Presentation to BNZ Forest Industries Conference 2011

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- The Market Challenges
- STIC and its R&D programme
- Technology roll-out & Christchurch opportunities
The Market Challenges

Why has timber not competed well in commercial multi-storey?

- **Short spans** - many load-bearing walls
- **Inflexible** – not open plan & not easily reconfigured

Why has timber not competed well in industrial single-storey (portal frames)?

- **Complex knee-joint design** and many on-site fasteners
- **Lack of pre-fabrication** and time consuming on-site erection

What is STIC doing in response?

Who is STIC?

STIC is the acronym for:

**Structural Timber Innovation Company Ltd.**

STIC is a Research Consortium based in NZ, with Australian and NZ shareholders and stakeholders

**EXPAN** is the STIC brand for all its technology outputs
STIC Stakeholders

- **STIC Shareholders are:**
  - Carter Holt Harvey
  - WeeBeam
  - Golden Edge
  - Nelson Pine LVL
  - PINE Manufacturers

- **Other Financial Stakeholders are:**
  - Forest & Wood Products Australia
  - Ministry of Science & Innovation

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STIC’s Overall Aim

**Convert**

- Concrete multi-storey
- Steel portals
- Pre-stressed timber portals
- Quick-Connect timber portals
What is STIC Developing?
1. Single storey roofs & portal and frames

- Research stream is being carried out at University of Auckland
- Programme Leader is Prof. Pierre Quenneville

NZ patent & PCT filed in Dec 2010
Major design guide completed at end of 2010

Portal Frame Design Guide Workshops in NZ & Australia

- Just completed 4 weeks of industry workshops in NZ and Australia
- Attended by more than 460 Engineers, architects, architectural designers, constructors and fabricators
- Very large response with around 200 licenses signed in Australia and NZ
What is STIC Developing?

2. Timber and TCC floors for multi-storey buildings

- Research stream is being carried out at University of Technology, Sydney
- Programme Leader is Prof. Keith Crews

**Critical challenges:**
- Air-borne acoustic attenuation
- Flanking noise attenuation
- Vibration control

Major design guide due Nov 2011

What is STIC Developing?

3. Pre-stressed timber frames and walls for multi-storey buildings

- Research stream is being carried out at University of Canterbury
- Programme Leader is Prof. Stefano Pampanin

**Critical challenges:**
- Quick & competitive beam-col connection system
- Joint stiffness
- Wind & seismic performance
- Long-term creep
What is STIC Developing?
3. Sustainability, Fire performance

- UC Biological Sciences Building, compared concrete, steel & timber blds
- Sequestered carbon in timber bld enables lower carbon footprint bld
- Testing on TCC floors demonstrated 1hr fire rating was achieved
- Large engineered timber members have predictable charring rate

Pre-stressed timber frames and walls – how does it work

- Post-tensioning tendons
- Frames
- Walls
- Floor diaphragm
- Beam-column
- Energy dissipation
Benefits

- **Ease of design** of frame, wall and portal systems
- **Rapid erection** – minimum on-site work
- **Pre-fabricated** structural elements with small dimensional tolerances
- **Light-weight** structures that can more easily cope with difficult soils & reduce construction costs
- **Cost / time competitive** method of connecting large structural timber elements
- **Carbon neutral** building (embodied carbon)
- **High resistance to hazard** events such as earthquakes & high winds

Seismic performance test programme
Roll-out of the new technologies

Tumu ITM building

- Construction commenced Mar / Apr 2011
- Uses EXPAN Quick-Connect technology

- World’s first Quick-Connect portal frame building

Roll-out of the new technologies

Massey University, Wellington

- Construction commenced early 2011
- Uses EXPAN Pres-Lam post-tensioned LVL moment frames
- Uses TCC floors
Roll-out of the new technologies

NMIT Arts & Media building

- Construction completed late 2010
- Uses EXPAN Pres-Lam post-tensioned LVL shear wall technology
- Was officially opened on 31st Mar 2011

World’s first post-tensioned, multi-storey timber building

Roll-out of the new technologies

Nikau Building at BRANZ HQ

- Construction commenced in late 2010
- Opened for occupation in early April 2011
- Post-tensioned construction
Roll-out of the new technologies

New STIC office

- Demonstration building
- On-going research by UC for long-term deflection & creep testing & aftershock measurement
- Withstood many simulated large magnitude seismic events during lab testing and Feb 22\textsuperscript{nd} earthquake!

- Transform lab test building to new Demo building

Rapid assembly & erection sequence on-site
Christchurch Earthquakes

Masonry Buildings
A NEW BUILDING TECHNOLOGY FOR A CONFIDENT AND REVITALISED CITY

TECHNOLOGY AND SUSTAINABILITY WORKING TOGETHER

SAFETY, DURABILITY AND BEAUTY – AN INTEGRATED SOLUTION
Courtyards, plazas and gardens of varying sizes can be created through the central city.

Trapping the sun and providing shelter from cold southerly and predominant easterly winds

Introduction of 5 storeys or additional cross buildings allows for a significant increase in the density of the central city without compromising the public amenity

Lanes, openings and alleyways through the buildings provide permeability and interest, creating a pedestrian friendly environment

Control of access to inner spaces allows the creation of public, semi-public and/or private spaces within each city block depending on the use

Varieties of scale and character of the urban spaces create opportunities for different precincts for different uses.
- Retail or public frontages face the streets creating vitality.
- On grade Car parking under the plaza reduces the demand for street parking freeing up the streets for pedestrians and cyclists.
- On grade vehicle delivery routes provides servicing access to shops and buildings above.

- Considered orientation and plan depth allow built density to be increased without compromising daylight and natural ventilation
- Collective thinking allow waste heat from one building to become a source of energy for the next
- Efficiencies of the scale improve the economic feasibility of community heating, renewable energy generation, rainwater harvesting or grey water recycling.
- Landscaped gardens increases the biodiversity and when combined with permeable city blocks create a pedestrian friendly city.
CO₂ EMISSIONS

VIBRANT STREETS AND COURTYARDS

shop
Snap-shot of future technology outputs

Nov 2011
Gluing / re-laminating guide. Durability guide.

Jun 2013
Design Guide for timber post-tensioned roofs

Aug 2012
Guide on improved TCC creep prediction

Jun 2013
Update Design Guide for TCC Floors

Nov 2011
TCC Floors Design Guide

Nov 2011
Interim design guide on stressed timber frames & walls

Nov 2012
Pre-stressed timber multi-storey for low wind / seismic areas Design Guide

Jun 2013
Pre-stressed timber multi-storey for high wind / seismic areas Design Guide

More Information needed?

Contact STIC:

- [www.expan.co.nz](http://www.expan.co.nz)
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Thank you

Questions?