

***“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
Build a Better New Zealand Conference September 2014
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

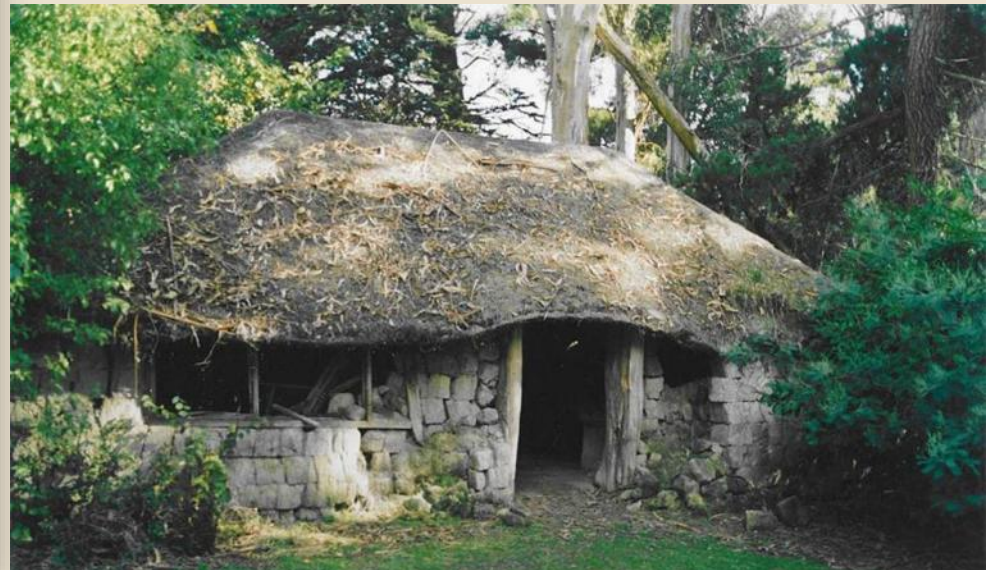


In 1844, George French Angas illustrated two substantial kāuta (cooking houses) during his visit to the settlements of Orakei, or modern-day East Auckland (top), and that of the Ngāti Tuwharetoa tribal chief, Mananui Te Heuheu, at Te Rapa on Lake Taupo. According to Angas, only the slaves appointed to food preparation were permitted to crawl through the circular apertures into the Lake Taupo kāuta.

GEORGE FRENCH ANGAS, PORTRAITS OF THE NEW ZEALAND MĀORI PAINTED IN 1844, REED, 1972



Pompallier House, Russell



Longbeach Cottage, Ashburton

From "Maori Architecture" by Deidre Brown

Natural Materials in NZ

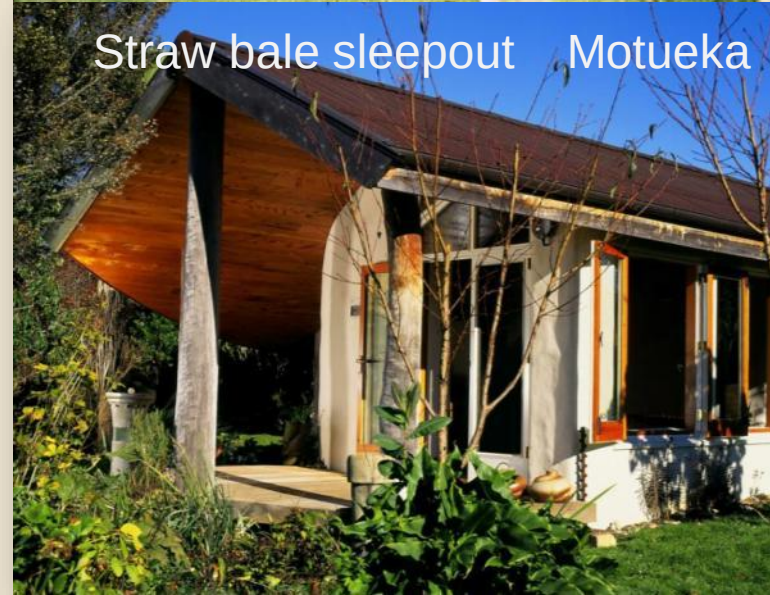
EARTH STRAW BALE LOGS CORDWOOD HEMPCRETE



YIMFY Earth Building Workshop
Auckland 2014



Adobe brick house Nelson



Straw bale sleepout Motueka

Straw Bale



Nebraska, USA - 1908



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



Panel fabrication – Flying Factory



Panel fabrication – Flying Factory



ModCell UK
www.modcell.com

Panel fabrication – Flying Factory



Balehaus: A prototype house



BaleHaus: A prototype house



ModCell UK
www.modcell.com



Gateway Building University of Nottingham MAKE Architects



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.sol design.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.sol design.co.nz



Plaster laid in mould

Structural frame positioned in mould

SB-SIPS Process for Power Shed

www.soldesign.co.nz



Pre-sized bales 'buttered' and fitted into frame

SB-SIPS Process for Power Shed

www.soldesign.co.nz



Interior



Exterior

First Custom SB-SIPS Panel

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
- International Straw Building Conference 2016 (ISBC 2016) Methven, NZ 3-9 March, 2016
www.facebook.com/isbc2016
www.strawbuildconference.co.nz

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