

PREFAB HOUSING: POTENTIAL FOR DEVELOPMENT

Challenging times for the New Zealand building industry mean that productivity is the buzz word of 2010, so a recent workshop to present and discuss research and development in prefabricated housing was particularly timely.

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Construction industry representatives from Kaitiā to Invercargill met at Victoria University's School of Architecture for the 'Kiwi Prefab' workshop earlier this year. The 140 representatives ranged from manufacturers and contractors, researchers and academics, architects, designers and engineers, to developers and policy-makers.

Quicker, cheaper, better?

Prefabrication, a form of off-site construction, is potentially a way to increase the quality and decrease the timeframe and cost of delivering housing. The New Zealand construction industry already widely uses prenailed components for new housing and transportable complete buildings for secondary housing. However, a greater uptake of prefabricated technologies is held back by historical misconceptions of low-quality, flimsy and temporary attributes and by the cost of investment in research.

Types of prefabrication

There are five types of prefabrication: component, panel, module, hybrid and complete building. Prefabrication in New Zealand falls roughly into two types: component and complete building.

COMPONENT PREFABRICATION

This includes stick pieces – lengths of timber precut, presized or preshaped put together on site. Components or subassemblies also include multi-material assemblages such as windows and doors, fixtures and fittings, and structural members such as prenailed roof trusses and wall frames.

PANELISED OR NON-VOLUMETRIC PREFAB

This involves manufactured panels assembled as a flat pack or kit of parts. This includes steel frames and wall panels (often with doors and windows included) stacked and shipped to be assembled on site. Prefabricated panel and non-volumetric elements include foundation



The HABODE prefabricated design includes sustainable features such as double glazing and thermal insulation. (Photo: Pamela Bell.)

systems, structurally insulated panels (SIPs), skylights, cabinetry, staircases and ductwork.

MODULAR OR VOLUMETRIC PREFAB

These are three-dimensional units constructed away from site and combined on site with other units or systems to create a whole dwelling. A structural three-dimensional object can be referred to as a volume or module, and a non-structural object is called a pod or unit. A modular home is a type of building that meets Building Codes, is factory-assembled in full-dimensional units and then fixed onto a permanent foundation on site.

HYBRID OR SEMI-VOLUMETRIC PREFAB

This is a combination of systems, such as module plus panel, or prefabricated systems plus conventional construction. This potentially brings together the benefits of prefabricated construction systems, while allowing for more flexibility and consumer choice.

BOX-FORM OR COMPLETE BUILDINGS

These are commonly known in New Zealand as relocated or relocatable and transportable dwellings. They comprise volumetric prefabrication of entire completed buildings constructed

in a factory or yard, which are then transported to site and attached to permanent foundations. These have been traditionally used for secondary dwellings, holiday homes or baches and agricultural workers' dwellings.

Prefabrication dates back to 1880s New Zealand has a long prefabrication history.

COMPONENT-BASED HOUSING

Early settlers imported component-based housing kits to New Zealand from the United Kingdom and the United States in the 1800s. A timber kitset method was used for the 1833 Treaty House in Waitangi. By the end of the 19th century, United States pattern books had spread populist designs, including bay villa and bungalow styles. The railway housing scheme began in the 1920s using a combination of prefabricated components and standardised planning through pattern books. Approximately 300 houses were produced from the purpose-built Frankton factory.

By the mid-20th century, prefabrication techniques were gaining popularity in Britain, the United States and Australia. The New Zealand

government invested in a period of prefab research and development, which resulted in prenailed components, precast concrete panels and the use of imported technologies from Sweden and the United Kingdom. Today, prenailed roof trusses and wall frames are in most new built homes.

Component technologies are at the heart of two enduring prefabricated housing companies: Keith Hay Homes and the Lockwood Group. The patented Lockwood system consists of aluminium-laminated solid-timber boards that interlock, both with each other and with aluminium jointing profiles. The group of franchisees have built over 30,000 houses using factory-made components that are assembled on site in about half the time of a traditional stick-built house. In 2008, they launched the EcoSmart home series designed by architect Dave Strachan as a way to bring sustainable design to the upper end of the housing market.

