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
# IBC2015 Construction Types

All heights assume NFPA 13 sprinkler system

<table>
<thead>
<tr>
<th>Occupancy</th>
<th>Type 1 Noncombustible</th>
<th>Type 3 Noncombustible/Combustible</th>
<th>Type 4 Heavy Timber</th>
<th>Type 5 Combustible</th>
</tr>
</thead>
<tbody>
<tr>
<td>A,B,R</td>
<td>A</td>
<td>A</td>
<td>A</td>
<td>A</td>
</tr>
<tr>
<td></td>
<td>B 180’</td>
<td>B 85’ 75’</td>
<td>B 85’ 70’</td>
<td>B 60’</td>
</tr>
<tr>
<td>A-2, A-3</td>
<td>A-2</td>
<td>A-3</td>
<td>A-4</td>
<td>A-4</td>
</tr>
<tr>
<td>A-4</td>
<td>None 12</td>
<td>4</td>
<td>4</td>
<td>3</td>
</tr>
<tr>
<td>B</td>
<td>None 12</td>
<td>6</td>
<td>6</td>
<td>4</td>
</tr>
<tr>
<td>R-2</td>
<td>None 12</td>
<td>5</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

Height Limit

# of Stories
Height Limits – Type 3 and Type 4

Max 5 Stories

85’ (3A, 4)
75’ (3B)

Max 5 Stories above podium

Type 1A 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 glu-lam)</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>

### Table 602.4

<table>
<thead>
<tr>
<th>Width, inch</th>
<th>Depth, inch</th>
<th>Minimum Nominal Solid Sawn Size</th>
<th>Minimum Glued-Laminated Net Size</th>
<th>Minimum Structural Composite Lumber Net Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>8</td>
<td>8</td>
<td>61/4</td>
<td>81/4</td>
<td>7</td>
</tr>
<tr>
<td>6</td>
<td>10</td>
<td>5</td>
<td>101/2</td>
<td>51/4</td>
</tr>
<tr>
<td>6</td>
<td>8</td>
<td>5</td>
<td>81/4</td>
<td>51/4</td>
</tr>
<tr>
<td>6</td>
<td>6</td>
<td>5</td>
<td>6</td>
<td>51/4</td>
</tr>
<tr>
<td>4</td>
<td>6</td>
<td>3</td>
<td>61/4</td>
<td>31/2</td>
</tr>
</tbody>
</table>

Notes: 4x6 nominal and 3x6 nominal are not Code permitted for joists.
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
This concludes The American Institute of Architects
Continuing Education Systems Course
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