A hot connection: why you should care about timber joints

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As the year pass, we are becoming a more ecologically conscious society, this means that there is a push for new buildings that put the wellbeing of our planet as a priority. For this reason, there has been a lot of interest in making new constructions made mostly out of wood products (as these are more sustainable), however legislators and concerned individuals have pushed back due to concerns about the fire safety. As anyone that has lighted a fireplace knows, wood can burn so these concern at not entirely unfounded.

To try to further the understanding of the fire behavior on timber buildings a study was done on an often-overlooked part of timber constructions, joints.

Joints are vital for any building, they are the glue that hold the structure together, and depending on the design of a building these joints can be very different from one another and so will their behavior against fire.

For this reason a study was done with 4 different configurations of joints in glue laminated timber to see the effects of different configurations such as: the size of the plate attaching the structural member (smaller vs bigger), the type of mechanical fastener used (shank nail vs self-tapping screw), and the protection of the joint. These configurations were then heated in very high temperatures for 30 minutes. During the testing a force was applied axially to simulate the forces that a timber member goes through during its regular use.

The results from the testing showed that the fasteners and the plates were transferring heat to the timber increasing the speed of the charring in the area under the joint. And although this is somewhat taken into consideration in the Eurocode regulations, the charring was seen to be more severe that the estimations provided by it, making designs following this regulation somewhat under conservative.

Another pattern that was seen was that the use of bigger plates leads to a more even charring and by consequence more endurance of the mechanical properties of the element under high temperatures.

This was also seen for the screws, since this type of fastener had a smaller amount of mass, the transfer of heat to the material was smaller than for the nails, showing that the use of slimmer fasteners could improve fire resistance.

The final test performed on a protected joint had the best mechanical performance, as the jointed area did not char significatively nor the temperature was able to alter the yielding strength of the metallic parts in a meaningful way.

The results from the tests were compared to those seen in previous research studies and the trends showed by this project were also observed in the literature giving some confidence that the findings from this project were heading in the right direction.

Although more testing should be performed to deepen our knowledge on the topic this thesis showed the importance on choosing the right configuration of fastener as a small variation on the type of fastener used can have a big influence on the performance and safety of a building.