MASS TIMBER CONSTRUCTION MANAGEMENT
DESIGN ENGAGEMENT & SITE PLANNING

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

Considerations:

- Procurement method
- Design phase
- Team experience with mass timber
- Understanding of current code
- Has a decision on the use of mass timber been made?

Design-Assist Subcontractors:

- Mass timber supplier
- Mass timber erector
- MEP subcontractors
Cost Drivers

Superstructure Cost Drivers
• Construction type & fire rating
• Size & geometry of building
• Structural column grid
• CLT panel spans & thickness
• Panel size & shapes
• Depth of glulam beams
• Connection details
• Acoustic floor assembly
• Shear wall / core layout

<table>
<thead>
<tr>
<th>Superstructure Costs</th>
<th>Mass Timber</th>
<th>Concrete</th>
<th>Structural Steel</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low Range</td>
<td>$42/SF</td>
<td>$40/SF</td>
<td>$38/SF</td>
</tr>
<tr>
<td>High Range</td>
<td>$75/SF</td>
<td>$54/SF</td>
<td>$48/SF</td>
</tr>
</tbody>
</table>

* Based on 2021 dollars in Denver, CO

Offsetting Factors – Beyond Superstructure
• Schedule reduction – up to 40% faster on superstructure work
• Enhanced trade flow – no re-shores
• Smaller foundations
• Reduced floor to floor height
• Reduction in ceiling finishes
• Smaller crane size
• Reduce temp heating costs (in cold climates)
Structure Comparison

Concept Pricing Considerations:

- Floor-to-floor height
- Structural grid & column spacing
- Footing/column quantity
- Foundation sizing & type
- Transfer slab/beams (i.e. U/G parking)
- Lateral resistance frame & shear walls
- Interior finishes
- Core & shell vs. fully built-out
- LEED/sustainability requirements
- Construction duration
## Impact of Construction Type

<table>
<thead>
<tr>
<th>Location of Event Space</th>
<th>Rooftop</th>
<th>1st Floor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Construction Type</td>
<td>III-A</td>
<td>III-B</td>
</tr>
<tr>
<td>Assembly Group</td>
<td>A-3</td>
<td>A-3</td>
</tr>
<tr>
<td>Fire Resistive Rating</td>
<td>1-Hr</td>
<td>Not required</td>
</tr>
<tr>
<td>Connections</td>
<td>Concealed</td>
<td>Exposed</td>
</tr>
<tr>
<td>CLT Panel Thickness</td>
<td>5-Ply</td>
<td>3-Ply</td>
</tr>
<tr>
<td>Superstructure Cost/SF</td>
<td>$65/SF</td>
<td>$53/SF</td>
</tr>
</tbody>
</table>
# Impact of Construction Type

<table>
<thead>
<tr>
<th></th>
<th>Office &amp; Residential</th>
<th>Office Only</th>
</tr>
</thead>
<tbody>
<tr>
<td>Floors</td>
<td>9-stories</td>
<td>8-stories</td>
</tr>
<tr>
<td>Building Height</td>
<td>92'-6&quot;</td>
<td>80'-6&quot;</td>
</tr>
<tr>
<td>Construction Type</td>
<td>IV-B</td>
<td>IV-C</td>
</tr>
<tr>
<td>Occupancy</td>
<td>B &amp; R-2</td>
<td>B</td>
</tr>
<tr>
<td>Fire Resistive Rating</td>
<td>2-Hr</td>
<td>2-Hr</td>
</tr>
<tr>
<td>Exposed Ceilings</td>
<td>30%</td>
<td>100%</td>
</tr>
<tr>
<td>Connections</td>
<td>Concealed</td>
<td>Concealed</td>
</tr>
<tr>
<td>CLT Panel Thickness</td>
<td>5-Ply</td>
<td>3-Ply</td>
</tr>
<tr>
<td>Superstructure Cost/SF</td>
<td>$77/SF</td>
<td>$62/SF</td>
</tr>
</tbody>
</table>
Manufacturer Selection

- Domestic vs. International Sourcing
- Varying Panel Fabrication Size Limits
- Engineering Support
- Panel Width Shipping Constraints – Land vs. Sea
- Proximity to Jobsite / Shipping Costs
- Supplier Only vs. Turn-Key
- Sustainability – FSC vs. SFI Certification
- Aesthetic Considerations
- Wood Species & Stains
Procurement Best Practices

- Early Go/No-Go Decision on Mass Timber
- Design-assist involvement
- Early supplier selection vs. competitive bid
- Optimize structural grid with supplier input
- Maximize time for design coordination
  - Shop drawing release
  - MEP coordination
  - Fabrication lead time
  - Constructability reviews
- Transfer of Revit model to contractor
MEP Coordination

Raised Access Flooring

Overhead Routing w/ Soffits
Case Study: Wood Innovation & Design Center
Case Study: CSU Pavilion at Laurel Village

1st CLT project in Colorado (2014)
LEED Platinum certification

- No topping slabs at floor assembly
- Rigid insulation at roof assembly
- Long span, exposed ceilings
- Extensive use of mockups
Case Study: DU Burwell Center

Challenge: No exposed conduit!

- Well defined space programming
- Originally explored access flooring
- 3” topping slabs at floor & roof assembly
- 3D model ALL conduit
- Penetration overlay with CLT shop drawings
- Strategic placement of soffits & ceilings
- Topping slab reinforcing
MEP Coordination: Best Practices

- Identify aesthetic MEP routing goals early
- Determine extent of flexibility required
- Early transfer of REVIT model
- Prioritize MEP penetration coordination
- Consolidate MEP in soffits/ceilings
- Maximize shop penetrations made with CNC machine in factory
- Minimize field penetrations
Critical Early Design Decisions

- Structure type
- Structural grid
- Select mass timber supplier
- Building height
- Construction type
- Fire Resistance Rating
- Occupancy Classification
- MEP systems
- MEP routing goals
- Floor-to-floor height
Construction Tolerances

Dissimilar structural material tolerances
• Allowable tolerances – ACI, AISC
• Steel: +/- 1/2”
• Concrete: 1/4” in 10 ft., up to 1’
• Mass Timber: 1/16”

Quality Control
• Build tolerance into the interface detail
• Base plate layout & verification
• Overlay field scan with 3D model
Erection Sequence

- Shear wall bracing plan
- Early establishment of diaphragm – lock the building in
- Coordination w/ Just-in-Time material delivery
- Ensure erection sequence aligns with details
Site Logistics

Targeted Goals:
- Pick CLT panels directly off the trailer
- Eliminate double-handling
- Eliminate onsite storage of material

Best Practices
- Align erection and fabrication sequence
- Optimize lay down area & crane placement
- Onsite vs. Offsite Marshalling Yard
Thank you!

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