

LEARNING LESSONS FROM GERMAN PREFAB

Germany has a sophisticated and highly regarded prefabricated building industry that has evolved over time through industry-specific research, collaboration and training.

By Johann Betz, JS Betz Consulting Ltd, Christchurch

Since the Huf Haus appeared on the popular UK television programme *Grand Designs*, prefab houses with a 'Made in Germany' stamp have developed a reputation for high-precision engineering. The programme followed a British couple and their German builder, Huf Haus, as they prefabricated and shipped the wall, floor and roof panels for the structure from Germany and assembled the architecturally designed home in less than 5 days in the UK.

German prefab from cookie-cutter to high-end

Prefab housing in Germany gathered momentum post World War II when housing and raw materials were in short supply. Prefabrication was seen as a quick and affordable way for young families to build their first home. During the 1960s, the industry discovered mass customisation and tried to get away from so-called cookie-cutter houses.

In the 1980s, the industry heavily focused on transforming its image to custom-made contemporary homes for any budget, with high indoor comfort and equally high resale value.

Timber prefab housing today

Traditionally, the vast majority of residential housing in Germany has been solid construction using bricks and mortar. Today, however, about 14% of all residential buildings are prefabricated, mainly timber-framed or similar systems. This share has doubled since the late 1980s/early 1990s.

The majority of about 350 timber building prefabricators are small to medium-sized companies employing between 10 and 50 people. Often they are traditional carpentry businesses that ventured into timber prefab



Operator finishes a fully closed timber-framed wall panel. (Source: Weberhaus.)

housing over the past decades as a value-add market. Their traditional domain of carpentry has been transformed from a labour-intensive industry to a highly automated one, dominated by computerised precutting, assembly and intense competition.

Panelised prefabs dominate

When comparing the characteristics of the New Zealand and German prefabrication industries (see Table 1), the absence of panelised, modular, or hybrid prefab systems in New Zealand is obvious, while the German industry is heavily concentrated on these.

Component and complete building prefabrication are the dominant forms of prefabrication in New Zealand, but they do come with a disadvantage. Component-based prefabrication means individual components (for example,

bricks, open timber frames, studs, rafters) are assembled on site component by component, which essentially does not capitalise on all the benefits offered by prefabrication. On the other hand, while it is possible to ship completed smaller dwellings like baches and extract them on site, there is an obvious upper limit to shipping size.

Therefore, the most successful forms of prefabrication are breaking down the structure into a number of panelised or modular elements (or a combination of both) that can be efficiently shipped and assembled on site.

The prefabrication process

After the client has selected a design, the structure is typically segmented into a number of panels (or modules) by specialised panelisation software (CAD packages). This step takes place on a screen, with the panelisation software helping to solve all construction details such as wall-to-wall joints, panel-to-panel joints and so on. Most prefabricators use a fully integrated panelisation package that can generate all building-related information from one central information model. A building model can contain information on thermal building performance, bill of material, CAD details and drawings, plus the machine code to communicate with computerised manufacturing equipment, like automated cutting equipment, nail bridges and others.

Once the design on the panelisation package is finalised, the manufacturing information is sent to the shop floor where timber members are (automatically) precut and the wall, floor and roof panels are assembled on tabletop jigs. The degree of automation varies from prefabricator to prefabricator but typically panels leave the factory fully closed with insulation installed. In



Luxhaus reference building.



Huf Haus ART 5 green[r]evolution.

some cases wiring, plumbing and even tiling are taken care of to some extent. The panels are shipped neatly stacked vertically or horizontally and are assembled by crane on site. Assembly of a standard family home in 4 days or less is not uncommon, but can only be achieved through a high level of planning, detailing and prefabrication prior to manufacture.

The prefab factory environment

Apart from accurate panelisation (or modularisation) at the design stage, the key to any successful prefabrication set-up is a flexible and lean manufacturing environment. Flexibility to accommodate creative architectural design and customer input is paramount.

However, any factory environment also has to follow lean principles to maximise machine and labour productivity and minimise waste to capitalise on the benefits prefabrication offers. The efficient use of manual labour and machine capacity is paramount and so are operator ergonomics and health and safety. Machines are used where viable (typically for precutting of all components) with highly skilled builders focusing on a high-quality standard and finish.

What should NZ be doing?

While there are no shortcuts to a prefab housing industry like Germany's, the following are considered important in establishing a healthy industry for prefabricators in New Zealand.

Bring individuals and companies with a common interest in prefabrication together for joint marketing initiatives to transform the industry's image from cheap and flimsy to a recognised high-quality form of building and living. The first step towards this has been taken with the establishment of the Prefab

Steering Group. In Germany, the vast majority of prefabricators are represented by one of the quality-assured industry organisations lobbying their interests.

Kiwi companies aiming for higher levels of prefabrication can do so without having to invest millions of dollars in plant upfront. The key is to start with a system that lends itself towards prefabrication, then inch towards more and more prefabrication, investing in the necessary infrastructure on the way. When setting up a prefab workshop, an individual with a strong manufacturing background and working knowledge of the building trades is essential to engineer the lean manufacturing environment. The role of the traditional Kiwi builder would be working in in-house prefabrication, on-site assembly and finish.

Industry collaborations with research and training institutes have been successful in Germany and should be encouraged. There are several German examples where joint projects with research and training entities have given the prefabricator an enduring competitive edge.

Specialist skills needed

It is important to recognise that prefabrication demands specialist skills, and industry must be prepared to deliver them. Germany is training dedicated process engineers aimed at the prefab industry at bachelor's and master's levels. Candidates learn how to design and build with timber, they learn about building sciences (thermal, moisture and acoustic performance of buildings), and they also learn how to engineer a complex prefab factory environment.

Maybe one day New Zealand will be offering a certificate or qualification tailored around the needs of prefabricators. ❖

Table 1: The predominant forms of prefabrication (see also page 44–45).

Prefab category	New Zealand	Germany
Component	✓✓	
Panelised or non-volumetric	✓	✓✓✓
Modular or volumetric		✓
Hybrid or semi-volumetric		✓
Box-form or complete buildings	✓	



A fully closed wall element is positioned by crane. (Source: Baufritz.)