Interreg North-West Europe
Adhesive-Free Timber Buildings
European Regional Development Fund

Technical Note 6
Fire Performances

One of a series of short briefings on timber technology produced by the towards Adhesive-Free Timber Buildings (AFTB) research project. The project is co-funded by Interreg NWE, 2016-2020. This note explains briefly the fire performance of adhesive-free engineered wood products

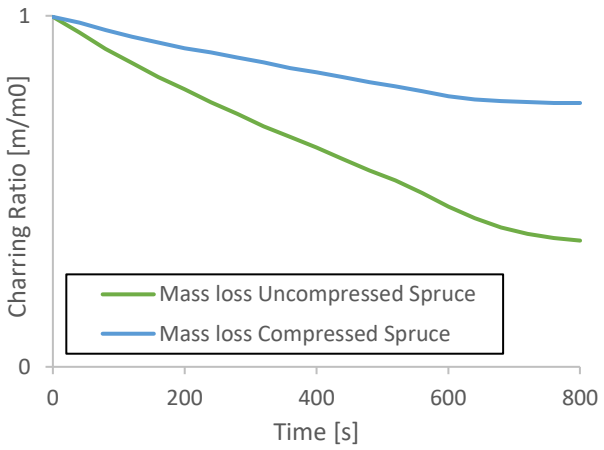
Even if it is not legitimate, fire-risk perception is a significant impediment to the adoption of mass timber, especially in high-rise buildings. Nevertheless, due to the protection layer formed by charring, wood is often a good choice when dealing with fires. Timber fireproof doors are a good example of this.
Due to the lack of internal voids, compressed wood (CW) is even performing better. It has vastly superior fire resistance compared to standard softwood. In order to precisely characterise the behaviour of CW against fire, the *University of Lorraine* has performed various numerical simulations and experimental testing.

Fire test under a cone calorimeter

Various parameters were analysed in order to compare the behaviour against fire of CW and uncompressed wood.

Loss of mass

Measuring the loss of mass permits to determine the charring rate of wood. *Spuce* (compressed and uncompressed) samples were tested under a cone calorimeter calibrated at 75 kW/m^2.



Mass loss of *Spruce* samples exposed to cone calorimeter

The previous figure indicates clearly that normal wood suffers a rapid loss of mass as compared to the densified wood. This means that CW chars at a slower rate.

Ignition and extinguishment time

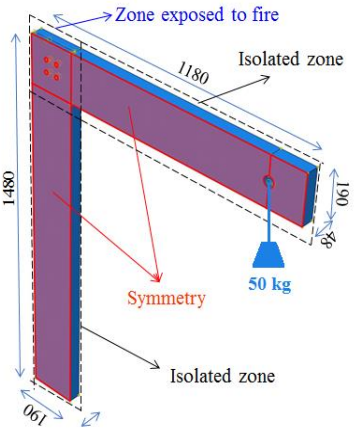
The ignition time defines how quickly the flaming combustion of a material occurs. It is slightly longer for CW than for normal wood. Contrarily, the extinguishment time is more than three times faster for CW than for normal wood. Both of this results are positive: CW will behave better than normal wood in fire conditions.

Comparison steel and CW dowelled connections

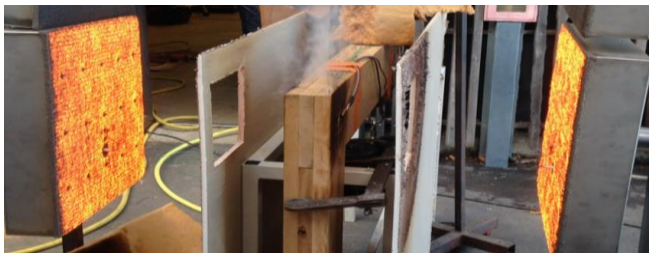
The behaviour under fire conditions of timber samples connected by CW dowels has been compared to more conventional steel dowels connections.

Experimental testing of L-shaped structure

A loaded L-shaped structure, connected either using steel dowels or CW dowel (16 mm diameter), was exposed to fire. The test's duration was about 50 minutes, until failure of the connections. Additionally, numerical simulations were performed in order to get an idea of the behaviour after i.e. 120 minutes of exposure. By using CW dowels, deep inside charring of the elements was prevented.

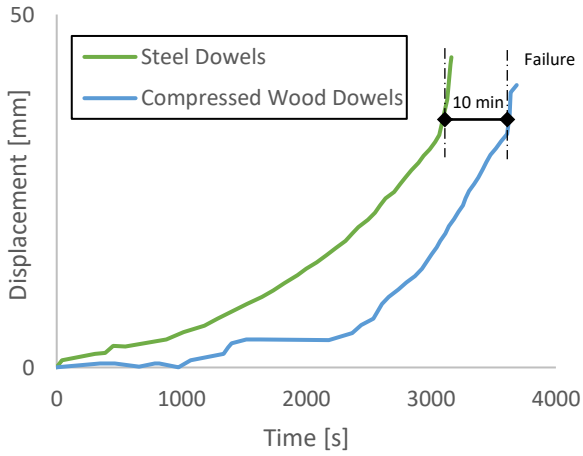


Sketch of L-shaped loaded structure



Fire test on L-shaped structure performed at the University of Lorraine

The following graph, representing the results of the experimental testing, shows clearly that failure occurs about 10 minutes earlier when the sample is connected by steel dowels, compared to CW dowels.



Results of fire test performed on L-shaped structure

Conclusion

After the same time of exposure, normal wood exhibit more charring than CW. Also, CW dowels withstand fire better than steel dowels and are thus more suitable for connections. It can be concluded that CW dowels are not considered as the weakest element under fire.

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Stakeholders Welcome

A key aim of the project is to engage with businesses, regulators and other interested parties. Adhesive-free timber building technology could be of interest to your business. Please get in touch via the e-mail addresses below:

For more information please visit the Adhesive Free Timber Buildings (AFTB) project website http://www.nweurope.eu/AFTB or use the contacts.

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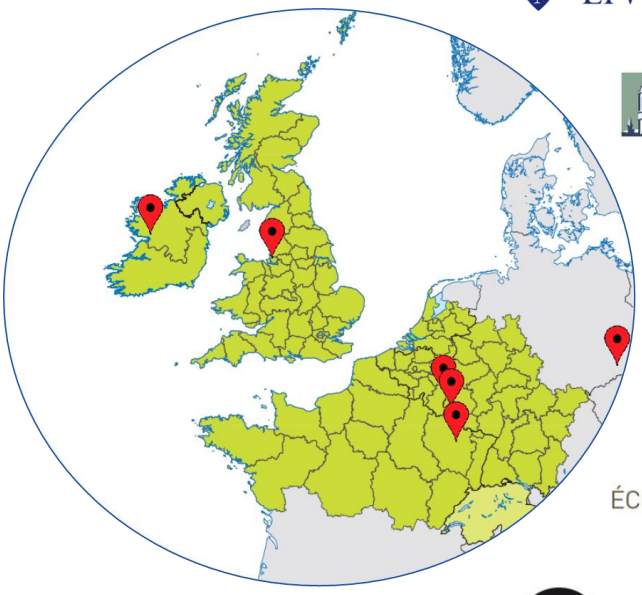

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