

JOINT GROUPS TOOTH GROUPS AND NAIL-PLATES

In GN Guidelines 101, we explained the background to the creation of joint groups to predict fastener performance in different timber species.

The timber code clearly spells out the expected performance of nails, screws and bolts in different joint groups, which are mainly categorised by average timber density.

These fasteners are spaced at relatively large distances and penetrate a substantial depth compared to nail-plates, where a multitude of small inter-connected teeth spread the shear load across a wider area but only to a depth of a few millimetres.

In this respect, nail-plated joints in timber can be compared to a welded steel joint.

Although there is some correlation between timber density and tooth holding of nail-plates, the relationship is not nearly as straightforward.

In addition to the nail-plate tooth shape, tooth holding is also influenced by timber species, timber grain, growth rate and inclusion of heart-in material.

Nail-plate teeth are short, commonly around 10mm in modern plates. Unlike other fasteners, nail-plates make only a shallow penetration into the timber surface and their performance is dependent upon the surface fibre strength.

Teeth that are embedded into the denser part of the growth rings of the timber have much higher strength than those in softer parts.

Timber of different species and sources have different growth ring pattern and ring density variation, even if their average densities are the same.

And depending on how the member is sawn (i.e. back sawn or quarter sawn) the teeth may cut perpendicularly through several rings or run parallel through a single ring. Naturally, teeth that are embedded in several dense rings hold better than those implanted just between rings.

At times, strength is not governed by tooth grip but by the strength of

By **ROBERT TAN**

Senior Engineer,
MiTek Australia Limited

the timber substrate itself. In some situations (see picture), the nail-plate can pull out a chunk of the timber beneath.

In this case, the joint capacity is probably more related to the timber strength group than its joint group. This behaviour is not normally found with other timber fasteners which penetrate more deeply.

Research has also found that tooth holding is reduced in some pine species when there is very soft 'heart-in' material present.

As visual grading, which could exclude heart material, is becoming a thing of the past, fabricators are

from standard tests conducted in each species according to the appropriate Australian codes.

They do not necessarily correlate with the joint groups associated with the different species. In the past, there has been confusion between describing joint groups for nail-plates and joint groups for other fasteners because of their common terminology.

In a move to end the misunderstanding and to distinguish between joint groups for nail-plates and other fasteners, MiTek has introduced a "Tooth Group" system specifically for their proprietary nail-plates.

By having separate grouping systems for nail-plates, which allows specific tooth capacities for each timber species and grade, there is



advised to adopt the appropriate group for heart-in material for all machine stress graded timber in truss design.

In summary, nail-plate tooth holding is more reliant upon the underlying timber properties than for other fasteners.

Hence, tooth capacities cannot simply be aligned with the average timber densities which are the main classifying characteristic for joint groups.

INTRODUCTION OF TOOTH JOINT GROUPS

Tooth capacities are determined by individual nail-plate manufacturers

advantage in achieving an optimum tooth grip on a particular species as this avoids down grading the value due to the performance of the lowest species in the group.

The truss designer is then able to enjoy more efficient and more accurate nail-plate and hanger designs with the separate groupings for each.

So before designing trusses, the detailer should ascertain the appropriate tooth group with the nail-plate manufacturer instead of simply adopting the more general joint group provided by the timber producer.

For more information, please contact your nail-plate supplier.