Forest&Wood Products Australia
Knowledge for a sustainable Australia

Improving the performance of nailplates

The quality and life of plated timber trusses for house construction can be cost-effectively enhanced according to a new study supported by FWPA.

The major recommendation was that all roofs be sarked to prevent external moisture penetration. Other changes to the manufacture of timber trusses were also suggested. The study's findings are being assessed and implemented by industry.

Plated timber trusses are used in most Australian homes. They're a reliable and cost-effective solution.

However, problems with trusses were reported in a retirement home in 2002. In the decades since construction the nailplates used to join the truss timbers had backed out, weakening the joints. Subsequent inspections of other buildings found similar examples of nailplates backing out of joints and reducing the strength of the trusses.

The buildings had used a now-obsolete brand of nailplates and there were other construction issues. Nonetheless Australia's three nailplate manufacturers came together with the FWPA to commission a CSIRO team headed by Dr Phillip Paevere to assess the causes and solutions.

They reviewed the literature; simulated the problem in a series of laboratory experiments; built two test houses – one with a moisture barrier and one without; they monitored three 'field' houses of differing ages; they inspected 41 randomly selected houses; they reviewed reports of problem houses; and created scenarios for analysis.

So what caused the problem?

"Many of the reported problems had occurred in un-sealed roofs or roofs with evidence of water penetration," says Paevere. There were also examples of problems due to manufacturing, handling and construction errors.

"Our small random survey of roofs suggested that this was not a widespread problem. However the laboratory trials showed that as few as 50 aggressive wetting and drying cycles could cause the failure of a highly loaded joint," says Paevere. The good news he says is that, "installation of sarking in a tiled roof will drastically reduce the potential for water penetration as well as the humidity variations in a roof space which can lead to condensation."

The major recommendation of the study was:

1. Sarking or equivalent measures to prevent external moisture penetration should be adopted for all roof construction in Australia.

Sarking of tiled roofs is already compulsory in Queensland. It brings wider benefits including more durable construction overall, and enhanced thermal efficiency. It's also best to vent steam from the kitchen and bathroom direct to the outside

Secondary recommendations were:

2. Examine the feasibility of reducing assumed tooth capacities for permanently loaded joints to below 100 per cent of current values.

This would result in using larger teeth and/or larger plates – reducing risks with highly loaded joints for very little cost penalty.

3. Explore sealant treatment on critical joints.

The application of a sealant material can reduce susceptibility to moisture-related backout, and if an effective and low cost sealant treatment can be incorporated into the manufacturing process, then this could potentially reduce the risk of failures of critical joints due to moisture penetration.

4. Explore tooth profile redesign for increased withdrawal strength for future metal-plate products.

This could also potentially open up new applications for nailplated connectors in more exposed environments.

"Industry was eagerly awaiting the report," says Robert Tan, chief engineer with nailplate maker MiTek who, together with Pryda and Multinail supported the research.

"We've briefed the industry through the national conference of the Frame and Truss Association of Australia and we're encouraging the regulators to move to sarking of all tiled roofs," he says.

FWPA project PNB036-0607:
Mechano-sorptive nailplate backout in nailplated timber trusses