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

Technical Note 3
Properties of Compressed Wood

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. The aim of this note is to summarise the mechanical properties of compressed wood and show the many possibilities that this material offers and its limits.

Compressed wood (CW) is used by industry for various purposes (veneer boards, fasteners... *See technical note 1*) and has been manufactured following different processes. The AFTB project partners, *as explained in the technical note 2*, use a process utilising high pressure and high temperature in order to produce CW with improved characteristics for structural applications.

Main properties of compressed wood

A range of material characterisation tests were performed on CW in order to get a better understanding of its structural behaviour. The purpose of creating a database of results is to facilitate their use in modern timber construction.

Dowels made out of compressed wood

Density, flexural modulus and strength

Various wood species were densified and tested (in three-point bending) in the different partner institutions of the AFTB project. The aim of compressing wood is to improve its mechanical properties mainly density, stiffness and strength.

The following figure shows for each tested wood species the increase in density, flexural modulus (stiffness) and flexural strength in comparison with the initial mechanical characteristics of an uncompressed wood sample of the same species. For example, the compressed sample of *Scots Pine* registered an increase of approximately 150% when compared to the strength of the uncompressed sample. In reality, it means that by compressing a sample of *Scots Pine*, it can reach a strength of 270 MPa, while the original strength of the uncompressed wood samples was about 107 MPa.

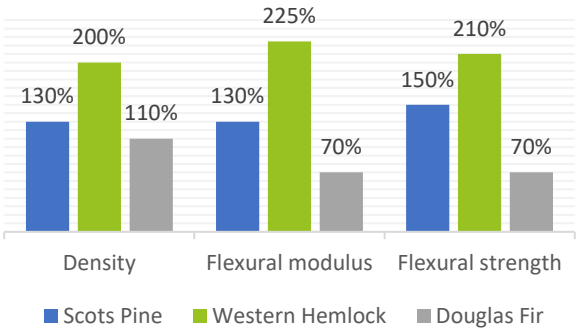
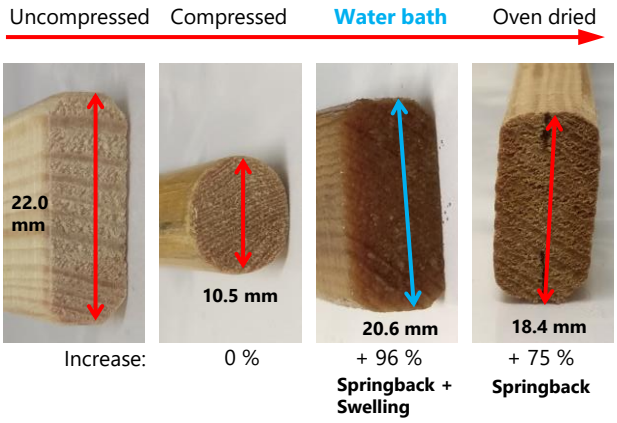


Figure presenting the increase in density, flexural modulus and strength due to compression of different wood species

Moisture dependent behaviour

Untreated CW recovers its original shape, at a rate determined by temperature and moisture content. For example, if desired, dowels though stable when stored in airtight bags after being manufactured, will seek to swell when exposed to ambient moisture. This is advantageous when using this material as a connector as it provides a permanent tight-fit. CW will rapidly return to its original dimensions when inserted in water. If dimensional stability is required, surface treatments to prevent moisture ingress or heat treatment may be used.



Behaviour of CW when exposed to different moisture conditions

Impact behaviour

A series of tests have been performed to study the impact behaviour of densified and non-densified *Spruce* and *Beech* wood. Determining the impact bending strength represents an established method to evaluate the toughness of materials. The examined wood specimens were tested using a pendulum impact and fall-test setup. An increased toughness was observed for all CW samples in regard to impact bending strength. Particularly *Beech* samples with a compression ratio of 50% achieved much higher performances.

Yield Moment

Yield moment of dowels is an important characteristic for calculation of load carrying capacity of a connection. The mean yield moment of CW dowels were compared with test results of commercially available *Beech* wood dowels. When tested in different directions (0˚, 45˚ and 90˚ grain orientation), CW always performs better than *Beech* wood.

Conclusion

The process of compressing wood significantly increases the mechanical performances in comparison to natural wood. Hence, CW can provide a sustainable solution where high structural performances are required.

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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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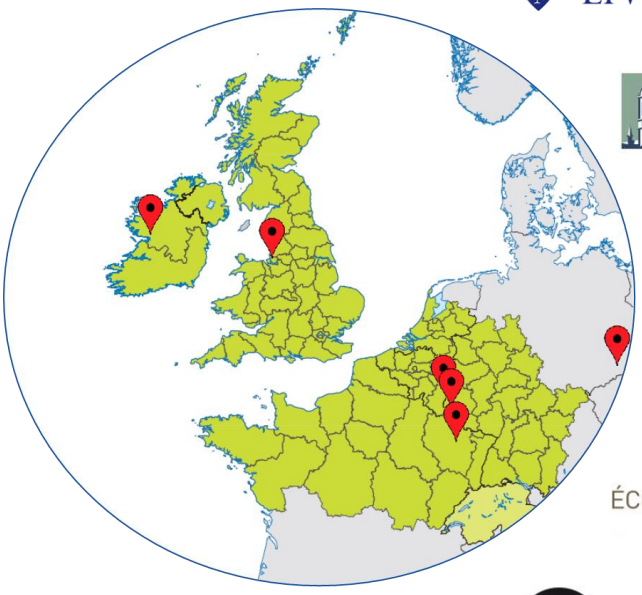

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