

Checking in Prolam

One of the advantages of glued laminated timber construction is that while seasoning checks may occur for the same reasons that they do in sawn members, checking in glued laminated timber will generally occur to a much lesser degree because of careful control of the moisture content of timber used for laminating.

Checks in wood are separations along the fibres normally occurring across the rings of annual growth resulting from stresses developed during changes in moisture content. Checks in glued laminated timber may appear as openings parallel to the grain on the sides of members. As wood loses moisture to the surrounding atmosphere, the outer fibres of the member lose moisture at a more rapid rate than do the inner fibres.

As outer fibres try to shrink, they are restrained by the inner portion of the member that has higher moisture content. The more rapid the rate of drying, the greater will be the differential in shrinkage between the outer and inner fibres resulting in higher shrinkage stresses. These resultant stresses perpendicular to the grain of the wood can cause characteristic wood seasoning checks. The influence of checks on the structural

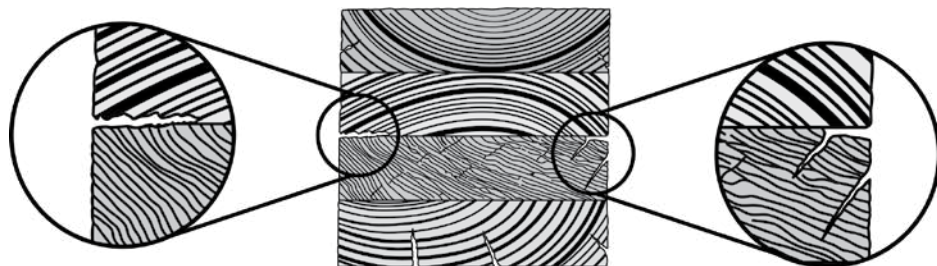
performance of glued laminated timber members is generally minor. Checking can be minimised by careful installation practices that avoid prolonged exposure of the members during construction.

Identification of Checking

Checks occur as transverse separations or openings that are nearly parallel to the grain direction in glued laminated timber and generally follow the grain direction around knots and along sloping grain.

Differences in the shrinkage rate of individual laminations used in glued laminated timber tend to concentrate shrinkage stresses at or near glue lines, resulting in checks. Checks are often confused with delamination that occurs when the glue bond is not adequate.

The presence of wood fibre separation in these openings is the key distinguishing characteristic of seasoning checks. Openings due to inadequate adhesive bonding may appear as smooth wood surface separations, possibly darkened by the adhesive film, or as glossy surface areas of adhesive with an absence of torn wood fibres.



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It can be assumed that stresses will develop along glue-lines in exposed glulam, simply because the grain orientation, ring orientation, wood density, response to moisture etc. thus will differ between adjacent laminations. European specifications for exposed glulam state that the growth rings in the laminations must all be oriented the same way, and they show a diagram of flat-sawn laminations all with the pith-side downwards.

This is hardly practical in New Zealand with Radiata as the ring orientation is likely to change across a finger joint, and many laminations will be quarter-sawn, flat sawn and everything in between.

Therefore delamination is to be expected but generally should not penetrate more than 20 mm in properly cured glulam, made with resorcinol adhesive. Exposed treated solid timber is likely to develop similar checking. The reason for this is that the moisture fluctuations that give rise to the stresses do not penetrate far, i.e. they are damped out by the resistance of the wood to diffusion of moisture.

Forest Research has tested glulam from a cool store that showed obvious delamination. There appeared to be little effect on strength unless the delamination goes right through. There have been experiments to determine how much delamination can be tolerated before an effect on shear is noticed. Where the glue-line was artificially narrowed by placing adhesive tape along the laminations prior to gluing, there was no effect down to 25%

of the width remaining. When the glued area was reduced by placing adhesive strips across the wood at intervals, an immediate effect was noticed. It all has to do with the stress-raisers generated by the delamination.

Some type of sealing is certainly helpful, and painting is excellent but it must be maintained. An oil-based preservative such as creosote is effective because the oiliness acts as a water repellent. I have seen a thick tacky substance applied to glulam bridge stringers, same as can be applied to steel as a rust preventative.

The bridge in question is at the entrance to the Whakarewarewa village in Rotorua and is still giving good service after 40 years. There are several proprietary formulations of water repellent sealants on the market, and some manufacturers apply "Ensele" as a matter of course.

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