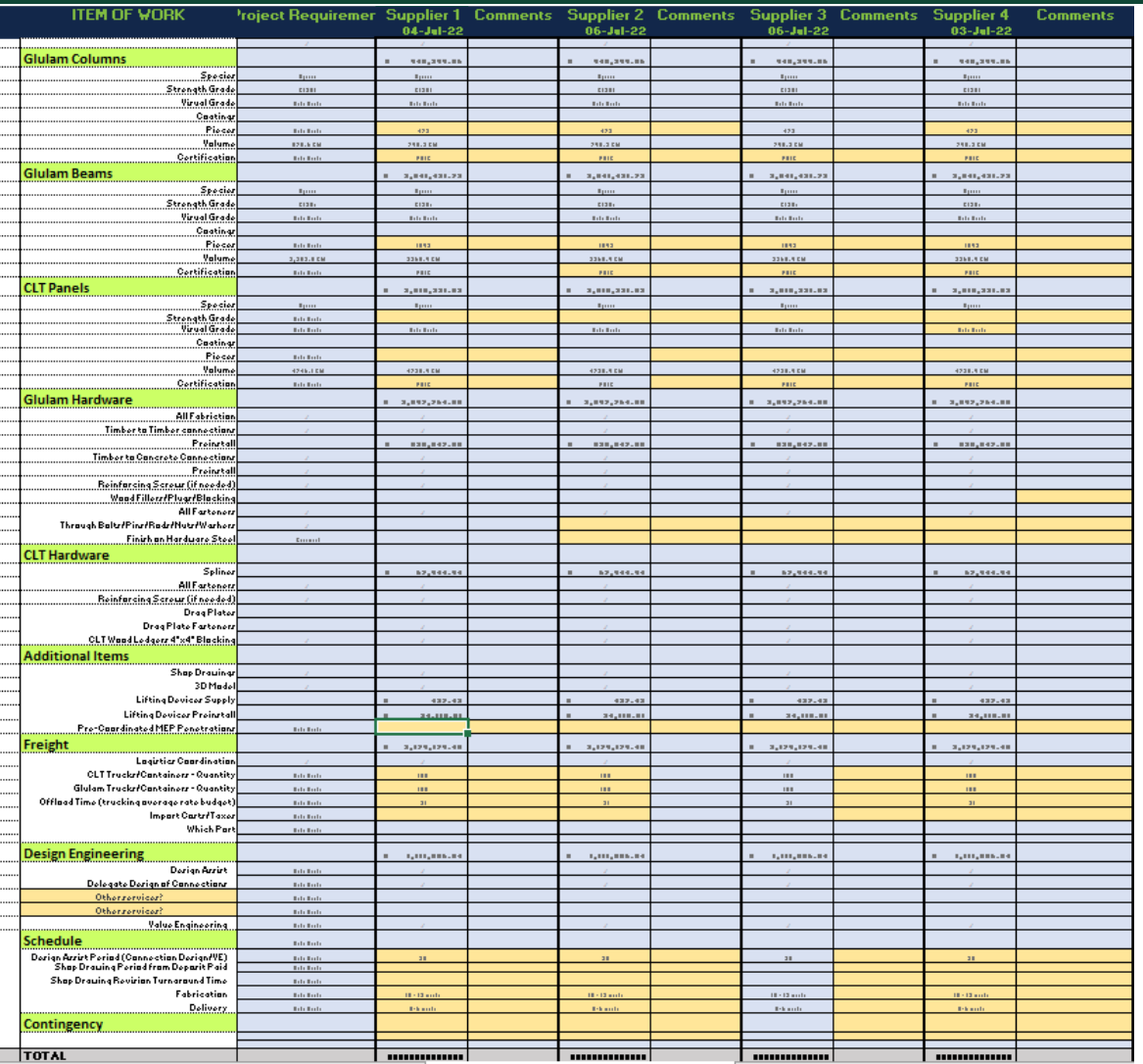
- **Supplier**
  - Looked at Options for Separating Scopes
  - Pre-assembly & Fabrication
  - Sourcing Locally
  - Certification & FSC
- **Design Assist & Value Engineering**
- **Modeling Capabilities**
- **Half Lap Instead of Splines** (Lots of Diaphragm Steel)
- **Use detailed "Supplier Bid Breakdown" to Align Scopes for all Bidders**

