Timber takes on new forms

While timber is a traditional building material for New Zealand housing, it is still evolving. Engineered wood products are being used not only for aesthetics but also for their seismic strength in multi-level construction.

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**TIMBER AND WOOD** is widely used in New Zealand construction. There are conventional elements for structural and non-structural use, but innovative new products are emerging.

**Advances in weatherboards**
Several producers have developed and obtained CodeMark approval for conventional weatherboard systems with improved detailing and fixing systems. One interesting new product is the curved 215 mm timber weatherboard manufactured by Woodform.

CodeMark approval has also been gained for weatherboards that have been heat treated rather than more common treatment processes involving infusion of anti-decay chemicals.

**Curved 215 mm timber weatherboards provide new design opportunities.**

**Engineered wood changing the game**
Above the light timber-frame systems come heavy engineered wood components such as LVL and glulam. Separately or together, these materials are extending timber construction into areas where it has not competed before.

**Most wood in structural elements**
Structural products are the largest users of wood in buildings. These range from smaller dimension sawn timber through to laminated veneer lumber (LVL) and I beams, glue laminated (glulam) timber and cross-laminated timber (CLT).

Sawn sizes of structural timber are increasingly used in complex truss layouts. This is because advanced software, the increased reliability of graded structural timber and the ability to place LVL components in highly loaded areas has extended options for building designers.

Overseas, for example, in Canada, applied research into fire-resistant systems has allowed the use of light timber-framing systems to be extended to 6-storey buildings. Work is progressing on this front in both Australia and New Zealand.
Glulam comprises layers of sawn timber usually face bonded into beams of larger sizes than can be obtained by other methods.

The utility of glulam, LVL and CLT has been extended by the large investments made in CNC (computer numerical control) machinery. These will saw, rout, bore and groove the timber products into components ready to be lifted, placed and fixed on site.

One CNC machine, for example, enables the processing of glulam, LVL, CLT and solid timber elements up to 30 m long, 4 m wide and 600 mm deep.

The speed and accuracy of this process significantly decreases construction time and the time required on site for heavy-lifting machinery. This makes the production of extremely complex structures significantly more cost effective.

**LVL a mature product**

LVL is a mature engineered wood product in New Zealand, and engineers and architects are now learning how to best use its structural and aesthetic properties.

It can be manufactured to required strength, stiffness, shear, bearing and connector properties. This means LVL components can be manufactured for a particular job at optimum performance, costs and use of resource.

The very high strength to weight ratio means loads are lower and therefore other structures such as foundations and connections can be smaller. In New Zealand, Nelson Pine, Carter Holt Harvey and Juken New Zealand manufacture LVL.

**Cross-laminated timber new addition**

CLT is the latest addition to the engineered wood construction armoury. While it has been used in Europe for some time, a New Zealand factory - XLam in Nelson - is now producing CLT panels and has developed design and construction methodologies for local conditions.

The structural properties of CLT mean that the design envelope for wood structures has changed, and worldwide, larger and taller structures are being built. A recent example is a 10-storey CLT apartment building in Melbourne.

In Christchurch, a 300-bed backpackers building under construction has CLT floors, walls and ceiling - approximately 5,500 m² of CLT in total. The building was modelled in 3D on CAD/CAM software, and all panels were CNC cut to millimetre precision, allowing for a rapid build.

**LVL and CLT in Expan buildings**

All these technologies can come together in Expan timber buildings. Expan was researched and developed by a consortium at the University of Canterbury School of Engineering.

The Expan range includes timber framing, wall and floor systems. The prefabricated technology embeds post-tensioned steel tendons into timber to lock the system together. The result is buildings that will move predictably in an earthquake but sustain no permanent damage.

**World first in Kaikoura**

The new Kaikoura District Council building is an example of an Expan building. This post and beam gravity structure is made of LVL, while the walls, or the lateral structure, are CLT and LVL. They are post-tensioned to create rocking shear walls.

This project is the first time globally that a CLT and LVL combination has been used to make shear walls. The walls are 70% CLT and 30% LVL. The LVL is significantly stronger and was added to areas of maximum stress to provide added strength. These are at each end of the walls and within the core of the walls where the largest post-tensioning stress occurs.

A Potius stressed skin panel flooring system, fabricated using LVL, creates diaphragms between the shear walls distributing lateral loads. Unlike most commercial buildings, there is no concrete in the flooring systems.

Potius roofing panels made from a similar system are preinsulated with polyurethane spray foam, and a preprimed MDF surface provides the ceiling lining.