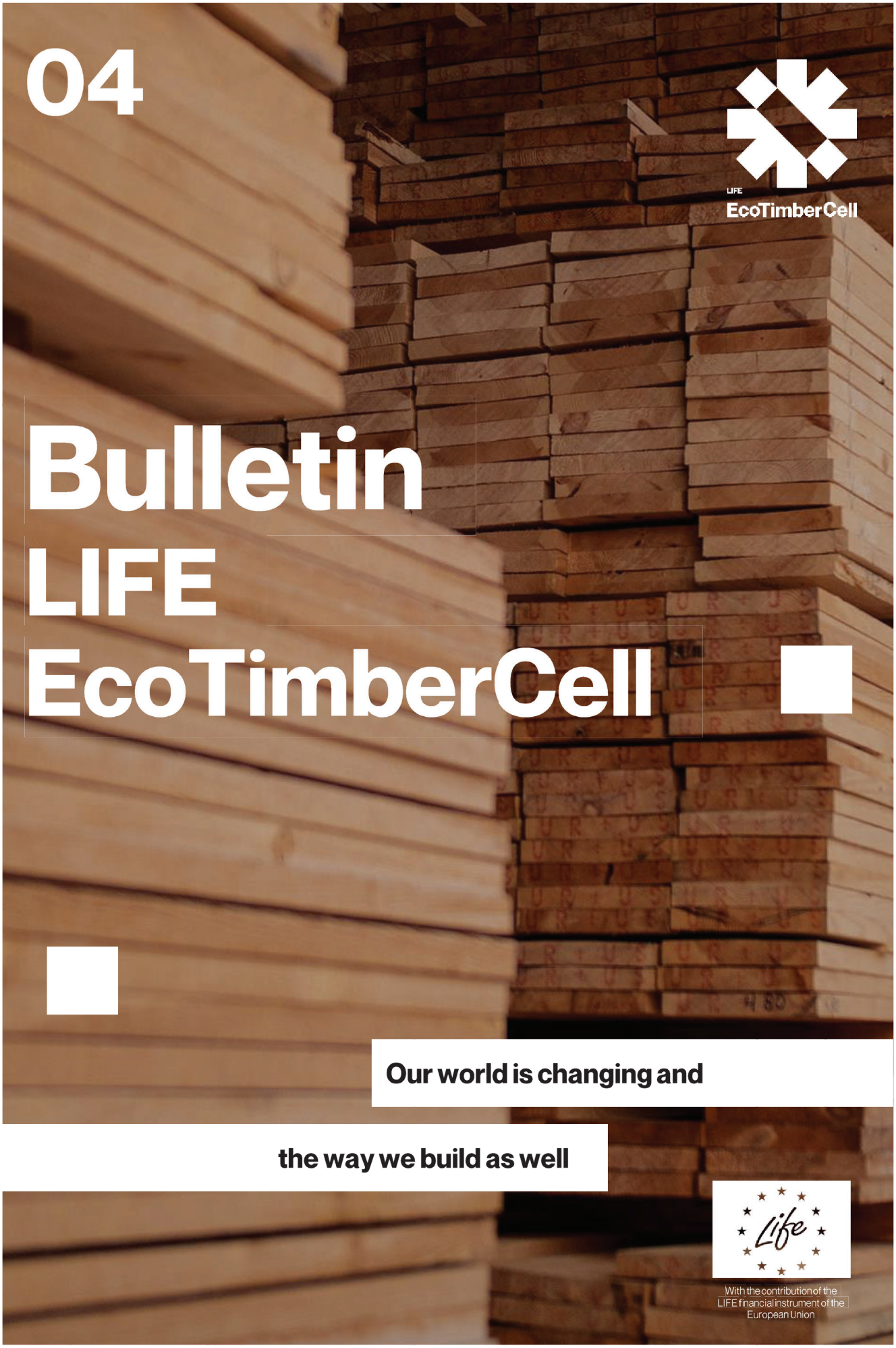

04

LIFE EcoTimberCell

Bulletin LIFE EcoTimberCell

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Our world is changing and

the way we build as well

With the contribution of the LIFE financial instrument of the European Union

Content

Introduction

The content of this newsletter focuses on the progress of the LIFE EcoTimberCell project and the development of the core unit "EcoTimberCell cell".

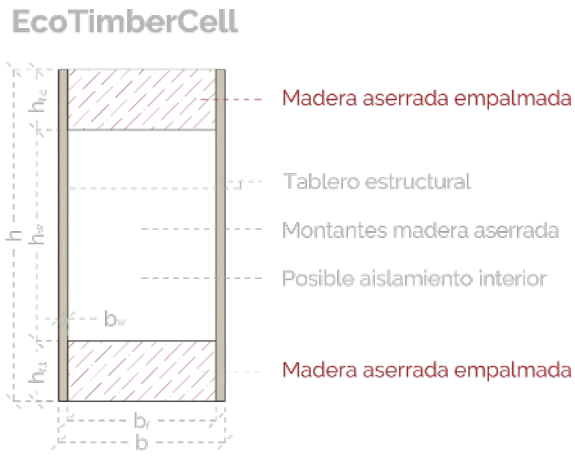
The materials that make up the ETC were characterised in action A2 (Bulletin 2), and from this point onwards the **study of the assembled product** has continued, as well as the move to industrial manufacturing..