CASE STUDY - SUPPLY

Develop a "Supplier Bid Breakdown" at an early stage:

- **Lay out all Project Requirements**
- **Eliminates any Scope Gaps**
- **Speak with Suppliers early**

CASE STUDY - SUPPLY



ITEM OF WORK	Project Requiremer	Supplier 1 04-Jul-22	Comments	Supplier 2 06-Jul-22	Comments	Supplier 3 06-Jul-22	Comments	Supplier 4 03-Jul-22	Comments
Glulam Columns		= $468,399.86		= $468,399.86		= $468,399.86		= $468,399.86	
Specier	Spruce	Spruce		Spruce		Spruce		Spruce	
Strength Grade	GL28H	GL28H		GL28H		GL28H		GL28H	
Visual Grade	Beta Basis	Beta Basis		Beta Basis		Beta Basis		Beta Basis	
Coatings									
Pieces	Beta Basis	473		473		473		473	
Volume	828.3 CM	748.3 CM		748.3 CM		748.3 CM		748.3 CM	
Certification	Beta Basis	PEIC		PEIC		PEIC		PEIC	
Glulam Beams		= $2,661,431.73		= $2,661,431.73		= $2,661,431.73		= $2,661,431.73	
Specier	Spruce	Spruce		Spruce		Spruce		Spruce	
Strength Grade	GL28h	GL28h		GL28h		GL28h		GL28h	
Visual Grade	Beta Basis	Beta Basis		Beta Basis		Beta Basis		Beta Basis	
Coatings									
Pieces	Beta Basis	1893		1893		1893		1893	
Volume	3,282.8 CM	3368.9 CM		3368.9 CM		3368.9 CM		3368.9 CM	
Certification	Beta Basis	PEIC		PEIC		PEIC		PEIC	
CLT Panels		= $3,888,338.83		= $3,888,338.83		= $3,888,338.83		= $3,888,338.83	
Specier	Spruce	Spruce		Spruce		Spruce		Spruce	
Strength Grade	Beta Basis								
Visual Grade	Beta Basis	Beta Basis		Beta Basis		Beta Basis		Beta Basis	
Coatings									
Pieces	Beta Basis								
Volume	4746.1 CM	4738.9 CM		4738.9 CM		4738.9 CM		4738.9 CM	
Certification	Beta Basis	PEIC		PEIC		PEIC		PEIC	
Glulam Hardware		= $3,897,764.88		= $3,897,764.88		= $3,897,764.88		= $3,897,764.88	
All Fabrication	✓	✓		✓		✓		✓	
Timber to Timber connections	✓	✓		✓		✓		✓	
Preinstall	✓	= $838,847.88		= $838,847.88		= $838,847.88		= $838,847.88	
Timber to Concrete Connections	✓	✓		✓		✓		✓	
Preinstall	✓	✓		✓		✓		✓	
Reinforcing Screws (if needed)	✓	✓		✓		✓		✓	
Wood Fillers/Plugs/Blocking	✓	✓		✓		✓		✓	
All Fasteners	✓	✓		✓		✓		✓	
Through Bolts/Pins/Rods/Nuts/Washers	✓	✓		✓		✓		✓	
Finishes Hardware Steel	Galvanized								
CLT Hardware		= $57,966.96		= $57,966.96		= $57,966.96		= $57,966.96	
Splines	✓	✓		✓		✓		✓	
All Fasteners	✓	✓		✓		✓		✓	
Reinforcing Screws (if needed)	✓	✓		✓		✓		✓	
Drag Plates	✓	✓		✓		✓		✓	
Drag Plate Fasteners	✓	✓		✓		✓		✓	
CLT Wood Ledgers 4"x4" Blocking	✓	✓		✓		✓		✓	
Additional Items									
Shop Drawings	✓	✓		✓		✓		✓	
3D Model	✓	✓		✓		✓		✓	
Lifting Devices Supply	✓	= 437.43		= 437.43		= 437.43		= 437.43	
Lifting Devices Preinstall	✓	= 34,888.88		= 34,888.88		= 34,888.88		= 34,888.88	
Pre-Coordinated MEP Penetrations	Beta Basis								
Freight		= $3,876,876.48		= $3,876,876.48		= $3,876,876.48		= $3,876,876.48	
Logistics Coordination	✓	✓		✓		✓		✓	
CLT Trucks/Containers - Quantity	Beta Basis	188		188		188		188	
Glulam Trucks/Containers - Quantity	Beta Basis	188		188		188		188	
Offload Time (trucking average rate budget)	Beta Basis	31		31		31		31	
Import Carts/Taxes	Beta Basis								
Which Port	Beta Basis								
Design Engineering		= $1,888,888.86		= $1,888,888.86		= $1,888,888.86		= $1,888,888.86	
Design Assist	Beta Basis	✓		✓		✓		✓	
Delegate Design of Connections	Beta Basis	✓		✓		✓		✓	
Other services?	Beta Basis	✓		✓		✓		✓	
Other services?	Beta Basis	✓		✓		✓		✓	
Value Engineering	Beta Basis	✓		✓		✓		✓	
Schedule	Beta Basis								
Design Assist Period (Connection Design/VE)	Beta Basis	28		28		28		28	
Shop Drawing Period from Deposit Paid	Beta Basis								
Shop Drawing Revision Turnaround Time	Beta Basis								
Fabrication	Beta Basis	10 - 12 weeks		10 - 12 weeks		10 - 12 weeks		10 - 12 weeks	
Delivery	Beta Basis	8-9 weeks		8-9 weeks		8-9 weeks		8-9 weeks	
Contingency									
TOTAL		##########		##########		##########		##########	

