BRIGHT FUTURE FOR PREFAB

Is prefabrication about to have its day? Its ability to reduce costs, boost productivity and its not well recognised environmental credentials make that a distinct possibility.

By Phil Stewart, Technical and Engineering Writing Ltd, Auckland

Off-site prefabrication of building components can advantage both owners and constructors. The benefits include faster construction times and reduced overall costs – pleasing owners – and more efficient production and assembly both on and off site – good for constructors. Additionally, both parties profit from a more environmentally friendly approach that uses fewer raw materials and produces less waste.

Now, indications are that prefabrication use in New Zealand and overseas may be approaching a period of rapid growth.

What makes it so efficient?
There are several reasons why prefabrication improves productivity and helps minimise on-site problems:

PARALLEL WORKSTREAMS
Prefabrication makes the on-site role one of assembly rather than complete construction. This means that work can take place simultaneously both in the factory and on site, reducing project timeframes.

EFFICIENT MATERIAL USE
Prefabrication in a factory makes it possible to optimise construction material purchases and usage. On-site waste is reduced as it is easier to recycle off-cuts and excess materials within the factory environment than on site. Additionally, having bulk materials delivered to the manufacturing facility means they can be stored in a protected environment, away from potential environmental damage or theft.

STABLE WORKLOADS
For builders, prefabrication can provide more predictable work schedules and on-going costs, as components can be manufactured at a set rate, regardless of the weather. This provides greater certainty and stability around use of resources and employment of staff.

REDUCE EXPOSURE TO WEATHER
There is always the risk, particularly in New Zealand, of exposed timber framing becoming saturated if exposed outside for too long. Because prefabricated structures are built in a factory-controlled setting using dry materials, the potential for high levels of moisture being trapped in new buildings is greatly reduced.

ON-SITE EFFICIENCIES
Generally, fewer site deliveries are required for prefabricated construction as the building components are larger and fewer in number. This can reduce transportation costs and the co-ordination of site traffic.

Residential construction

Prefabricated house construction in New Zealand is not new – some companies have been selling ‘kitset’ homes for over 50 years. With advances in computer-aided manufacturing, prefabricated house design has progressed rapidly in the last decade, enabling customers to customise their design to almost the same degree as one-off on-site builds.

Prefabcation already exists in the traditional New Zealand house building market to some degree – over 80% of timber framing used for residential building is precut. As demand for efficiencies in construction increases and the on-site construction skill base declines, it is likely that prefabrication use will increase. This could mean the growth of in-factory construction of components that would otherwise be built on site, such as prefabricated entire frames and roof sections.

MOVING TO MODULAR

The next step would be prefabrication of modular units that can only be built in factories, which require new methods for assembling and
connecting on site. Examples include modular ‘building blocks’ that form the room of a house. These could be built from timber, concrete or steel and would enable fast on-site assembly and even opportunities for future removal or interchanging.

Such methods may seem radical now, but overseas on-site assembly of modular building blocks is common. In Wembley, London, a 19-storey residential building was made from 805 separate prefabricated modules stacked together. The modules were exceptionally large, at 16 m long and 3.8 m wide. Completed in mid-2011, the entire build took only 27 weeks.

In Scandinavia, over 80% of homes are prefabricated, and many parts of Europe have well established prefabrication industries.

Non-residential construction

In the US, prefabrication on commercial projects has experienced a resurgence in the last few years due to a growing awareness of its cost and time advantages.

In 2011, McGraw Hill Construction US released the report Prefabrication and modularisation: increasing productivity in the construction industry. The report surveyed businesses across all sectors of the construction industry and found:

■ 66% reported prefabrication reduces project timeframes (35% reported reductions of 4 weeks or more)
■ 65% reported prefabrication reduces project budgets (41% reported reductions of 6% or more)
■ 77% reported prefabrication reduces site waste (44% report reductions of 5% or more).

In Europe, like the US, prefabricated construction is heavily promoted as time and cost efficient and environmentally friendly. In the UK, the market for non-residential prefabricated construction is approximately US$2.5 billion. McDonald’s restaurants in the UK use prefabrication technology to build their new outlets, recently setting a new record for a building being constructed and operational within 13 hours.

SEVERAL LOCAL EXAMPLES

In New Zealand, two different building projects are examples of how prefabrication has enhanced efficiency and delivered other positive outcomes.

Construction company Stanley Group was approached in October 2008 to provide a price for the 140 m² 2-storey Hobbs Wharf Market Building at Gulf Harbour. This project had originally been tendered as a conventional on-site design, which had come in at $280,000, double the client’s budget of $140,000.

Stanley Group submitted a lump sum contract to deliver the project as a prefabricated build within budget and within a tight 3-week deadline. Completely prefabricated off site and erected on site in 5 days, the market building opened on time on 14 November 2008.

In 2005, Chateau Tongariro Hotel opted for prefabricated construction for building a 5-storey hotel wing extension. Work had to be performed within a defined weather window, in a remote location, with limited local labour available. A complete modular solution was constructed, resulting in a short construction period successfully finished within the period of fine weather. On completion, it was Australasia’s only multi-storey modular building.

Bright future for prefab

In the US, the McGraw Hill survey found that businesses who use some form of prefabrication will increase from 85% to 98% by 2013. Currently, 37% of companies are using prefabrication on over 50% of all their projects – predicted to grow to 45% by 2013.

PrefabNZ, New Zealand’s off site prefabrication organisation, has ambitious goals for the local market. It aims to more than double the industry’s total use of prefabrication by 2020 from the current 17% to a target of 40%.

While efficiency and economic drivers will be the primary reasons for growth, PrefabNZ also believes education about prefabrication is necessary. Studies have shown that perception of prefabrication is not great, with many in the industry not aware of its environmental benefits in particular.

To provide information and education, PrefabNZ has established a website, monthly newsletter and networking events. It has also joined with BRANZ and Victoria University of Wellington in developing a Prefab Tool that compares off-site prefabrication methods with traditional on-site building for any project. The Tool is a simple user-friendly Excel spreadsheet that can be used across the industry to promote conversations about cost and time benefits, different prefabrication types, quality and sustainability benefits.

With budget-conscious clients and the drive for green practices, the demand for prefabricated residential and non-residential construction may grow in New Zealand in accordance with international predictions.

Prefabrication could well be the solution for a construction market facing shortages in on-site skilled labour and for an industry striving for increased productivity.

MANY ENVIRONMENTAL BENEFITS

The efficiency gains from prefabricated construction are widely known across the industry in New Zealand, but its environmental benefits are less understood. These include:

■ less raw material needed – the use of materials in factory assembly can be more precise, and there is less chance of materials getting damaged on site
■ the ability to recycle – it is easier to recycle off-cuts and excess material within a factory environment than on site
■ the reuse of structures – it is more practical to disassemble a modular project and salvage or reuse significant components of the building
■ less site disturbance – this is because the prefabricated structure is constructed off site simultaneously with the foundation and other site work, reducing the time and impact on the surrounding environment, as well as the number of vehicles and amount of equipment needed on site.