SB13 GRAZ-SUSTAINABLE BUILDING CONFERENCE 2013

Medium-rise structural timber apartments: Luxury or long-term carbon storage solution?

Douglas Thomas
Dr Grace Ding
Professor Keith Crews

University of Technology Sydney-Australia

September 27, 2013

Agenda

Background

- Timber use in modern construction
- Timber use in residential apartment construction
- Barriers to multi-residential timber buildings

Market perception survey

- Methodology
- Observation and analysis
- Discussion

Strategies

Further Research

Background

Timber use in modern construction

- Engineered timbers
  - Cross laminated timber (CLT)
  - Glulam
  - Laminated veneer lumber (LVL)
  - Oriented Strand Board (OSB)

Background

Timber use in modern construction

- Engineered timber floor systems
  - Timber concrete composite (TCC) floors

Background

Timber use in modern construction

- Cross laminated timber (CLT) and cavity floors with OSB.
- Paul Chevallier School complex
- Rillieux-la-Pape-Lyon, France
- Completed in 2013

Background

Timber use in modern construction

- Laminated veneer lumber (LVL)-stressed steel cables for seismic loads
- Pre-cast timber concrete composite (TCC) floors
- Massey University-Wellington, New Zealand

Background

Timber use in modern construction

- Laminated veneer lumber (LVL)-stressed steel cables for seismic loads in sheer walls
- Pre-cast Timber Concrete Composite (TCC) floors
- Nelson Marlborough Institute of Technology (NMIT) New Zealand

Background

Timber use in modern construction

- Life Cycle Tower One-8 storeys commercial building
- Concrete core-TCC floors
- Modular construction
- Dornbirn-Austria (2012)

Background

Timber use in multi-residential construction

- Cross laminated timber superstructure
- 6 storey apartment block
- 53 condominiums/units
- St. Roch district-Quebec city, North America (2013)

Background

Timber use in multi-residential construction

- Concrete ground floor-CLT above (Stadthaus)
- 9 storeys-29 condominiums/units (mixed private/social housing
- Murray Grove-London (2009)
- 340 tons less embodied carbon
- 200 tons of sequestered carbon

Background

Timber use in multi-residential construction

- Cross laminated timber structure-brick veneer (Bridport house)
- 8 storeys-41 apartments (social housing)
- Hackney-London (2011).
- 892 tons less embodied carbon
- 1221 tons sequestered carbon

Background

Worlds tallest timber residential building

- 10 storey apartment building in Docklands-Melbourne, Australia (2012)
- Ground floor concrete-remaining floors and walls CLT-private residential
- 23 apartments-32.2m tall
- 690 tons less embodied carbon
- 761 tons sequestered carbon

Background

Timber use in multi-residential construction

- Concrete and steel are predominantly used in residential unit construction in Australia
- Why timber?
  - Reduce carbon emissions
    - Low embodied energy (grey)
    - Sequestered carbon
  - Light weight
  - Prefabrication-quality control
  - Construction time- 40% quicker
  - Preliminaries
  - Safety

Background

Barriers to multi-residential timber buildings

- Legislation
  - National code of construction -fire and acoustic
  - Fire authorities
  - Alternate solution-expensive and time consuming
- Insurance
- Financial risk-lack of costing details
- Lack of experience-construction professionals
- Supply chain-lead times
- Building innovation can takes decades for adoption
- Design and Construct environment (detailed design required)
- **Market perception of timber in residential construction**

Research Method

Market Perception Survey

- Internet survey
- Distributed to construction and non-construction professionals
- Approximately 15% response (310 Number)
- State of NSW, Australia

Questions

- Demographics
- Attitudes towards sustainable construction
- Material preference for medium-rise apartments
- Expectations of a premium for sustainable timber apartments

Observation and analysis

Market Perception Survey

Demographics

- Females underrepresented
- Similar age distribution as the population of NSW, Australia
- Construction professionals 48%/ Non-construction workers 52%

