

## 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:

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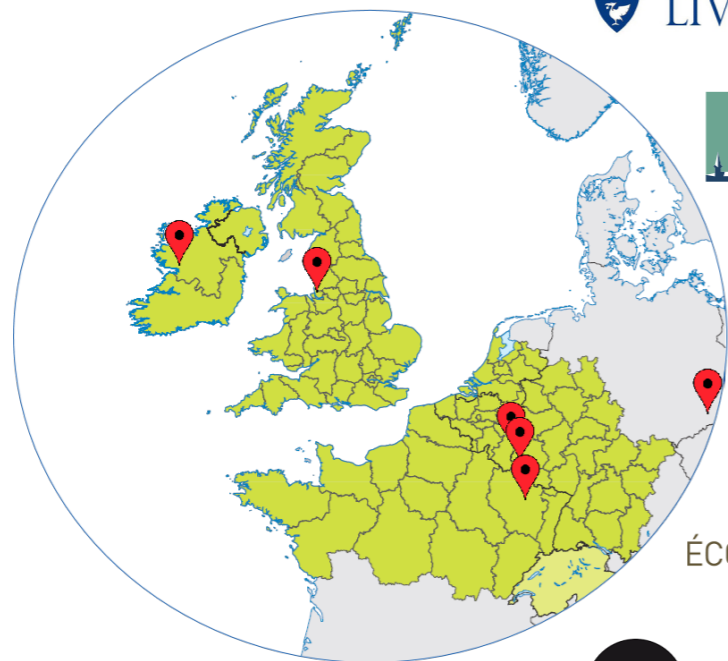
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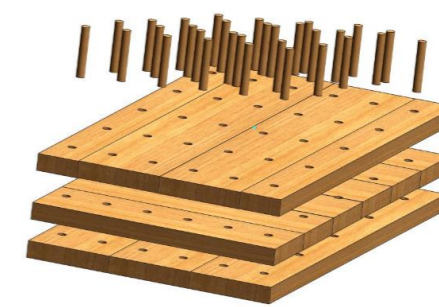
## Sustainable & natural, engineered wood products

### What's the challenge?

Regulatory pressure and customer demands are **driving an increasing need for sustainability in the construction sector.**

However, whilst timber itself is a sustainable material, other non-sustainable materials are used with timber in construction.

**Replacing the glue in laminated timber products offers a route to this goal - the Towards Adhesive Free Timber Buildings project seeks to deliver on this vision.**



Images, (left to right): dowel connected EWP; schematic of assembly; double-curved EWP roof structure at Royal Holloway University, UK (image courtesy of Buckland Timber, UK)

Five million m<sup>3</sup> of engineered wood products (EWPs) are produced in the EU annually and the market is growing as EWPs provide a **'green' alternative to steel and concrete.** Despite the many benefits of EWPs, they have some drawbacks. Petro-chemical based glues and paints end up in EWPs during production and construction. Unfortunately, in some EU member states, rather than being recycled or recovered, construction and demolition wood waste will end up in landfill dumps.

### Is there a solution?

To address this, a consortium with members from six European countries was formed to **develop adhesive-free EWPs** through a joint project supported by Interreg NWE, a programme of the European Union.

### How can the Towards Adhesive Free Timber Buildings project help?

The project will:

- **manufacture** thousands of compressed wood dowels
- **test the dowels individually** before using them in the assembly of EWPs: CLT, beams and beam-beam connectors
- **employ numerical simulation** via Finite Element analysis to guide the testing process and validate conclusions
- **construct three demonstrator structures** in Dresden, Germany; Epinal, France; and Liverpool, UK.

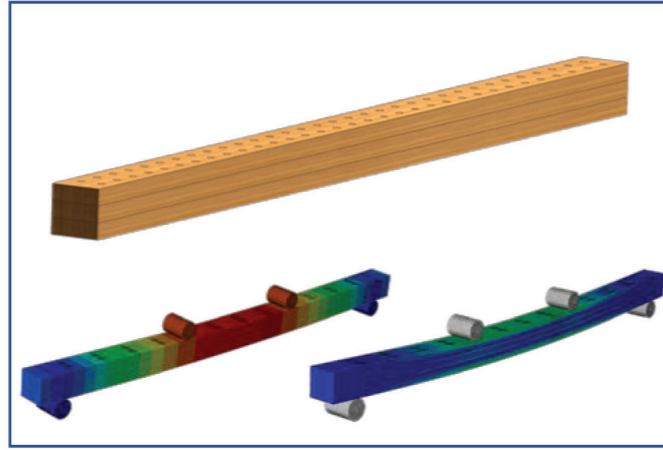
The Towards Adhesive Free Timber Buildings (AFTB) project is an inter-regional project with collaboration between six European institutions. The project is funded by the European Regional Development Fund (ERDF) via the Interreg NWE Programme.

