“Is There a Place for Natural Building in New Zealand’s Conventional Housing Market?”

A Prefabricated Straw Bale Case Study

Blue Forsyth, Min Hall and Sven Johnston
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Auckland        New Zealand
Natural Materials

Biological - organic

Geological - inorganic
Why is it important?

The Construction Industry is responsible for:

- 40% annual natural resource consumption
- 30% energy consumption
- 30% greenhouse gases

Measures to improve sustainability within the construction industry have been focused on:

- energy efficiency – a lot
- embodied energy - less
Natural Building in New Zealand

Pompallier House, Russell

Longbeach Cottage, Ashburton

From “Maori Architecture” by Deidre Brown
Natural Materials in NZ

EARTH    STRAW BALE   LOGS   CORDWOOD   HEMPCRETE

YIMFY Earth Building Workshop
Auckland  2014
Straw Bale

NZ’s First Straw Bale House - Marlborough 1993-5
Straw Bale Construction in New Zealand
Annual Straw Burn-off South Canterbury

Photograph: John Bisset for Timaru Herald, 9 March 2012
Prefabrication

- Components
- Panels
- Modular
- Complete buildings

**PROS**
- Save time
- Save money
- Improve quality
- Improve resource efficiency (materials and labour)
- Improve workplace safety

**CONS**
- High start-up cost
- Public perception
- Market size
- Transport limitations
Straw Bale Prefab

Advantages
- Reduce overall build cost
- Speed up construction
- Reduce weather delays
- Plaster all year round in a controlled environment
- Improve quality of and accelerate plaster application
- Reduce risk of exposure to moisture
- More suitable for small urban sites
- Builders on rural sites spend less time away from home

Methods
- Loose straw
- Complete bales
Stramit Board and Durra Panels

Stramit panel – University of Bath

Durra panels
Ortech Industries
Victoria, Australia
Ecococon Straw Panels
www.ecococon.lt/english/
Panel fabrication – Flying Factory

Balehaus: A prototype house

ModCell UK
www.modcell.com
Chris Magwood
The Endeavour Centre
Ontario, Canada
www.endeavourcentre.org
Straw Bale Prefab in New Zealand

- Sol Design Ltd develop a unique on-site panel system coined ‘tilt bale’
- 10m² experimental prefab structure, Geraldine 2011
- Prefab panels constructed for a power shed for an off-grid property near Geraldine 2014
- Straw Bale Structurally Insulated Panels (SB-SIPS)
- Building consent granted for SB-SIPS house at Hororata, August 2014
SB-SIPS

AIMS

- Pre-finished panels
- No additional cladding required
- Clean lines

CHALLENGES

- Achieving the desired level of finish 'off the mould'
- Incorporating flashings - vertical junctions and horizontal
- ‘Clean-line’ detailing connections between panels and to foundations
- Lifting, handling and transporting finished panels – 1200-2500 Kg
SB-SIPS Process for Power Shed

www.soldesign.co.nz

Structural Frame

Mould/Form
SB-SIPS Process for Power Shed
www.soldesign.co.nz

Structural Frame preparation

Pre-plastering bale fit and sizing
SB-SIPS Process for Power Shed

www.soldesign.co.nz

Plaster laid in mould

Structural frame positioned in mould
Pre-sized bales ‘buttered’ and fitted into frame
SB-SIPS Process for Power Shed
www.soldesign.co.nz

First Custom SB-SIPS Panel

Interior

Exterior
Key Findings

- Considerable interest
- Plans should be produced expressly for the SB-SIP system
- Panels should be standardised as much as possible to take advantage of economies of scale
- No on-site finishing is a challenge
- Major advantages are
  - Degree of quality control possible
  - Reduction in on-site time
  - Ability to work in all weathers
Looking Ahead

- The completion of projects underway including:
  - The ‘Power shed’
  - The first consented SB-SIP house
- Geraldine townhouse development
- Development of ‘mini-bales’
- Searching for projects that will facilitate development of system
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- EBANZ conference, Kapiti Coast, Labour Weekend 2014
  www.facebook.com/earthbuilding
  www.facebook.com/isbc2016
  www.strawbuildconference.co.nz

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