Bid Evaluation & Comparison

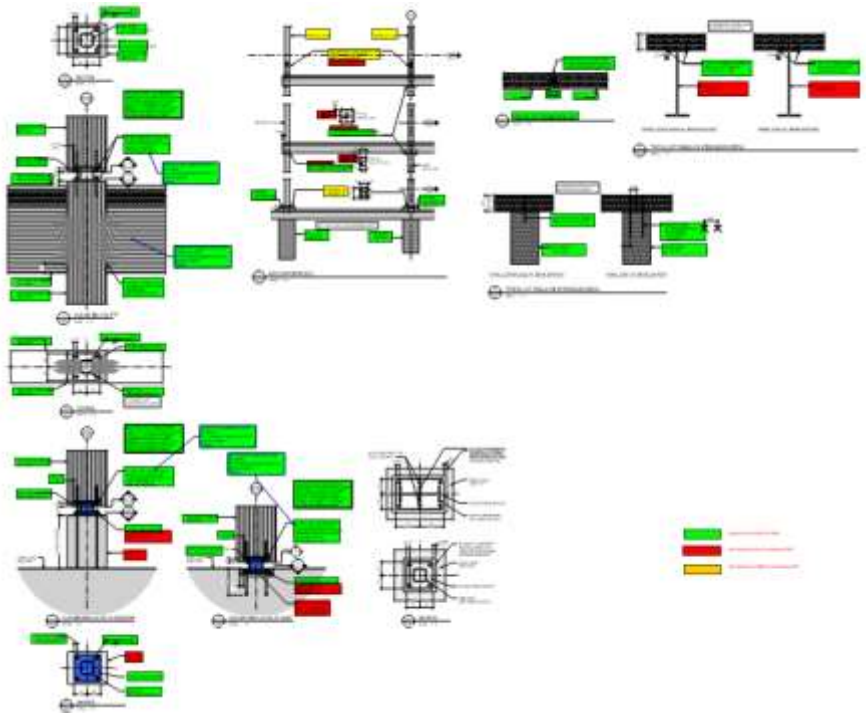
- Compare all Suppliers Once Each Supplier has been Assessed
- Add in any Risks or Contingencies

CASE STUDY - INSTALL

- **Install Scope**
  - Install Glulam Columns, Beams and CLT Floor/Roof Panels (Connections Pre-installed by Supplier)
  - Install Steel (Diaphragm Straps, Drag Plates, Perimeter Channel and CLT Bearing Ledgers @ Concrete Core, Perimeter HSS for Header and Sill Support)
  - Guardrails