PROFESSION	No.	Percentage %
Architect	17	5.7
Cost Planner	4	1.3
Builder	11	3.7
Project Manager	33	11.1
Engineer	14	4.7
Developer	20	6.7
Property	24	8.1
Building Trade	2	0.7
Other Building related	19	6.4
Total Construction	**144**	**48.4**
Non-construction	**153**	**51.6**
TOTAL SAMPLE	297	100

Observation and analysis

Market Perception Survey

Sustainability

- ↑ society effort towards sustainability — 90% for,7% against
- ↑ sustainable material use in construction — 94% for,4% against
- Timber is sustainable building material — 65% for,6% against

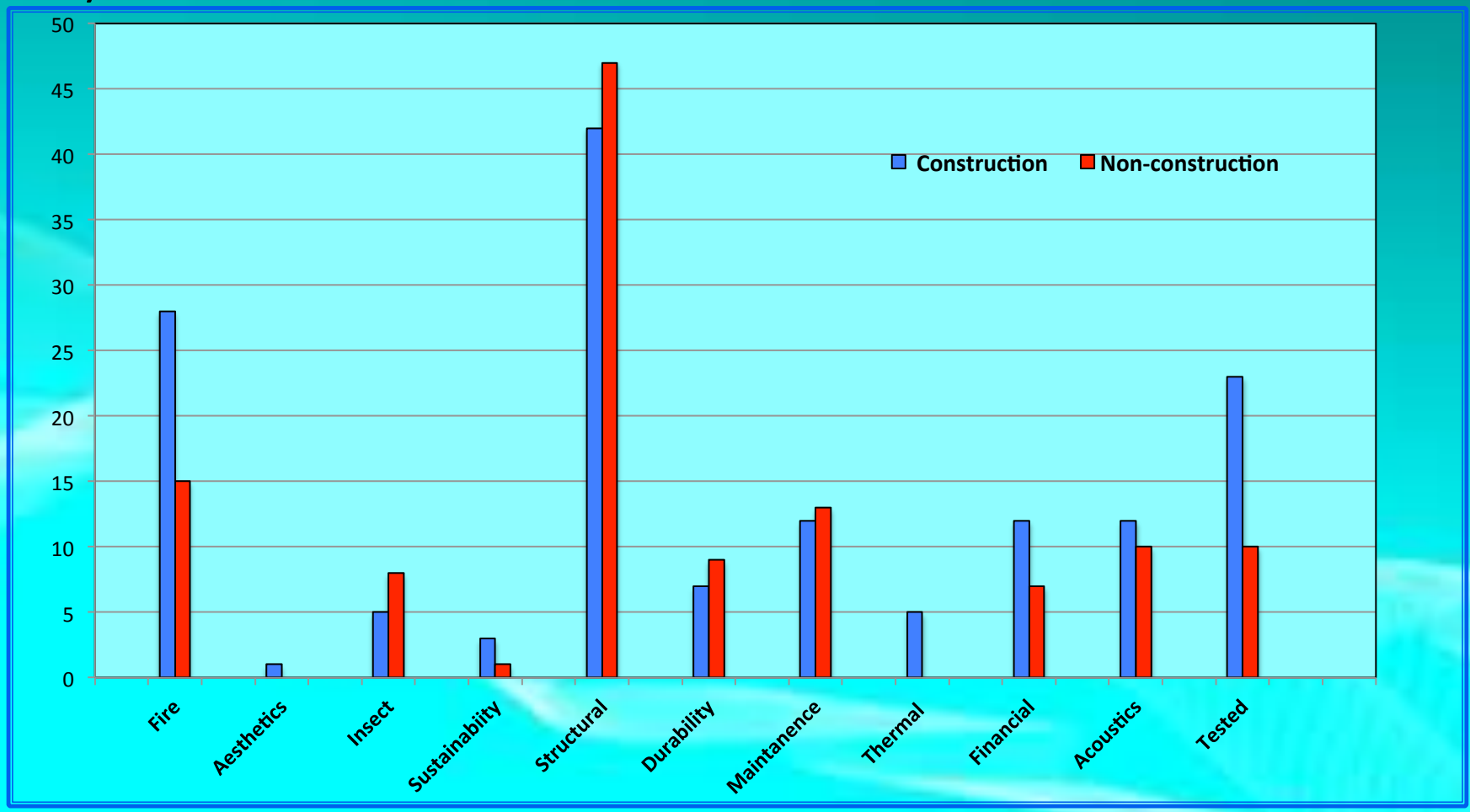
Material preference for apartments

Demographic group	Prefer to live in a timber apartment %		Prefer to purchase a timber apartment %	
	Timber	Concrete	Timber	Concrete
All responses	21	79	10	90
Male	12	88	6	94
Female	36	64	20	80
Construction	16	84	7	93
Non-Construction	26	74	14	86

Observation and analysis

Market Perception Survey

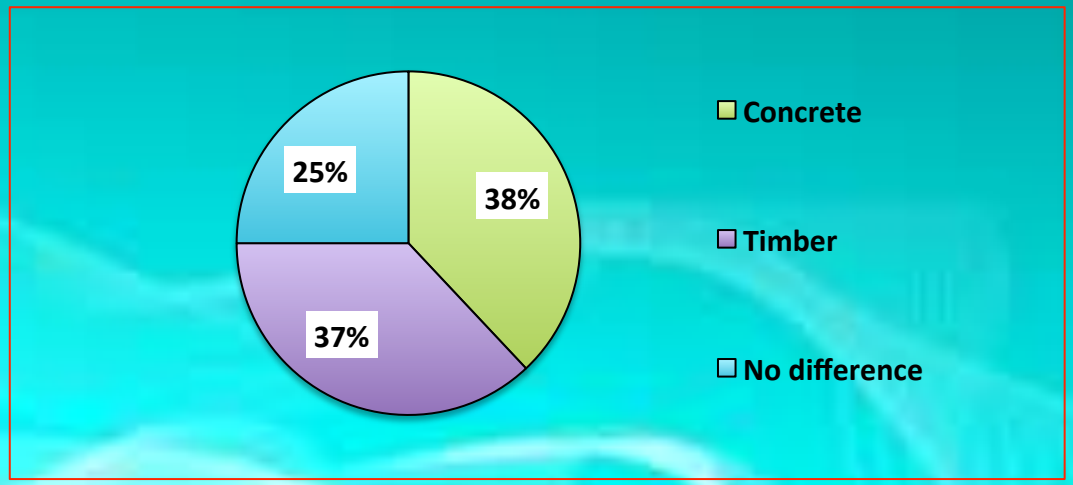
Why concrete over timber?



Observation and analysis

Market Perception Survey

Pay more for timber or concrete apartments?



How much more would you expect to pay? ($550,000 apartment)

- Concrete $16,000-2.9%
- Timber $15,600-2.8%

Discussion

Market misperceptions and issues

- Structural adequacy of timber in taller buildings
- Fear of the combustible nature of timber in tall buildings despite legislative requirements
- Familiarity and acceptance by the construction industry and general public of reinforced concrete apartment construction
- Projection of common negative perceptions of residential timber performance such as insect and water damage onto larger residential timber construction projects.

Strategies

Increased Education

- Educate the demand side of the market.
- Produce a clear and simple report on the effects of carbon tax.
- Publicly showcase innovative timber construction methods.
- Educate future construction professionals on sustainable building options.

Further Research

Supply side interviews

- Semi-structured interviews with Construction professionals

- Initial findings
  - Cost prohibitive to 2nd tier companies
  - Lack of accurate cost data (ruled out at feasibility stage)
  - Design for a timber structure
  - Needs to be Client driven
  - Government incentives-additional floor area for carbon reduction
  - Suitable for Building Information Modelling (BIM)
  - Multiple benefits once a mainstream construction methodology

The End

Questions?