

INFORMATION SHEET

FIRE

FIRE PERFORMANCE OF CONNECTORS NAILS, SCREWS AND NAILED PLATE CONNECTORS

The information provided below has been taken from the New Zealand Timber Design Guide 2007, published by the Timber Industry Federation and edited by Professor A H Buchanan. To purchase a copy of the Timber Design Guide, visit www.nztif.co.nz

Nails and screws are generally good connectors because they penetrate into the wood leaving a small surface area, the head, directly exposed to the fire.

The timber also acts to protect the shaft of the nail or screw from the immediate effect of the fire.

The deeper the nail or screw penetrates into the timber, the more it is protected from the effects of the fire and the longer the connection will function.

Screws also have the advantage of a thread providing better a holding/gripping capacity than a nail but on the other hand they are less ductile than steel nails.

BOLTED CONNECTIONS

Bolted connections are relatively common and are very effective in fire and it is generally better for fire performance to use many smaller bolts rather than just a few larger ones.



Post and beam bolted connection. Also nailed joist hangers

Source: AH Buchanan

TOOTH-PLATE CONNECTORS

Tooth-plate or truss plate connectors commonly used in lightweight roof structures do not have good performance when exposed to fire because the large surface area, directly exposed to the fire, is quickly heated and provides little protection to the timber surface beneath.

The depth of embedment of the teeth into the timber is quite small and is likely to fail quickly under fire conditions.

This may lead to premature failure of timber truss roof supports.

Following exposure to fully developed fire this type of connection may fail after only a few minutes.

GLUES

Adhesives are sometimes used in timber connections to laminate timber or for gluing steel rods within timber members.

However, if fire behaviour is important, then thermosetting adhesives such as resorcinol or melamine are best because they are resistant to elevated temperatures and allow laminated timber sections to perform similarly to solid timber of the same dimensions.

Epoxies and elastomerics should generally be avoided if fire performance is critical because they rapidly lose strength at elevated temperature.

Epoxy adhesives rapidly lose strength at temperatures above 50 deg C.

OTHER STRUCTURAL CONNECTORS

Steel shear plate and split ring connectors are used to improve shear performance and are slotted into butting wood surfaces.

These connectors do not perform well because they rely on the shear strength of the wood which rapidly reduces when the wood is heated.



Poor fire performance of an unprotected tooth-plate connection

Source: AH Buchanan



Expoxied rod connections

Source: AH Buchanan



Expoxied rod connection after fire exposure

Source: AH Buchanan