## Testing and modelling

The partners are comparing the properties of compressed wood dowels to traditional hardwood dowels in bending, tension, compression and shear. The embedment of the dowels in timber laminates will also be compared.

CLT, grid, beam and connector structures will then be compared to equivalent glued EWPs produced commercially, via destructive four-point bending tests.

**Over the course of the project over 600 individual tests will be performed providing a body of evidence to accelerate the adoption of this technology.**



Finite element model showing exaggerated displacement of dowel laminated timber under loading, University of Liverpool

Led by the Luxembourg Institute of Science and Technology, numerical modelling, will be used to optimise the EWP design and to extract generally applicable information from the testing programme.

## Demonstrator structures

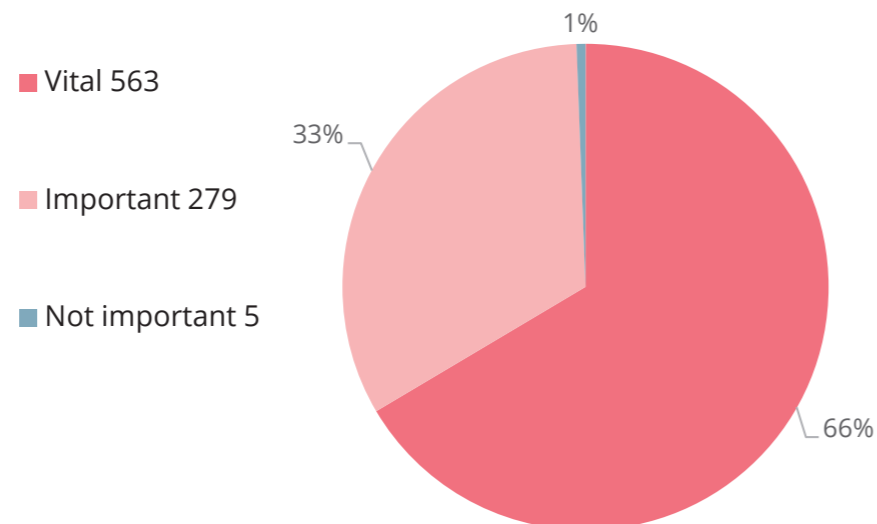
In order to prove the real world applicability of the adhesive-free construction techniques, **the consortium will build three demonstrator structures:**

1. **a structure**, to be located in Ness Botanic Gardens, near Liverpool, UK
2. **a portal frame demonstrator structure with roof**, at the Wood Campus of the University of Lorraine, Epinal, France
3. **a design will be developed** in Dresden, Germany.

These structures will allow partners to gather data on how the compressed dowels perform over time and provide for engagement with prospective users and the wider public.

## How important is sustainability for the construction industry?

Survey for "The Green Perspective, a UK construction industry report on sustainability" by the Chartered Institute of Building, UK



## Background and advantages

Hardwood dowels have been successfully used to connect elements in timber frames for thousands of years. Unfortunately, these connections suffer from creepage and a loss of stiffness over time, which can lead to unacceptable displacements within the structure. This can be accepted for small structures but prohibits using the technology for large, multi-storey projects. **Dowels made from compressed wood, their density increased by up to 68%, spring back towards their original shape over time, thus maintaining pressure within the connection.** This retention of stiffness and form should allow the technology to be used far more widely.



Traditional dowel-connected timber-framed building, England, (left). Photo credit: Doug Elliot

Currently, such buildings where timber is used utilise glue laminated timber connected with steel brackets. **Compressed dowel connections eliminate the risk of corrosion and metal-mediated heat loss, while significantly reducing the total carbon impact of the structure.** For specialist users such as hospitals and universities, eliminating the steel connectors also allows use in high magnetic field environments. The EWPs can also be modified and finished on-site using basic carpentry skills, allowing for a more flexible approach to construction.



Modern timber techniques in the Japanese Pavilion at Hannover Expo (right).

Photo credit: Jean-Pierre Dalbéra.

At the end of a structure's life, decommissioning and disposal costs can also be reduced by the use of adhesive-free EWPs. It is envisaged that these structures can be suitable for reuse or as fuel for power generation or heating. Reducing the volume of construction waste sent to landfill is also a key sustainability priority. **Moreover, moving towards adhesive-free EWPs will open up higher value-added circular economy opportunities, through the deconstruction, re-use and re-cycling of these adhesive-free EWPs.**