Framing timber performance – measure it or guess it?

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Recently a trade journal ran a timber feature with an article "Image versus Performance". This advocated performance-based systems for sorting timber.

One may be asking how does non-performing framing timber manifest itself? Strength failures are rare in New Zealand (Fig. 1) with the size of most timber beams and members being controlled by deflection. There is usually reserve strength.

Fig. 1: Strength related failure in North America.

The most common type of failure in New Zealand is excessive deflection (Figs. 2 & 3) in the form of sagging lintels, floors or roofs, resulting in complaints from homebuyers and call-backs for builders.

Fig. 2: Sagging rooflines not on one but both of these units.

Fig. 3: Three metre garage lintel sagging 45mm at mid span. This lintel was one of eight that sagged excessively resulting in over $100,000 in repairs to this multi-million dollar house.

What are the current methods of grading timber used in New Zealand?

The timber industry uses either Visual Grading or Machine Stress Grading or a combination of both to sort timber into different grades. The primary intention of both systems is to sort the timber into grades for the construction industry that achieve the structural engineering properties assigned to the grades in NZS 3603.

Do the different grading processes give equal levels of product performance? No.

With machine stress grading the performance of the grading process and operation of the grading machine is controlled following the grading machine manufacturer guidelines. The performance of the timber is monitored through the manufacturer following a set of standards common to Australia and New Zealand (Fig. 4).

The outcome of these standards is that the manufacturer periodically verifies at least one engineering property (normally bending strength) of the grades they produce. Most producers of machine stress graded timber will do continuous testing of their product in house.

With visual grading however there is no requirement to check the performance of the grading process or the performance of the timber (Fig. 5). This leaves individual manufacturers free of any responsibility for the engineering properties of their product.

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Burton, Forest Research, as saying that changed forestry practices had resulted in more variability in strength and stiffness. Some “might as well be a different species” because of increased growth rates. Dr Burton said Forest Research supports change “towards performance grading, where every stick of timber is performance-assessed”.

An article in Progressive Building (authored by Doug Gaunt, Forest Research) outlined visual and performance grading and the potential for No.1 Framing to underperform. It was coaxed that grade compliance was variable.

Why is there a need to amend NZS3603? This document underpins NZS3604 and therefore, by their relationship, parts of the NZ Building Code. NZS 3603 is also the basis for the design of trusses and other components where specific design is required. If timber is to be used as a structural component it needs supporting data to prove that the properties comply.

The problem with the present document is the visual grading rules cannot ensure that the NZS3603 design properties are met for No.1 Framing. There are no lower limits set for any properties. There is no visible link from the known performance characteristics of the loadings to the Design Code and through to the grading rules for No.1 Framing. This is not say that correctly performing structural timber is absent from No.1 Framing. The issue is how much, how to identify it and where can the building industry buy it.

An expert Standards Committee has published a solution that outlines two steps. The proposal is:

- A producer, visually grading, can verify that his product has the strength and stiffness properties of the grade. There is a Standard that will be the basis for a verification procedure. Procedures for this will emerge in the near future.
- Where the product does not come up to the NZS3603 properties or where the producer is unable or unwilling to put in place verification, it is proposed to scale down the strength and stiffness properties. The scaling factor proposed reflects the lower limits on strength and stiffness known to be currently present in No.1 Framing grade in New Zealand.

There is no bias or constraint against visually graded product inherent in the proposed NZS3603 amendment. Its use may continue.

The proposal aims to bring the product into line with the expectations of specifiers and users. It also brings it into line with international standards that require that structural timber be supplied with reliable supporting data. There are immediate outcomes relating to specific designs; e.g. roof trusses. There may be flow-on effects to NZS3604 but these have not yet been explored.