The new millennium welcomed in a resurgence of interest in architect-designed prefabricated housing. New Zealand's forerunner was the elegant bachkit designed by Andre Hodgskin Architects and now produced by Replica Architects. Based on a modular planning system, it features componentised steelwork, subfloor timber, wall framing, track system, roof ellipse and flat-pack internal cabinetry.

TRANSPORTABLE BUILDINGS

The complete or transportable building has played an important part in New Zealand's housing history. The government invested in worker housing for the country's hydro-electric schemes with complete buildings produced in a purpose-built factory by Albert De Geest of Oamaru. During the 1970s, De Geest constructed 549 complete houses for Twizel and 350 componentised houses for sites at Cromwell.

Kiwis have a love affair with simple secondary housing or baches. Contemporary transportable housing features ingenious designs to enable more space once they are assembled at site. Unfolding elements create more floor area, such as the port-a-bach's fold-down deck, iPAD's clip-on decking and HABODE's hinging floor and resulting butterfly roof form.

Interesting things happening

New Zealand's prefabricated housing industry is interesting, varied and active. This was reflected in the workshop's short presentations from industry representatives. German prefabrication



Atelier Workshop's port-a-bach design features a fold-down deck that refolds to create a secure unit for insitu storage or relocation. (Photo: Paul McCredie.)

consultant Johann Betz showed examples from Germany's industry and made comparisons with New Zealand (see pages 46–47). Grant Laing of Christchurch-based Laing Homes introduced his business's 23-year history of moving houses plus constructing timber-based Maxim panel transportable buildings. Wanaka architect Anne Salmond outlined a housing project currently on the drawing board (see pages 62–63). These high-performance houses are based on a standardised module but can be customised by individual clients. Manufacturer Robin Jack of W & R Jack impressed the audience with an array of cross and glue-laminated timber technology and machinery from the nationwide business.

Engineer Anne Mackenzie presented several projects that her business, Build Green, is involved with, including container-based student accommodation for Canterbury University (see page 48). The Department of Building and Housing's Peter Thorby spoke about the new MultiProof approval service and how this can speed up the building consent process. Consultant William Pennington spoke on behalf of developer Ian Cassels of The Wellington Company, showing examples of this developer's commitment to both prefabrication and sustainability.

Critical mass required

Large production runs matched by market demand are required to make most systems

economically viable. New Zealand is challenged by a small consumer market and volatility to international macro-economic conditions. However, government investment into research and development to explore design and manufacture enabled it to extend its regulatory role to lead change throughout the mid-20th century. Richard Ogden, chairman of Buildoffsite UK, an industry-wide campaigning organisation that promotes greater uptake of off-site techniques by the UK construction industry, provided a succinct overview of off-site (the UK term encompassing prefabrication technologies) with vivid examples of large-scale commercial applications. These inspiring precedents were both enlightening and encouraging.

Commitment to work together

The major outcome of the workshop was the election of a steering group to address pressing concerns and drive an increase in prefabrication uptake in the New Zealand construction industry. It will progress the issues and opportunities identified at the workshop, prioritise them and report back to workshop attendees on how to address the issues raised and increase collaboration and coordination of New Zealand's prefabricated housing industry. Collaboration is essential. Buildoffsite UK offers a precedent for what can be achieved through coordinated marketing and communication campaigns. ◀

Prefab pros

- Increased quality (Q)
- Shorter timeframes (T)
- Cost savings (C)
- Factory efficiencies and social benefits
- Effective material use and sustainable benefits
- Tangible outcomes for clients (known Q, T, C)

Prefab cons

- Individual site context
- Transport box restrictions
- Socio-cultural misperceptions
- Limited market size
- Prohibitive start-up costs
- Supply chain disruption