- **Site Logistics**
  - Met with all bidding GCs to discuss their logistics
    - Site Conditions
    - # of Cranes & Placement (Tower Crane)
    - Schedule (Plan for Concrete Cores)
    - Review Scope
    - Truck Route
    - Possible Truck Staging Area

CASE STUDY - INSTALL



Scope Delineation

Project Considerations

- **Larger crew to keep pace as there was a lot of steel to install**
- **Crane and site logistic for each GC**
- **Limited Onsite Storage Area**
- **Picks per day**
- **Material unloading strategy**
- **No allowances for onsite moisture management, material repairs or finishing**

CASE STUDY - INSTALL

Scope Method

ITEM OF WORK	Quantity	Unit	Hours/Pc
Mobilize			
Project site setup	1	allow.	
Layout	1	allow.	
Surveying	1	allow.	
Training/Orientation	240	pcs	
Mass Timber Installation			
Glulam Beams	224	pcs	
CLT Floor Panels	466	pcs	
Drag Strap	154	pcs	
102 x 102 x 9.5 HSS	30	pcs	
Fire Caulking per detail 6-A750	6	locations	
Perimeter C150x12 Channel	127	pcs	
1-S3.00	142	pcs	
2-S3.00	105	LF	
3-S3.00	525	LF	
Fire Caulking per detail 3-A750	239	locations	
Demobilize	1	allow.	
Allowances			
Warehouse/ Material Handling		months	
Adverse Weather Allowance		months	
Install Perimeter Guardrail	4	floors	
Overtime Allowance	12.5%		
Total			

- Scope Method is good for pricing as it covers all scopes
- Unit rates per item based on historical data
- Baseline of hours to complete the project and compare to sequence we develop
- Also incorporates project setup, mobilization and demobilization

CASE STUDY - INSTALL

Sequencing Method

Level	Mass Timber Pieces / Floor			CLT panel area (SF)	GFA (SF)	Perimeter (ft)
	Columns	Beams	Floor panels			
L1					20839	
L2	52	57	105	18,324	17825	845
L3	46	40	93	15,757	17793	610
L4	46	40	93	15,757	17793	610
L5	46	40	93	15,757	16770	610
Roof	46	40	93	15,757	0	
PH	4	4	6	823		
TOTAL	240	221	483	82,175	91,020	2,675

Task	QTY	Days	Workers
Stand L2-L3 columns	46	1.5	6
Place L2 glulam beams	40	1.5	6
Place L2 Panels	93	3	6
Splines/Steel/guardrails			4
Days Per Cycle		6	
# of Cycles		4	

Work Force	Rate	Units
Crew Size	10	PPL
Work Days / Week	5	Days
Work Hours / Day	8	Hours
Heaviest Item	9,200	LBS

Typical Cycle Days	24	Day
Additional Days	8	Day
Mob/Demob	5	Day
Layout	2	Day
Sequencing Days	39	Day
Weeks	7.8	Week
Used Week	8	Week
Total hours	3,120	Hours
Productivity		
Hours/MSF	38.0	Hours/MSF
SF/Week	10,272	SF

- Sequencing Method is great for developing a schedule and optimizing the crane
- Develop a cycle based on the crane crew and staff up to complete non-critical tasks

CASE STUDY - REVIEW

Key Take Aways from Case Study

- **GC's logistics plan and schedule can impact how we execute the mass timber scope**
- **Need to have very clear methodology to compare all bids received and allow contingencies for possible scope gaps**
- **Suppliers and installers may provide different bid packages based on their capabilities and willingness to take on scope items**
- **Understand if and how you want present cost savings measures if possible**

ITEMS TO CONSIDER

- Allow for additional preconstruction and planning time compared to other construction methods
- Understand nuances between different mass timber players (suppliers, contractors, installers) and how they can affect pricing and risk
- Know your options and manage expectation
- Sequencing and trade coordination is key to driving schedule
- Strong communication between GC and mass timber proponents

LEARNING OBJECTIVES

- Identify Unique Factors of Mass Timber Projects
- Account for the Complete Scope, Comparing Apples to Apples
- Mitigating Risk

QUESTIONS?

This concludes The American Institute of Architects Continuing Education Systems Course

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