New Technologies to Revolutionise Timber Buildings

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Outline

- New materials and prefabrication techniques
- Advanced design technologies
- New structural concepts
- New forms of timber buildings
- Current & future R&D initiatives
New materials and prefabrication techniques
Shortcomings of current building practices
- Time and labour costs
- Not an optimal construction environment (exposed to elements)

*These are forcing the industry to adjust and develop prefabricated solutions*
New materials
LVL and X-LVL
Crosslam
Glulam slabs
Prefabrication techniques
Prefab wall systems

Source: Växjö University
Prefabricated slab systems
Wood Innovations 08

Advanced Design Technologies
- Cad/Cam
- efficient design procedures
- better understanding of effects of fire and earthquakes
CAD / CAM Systems

• Potential for development of cost effective, new products that will compete with existing building systems
• Recognition of need to link R&D closely with commercial viability
• Requires significant investment
More efficient design tools

- CAD software that can size and detail structural parts (e.g. CADWORKS) and design procedures …
- for connection design
- lateral load resisting systems

*Urgent need to fund development and updating of both AS 1720.1 & NZS 3603 Timber Structures Design codes with software – particularly connection design*
Worldwide research effort to demonstrate the behaviour of timber buildings under severe seismic loading
... and to demonstrate the fire resistance of timber buildings
New Structural Concepts
Timber-concrete composite construction
Other innovations
Multi-Storey Residential and Commercial Buildings
Development of MSTF construction

Multi-storey timber framing for buildings in North America and Europe well established, for 4 to 6 storey

9 storey residential built from “cross laminated” panels

6 storey commercial built using glulam frames and TCC floors
Concept for a proposed 6 storey building

Concrete core and Timber gravity frame
In the future, LVL core with LVL columns and LVL/concrete beams
New forms of timber buildings
First storey in concrete
Next 4 in timber
8 storey timber building in Växjö, Sweden
4 - 8 storey timber buildings
First storey in Concrete, the top 7 in timber
9 storey X-Lam Building in London

Also
8 storey in Sweden
6 storey in Ireland and all over Europe
R&D Initiatives
Current R&D

Three main research initiatives:
1. Development of multistorey timber seismic frames at UC
2. Engineered Timber Building Systems for Non Residential Applications
   - UTS and UC, funded by FWPA 2007 to 2008 ($630k)
3. Structural Timber Innovation Company
   - UC, AU & UTS, funded by NZ Gov & Industry
   - $10m NZD over five years, commencing 2008 / 09
Current R&D

• Development of New Systems:
  – Prestressed Timber Frames
  – Timber Concrete Composite flooring systems
  – Use of CAD / CAM manufacturing and prefabrication

• Assessment of Competitor Systems:
  – Currently used building systems used for floors and walls (e.g. precast / prefabricated / tilt-up conc)
Timber Framing Systems

Recent work at UC

Use of column & beam frames for multi-storey buildings in seismic areas

post tensioned LVL frames that are “self healing”
Outcomes to date

- Research to date has proven the technical viability of TCC floor systems, spanning up to 8m.
- 2 most important factors affecting the connection performance are the length of the notch and the presence of a coach screw.
- Rectangular, triangular and trapezoidal notches with coach screws or metal plates provide an excellent connection system.
- R&D for MSTF systems set to expand with formation of STIC.
Structural Timber Innovation Company (STIC)

- Focus on developing markets for “engineered” timber products in non-residential markets
- Targeting Commercial & Industrial Buildings
- Three Main Programs / Objectives:
  - Roof Systems
  - Floor Systems
  - Wall and Framing Systems
- R&D driven by Researchers & Industry Partners
Market Development Focus

New Zealand:

- 6 to 8 storey timber framed buildings
- Seismic performance requirements
- Large spanning floors & roofs for commercial & industrial
Market Development Focus

Australia:

- 2 to 3 storey timber framed buildings
- Gravity & Wind performance requirements
- Large spanning floors & roofs for commercial & industrial, perhaps in combination with precast concrete systems
CONCLUSIONS

- exciting times for structural timber, but with some significant challenges
- new concepts and improved design techniques
- new structural materials and prefabrication
- timber buildings are taking new forms
- current significant investment in R&D as an “enabler” for timber!
Thank you for your attention