Building with engineered wood construction systems

Fire Safety Engineering in Timber Buildings

1 June 2015
Robert Gerard, Arup Sydney

Frame Australia 2015 Conference and Exhibition
Fire Safety in Timber Buildings

• Perception vs. reality
Fire Safety in Timber Buildings

- Timber Buildings
- Fire Performance
- Fire Solutions
Traditional Forms

• Light timber framing
• Low-rise buildings
Traditional Forms

- Heavy timber framing
- Low-, mid- and high-rise
Future Forms

• Pushing boundaries
  - Structure
Future Forms

- Pushing boundaries
  - Prefabrication
Future Forms

• Pushing boundaries
  - Complexity
Future Forms

• Pushing boundaries
  - Expressed timber
Future Forms

• Pushing boundaries
  - Height

2000 Platform
2008 CLT
2012 Glulam / RC
2013 CLT
2015 Glulam / CLT / RC
2015+ Glulam / CLT / Hybrid Construction
Fire Performance

• Charring
Fire Performance

- Fire resistance
Fire Performance

- Charring rates
- Contribution to fuel load
- Delamination
- Potential for self extinguishment
- Structural response
Fire Strategies

- Active systems
- Passive systems
Implementation

- Prescriptive requirements
- Performance solutions

<table>
<thead>
<tr>
<th>Country</th>
<th>Applicable Building Code</th>
<th>Maximum # of Stories</th>
<th>Performance Design</th>
</tr>
</thead>
<tbody>
<tr>
<td>Australia</td>
<td>2015 Building Code of Australia (BCA)</td>
<td>3</td>
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<tr>
<td>Austria</td>
<td>Austrian Building Codes</td>
<td>8 (*22m)</td>
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<td>Canada</td>
<td>2010 National Building Code of Canada (NBCC)</td>
<td>6</td>
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<td>Germany</td>
<td>2012 Federal Building Code</td>
<td>8 (*18m)</td>
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<td>Sweden</td>
<td>2013 Planning and Building Act</td>
<td>8</td>
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<td>UK</td>
<td>2010 Building Regulations</td>
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<td>✓</td>
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</tbody>
</table>

* Indicates a height limit in addition to a maximum story limit
Case Studies

- Stadthaus, London, UK, 2009
  - 9-story, CLT residential building
  - Encapsulation (passive fire protection)
  - Non-sprinklered
Case Studies

• Forté Building, Melbourne, Australia, 2013
  - 10 story CLT residential building
  - Sprinkler protected
  - Partial encapsulation (passive protection)
  - CLT isolated core
  - CLT floors
Case Studies

  - 4 story education / office building
  - Glulam beams w/ CLT walls
  - Non-sprinklered
  - 60-minutes FRR via charring
  - CLT isolated core
  - Timber cassette floor slab
  - Timber cassette façade panels
Case Studies

• Treet, Bergen, Norway, 2015
  - 14 story residential building
  - Glulam frame
  - Timber prefabricated modules
  - Sprinkler protected
  - 90-minutes FRR via charring
Case Studies

Svartamoen Trondheim Norway - 5 Residential 2005
MFH Holzenhausen Steinhausen Switzerland - 6 Residential 2006
Waterson Street Hoxton United Kingdom - 5 Residential 2006
Lagerhuset Eslov Sweden - 10 Residential 2008
Limnologen Vaxjo Sweden - 8 Residential 2008
E3 Berlin Germany - 7 Residential 2008
Stadhaus, Murray Grove London - 8 Residential 2009
Bridport House London - 8 Residential 2011
Bad Aibling, H8 Bad Aibling Germany - 8 Mixed 2011
Grün Berlin Germany - 5 Residential 2011
Forte Living Melbourne Australia - 10 Residential 2012
Life Cycle Tower One Dornbirn Austria - 8 Office 2012
52 Whitmore Road London United Kingdom - 6 Mixed 2012
UBC Earth Sciences Vancouver Canada - 5 Education 2012
Via Cenni di Cambiamento Milano Italy - 9 Residential 2013
Studentenwohneim Oslo Norway - 8 Residential 2013

House of India Paris France - 7 Residential 2013
WHA Wagramerstrasse Vienna Austria - 7 Residential 2013
Panorama Giustinelli Trieste Italy - 7 Residential 2013
Bullit Centre Seattle United States - 6 Office 2013
Tamedia Zurich Switzerland - 6 Office 2013
District 03 Quebec City Canada - 6 Residential 2013
WIDC Prince George Canada - 6 Office 2013
Merina Verde Caorle Italy - 6 Hotel 2013
Woodcube Hamburg Germany - 5 Residential 2013
Banyan Wharf London United Kingdom - 10 Residential 2014
Illwerke Zentrum Montafon Dornbirn Austria - 5 Office 2014
Rundeskogen Sandnes Norway - 8 Residential 2014
Treet Bergen Norway - 14 Residential 2015
Shaing-Yang Woodtek Taiwan - 5 Office 2014
St. Dié-des-Vosges St. Dié-des-Vosges France - 8 Residential 2014

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Pushing the limits

- Architectural ambition
- Research and education
- Fire safety
Pushing the limits

- Timber Buildings
- Fire Performance
- Fire Solutions
Pushing the limits

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