Hybrid Mass Timber + Steel
RISD Quad

Disclaimer: This presentation was developed by a third party and is not funded by WoodWorks or the Softwood Lumber Board
RISD Quad New Residence Hall

Key Project Challenges

- Schedule and speed
- Aggressive institution wide sustainability goals
- Adjacent concrete flat plate dormitories
- Design goal to create artist loft experience
- Interest in mass timber
Cross Laminated Timber

- Made with sapling lumber
- Manufactured in up to 65’ lengths
- Two-way action possible
- Sequestered carbon

Diagram showing different layers and measurements of Cross Laminated Timber.
### IBC2015 Construction Types

#### All heights assume NFPA 13 sprinkler system

<table>
<thead>
<tr>
<th>Occupancy</th>
<th>Type 1</th>
<th>Type 3</th>
<th>Type 4</th>
<th>Type 5</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Noncombustible</td>
<td>Noncombustible/Combustible</td>
<td>Heavy Timber</td>
<td>Combustible</td>
</tr>
<tr>
<td>A,B,R</td>
<td>None</td>
<td>180'</td>
<td>85'</td>
<td>70'</td>
</tr>
<tr>
<td>A-2, A-3</td>
<td>None</td>
<td>12</td>
<td>4</td>
<td>3</td>
</tr>
<tr>
<td>A-4</td>
<td>None</td>
<td>12</td>
<td>6</td>
<td>4</td>
</tr>
<tr>
<td>B</td>
<td>None</td>
<td>12</td>
<td>6</td>
<td>4</td>
</tr>
<tr>
<td>R-2</td>
<td>None</td>
<td>12</td>
<td>5</td>
<td>4</td>
</tr>
</tbody>
</table>

- **A**: Interior structure fire rated
- **B**: Interior mostly unrated

**Can use Mass Timber in ALL types**

<table>
<thead>
<tr>
<th>Height Limit</th>
<th># of Stories</th>
</tr>
</thead>
<tbody>
<tr>
<td>A: Interior structure fire rated</td>
<td>B: Interior mostly unrated</td>
</tr>
</tbody>
</table>
Height Limits – Type 3 and Type 4

- Type 3:
  - 85' (3A, 4)
  - 75' (3B)

- Type 4:
  - Max 5 Stories
  - Above podium

Residential Dormitory (R-2)
# Minimum Heavy Timber Sizes (Type 4)

<table>
<thead>
<tr>
<th>Member Type</th>
<th>Floor Framing</th>
<th>Roof Framing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Column</td>
<td>8x8</td>
<td>6x6</td>
</tr>
<tr>
<td>Beam</td>
<td>6x10</td>
<td>6” minimum thickness</td>
</tr>
<tr>
<td>Floor Deck (solid or glulam)</td>
<td>4” nominal</td>
<td>2” nominal</td>
</tr>
<tr>
<td>Cross laminated timber</td>
<td>4” actual</td>
<td>3” nominal</td>
</tr>
</tbody>
</table>

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**Table 602.4 Wood Member Size Equivalencies**

<table>
<thead>
<tr>
<th>Width, inch</th>
<th>Depth, inch</th>
<th>Width, inch</th>
<th>Depth, inch</th>
<th>Width, inch</th>
<th>Depth, inch</th>
</tr>
</thead>
<tbody>
<tr>
<td>8</td>
<td>8</td>
<td>6 1/4</td>
<td>8 1/4</td>
<td>7</td>
<td>7 1/2</td>
</tr>
<tr>
<td>6</td>
<td>10</td>
<td>5</td>
<td>10 1/2</td>
<td>5 1/4</td>
<td>9 1/2</td>
</tr>
<tr>
<td>6</td>
<td>8</td>
<td>5</td>
<td>8 1/4</td>
<td>5 1/4</td>
<td>7 1/2</td>
</tr>
<tr>
<td>6</td>
<td>6</td>
<td>5</td>
<td>6</td>
<td>5 1/4</td>
<td>5 1/2</td>
</tr>
<tr>
<td>4</td>
<td>6</td>
<td>3</td>
<td>6 1/4</td>
<td>3 1/2</td>
<td>5 1/2</td>
</tr>
</tbody>
</table>
Choosing by Advantages

Options

- Girder-slab (precast concrete with steel)
- All glued laminated timber frame and decking
- Steel-CLT hybrid

Key Factors

- Speed of construction
- Sustainability
- Aesthetic “look and feel”
- Cost
- Span and depth of members
Overview: Hybrid CLT-Steel Construction

**Features**

- Steel frame with CLT slabs
- One-way CLT panels – entire building width
- Construction Type
  - Type 1A construction – Below Lvl 2
  - Type 3B construction – Above Lvl 2
- Exposed CLT ceilings
- Topping slab and acoustic isolation mat for sound isolation
Floor Assembly – Acoustic Separation

- IBC 2015 Sound Transmission (1207)
  - Sound Transmission Class >= 50
  - Impact Insulation Class >=50

- Final Assembly (USG Products):
  - USG Levelrock SAM-N25 Ultra – Sound Attenuation Mat
  - USG Levelrock Sound Reduction Board
  - USG Levelrock 3500 Floor Underlayment (2” min thickness)
CLT in Exterior Wall Assembly

- IBC 2015 Requirements (602.4)
  - Allowed in walls with 2 hour rating or less
  - Must be protected on exterior surface
Constructability Considerations

**Key Issues**

- Mix of trades – wood and steel erector
- Fasteners chosen for speed
- Most holes field drilled – simplifies coordination
- Diaphragm design using spline connectors
All field connections bolted
Unframed openings in floors
Coordination of MEP systems
Early steel release (10/18), all utilities exposed in corridors with no ceilings, > 400 beam penetrations, 0 penetrations added in the field.

Utilities include sprinklers, refrigerant lines (3-pipe VRF), condensate lines, supply and exhaust ducts (ERV), roof drains and overflows, domestic plumbing and sewerage, lighting and electrical, IT with conduit and cable trays, etc.
Exterior Skin Construction
Exterior Skin Construction
Exterior Skin Construction
This concludes The American Institute of Architects Continuing Education Systems Course

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