This analysis has focused on the following points:

- Gluing between materialsCálculo numérico
- Validation tests
- Thermal simulation
- ETC +

Context

The cell is a linear structural element, tipo "Box girder" type, where the wooden cords work mainly under axial stress, and the panel is responsible for connecting them, therefore it will be mainly subjected to shearing stress when the stress on the element is bending.



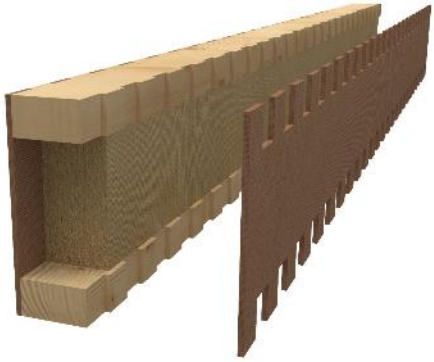
The wood used in the cords will always be structural wood from nearby species. In this case, as we are located in the northwest of the Iberian Peninsula, we mainly have ***Pinus pinaster, Pinus radiata, Castanea sativa y Eucalyptus globulus***, as species recognised in the UNE EN 1912.

The main board used is the **hard fibreboard manufactured by Betanzos HB**, type "Hardboard". This board, besides coming from proximity plantations, is characterized by being **100% natural**, totally free of adhesives.

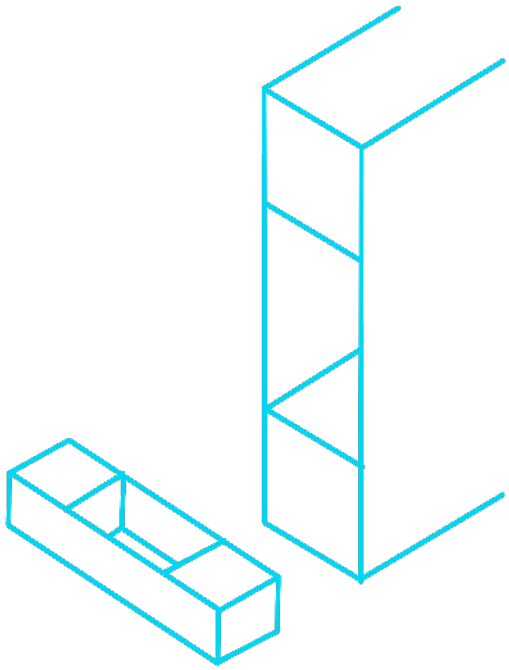
The connection between the board and the wood is planned in two different ways:

- By using structural adhesive (EcoTimberCell)

- By using a toothed joint (EcoTimberCell+)

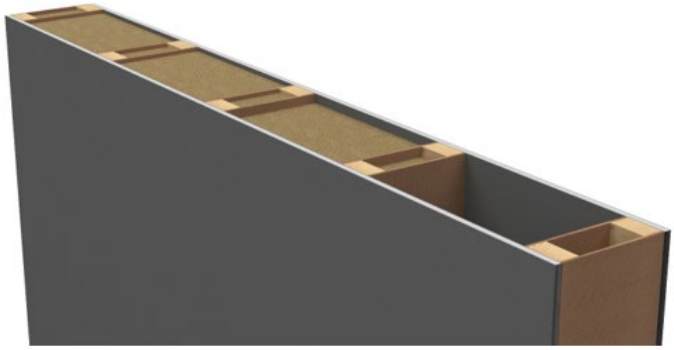


ETC as a structural element can be left hidden, fully or partially visible.



ETC cell, s the basic unit for the development of the EcoTimberCell systems developed in the C4 action. This action is complemented by the C5 action which focuses on connection and construction details.

Sistema ETC Box



Sistema ETC Frame

Gluing between materials.

Nowadays the use of adhesives in structural wood products is fundamental, as it allows pieces of wood or derivatives to be joined together, to work structurally together.

In the case of the EcoTimberCell cell, the adhesive is required in:

- Finger-jointing of small-sized **sawn wood strips.**
- The **connection between the board and the wooden cords.**

Connection between the board and the wooden cords.

For the evaluation of the capacity of the adhesive to join the board to the wood, **the four main species proposed in the project and different adhesives are evaluated.**

This study involves carrying out **shear line and delamination tests** in accordance with the UNE-EN 14080:2013 standar.

- Cutting in glue line

Ensayo madera-madera

Ensayo madera-tablero

life-ecotimbercell.eu

In this type of wood-board test the aim is to **find the weakest point of the board and evaluate the difference between the smooth and rough gluing surface** of it

Delamination test

Delamination tests were carried out on pieces of **wood of different species, including larger specimens with interleaved boards** in the glue lines.

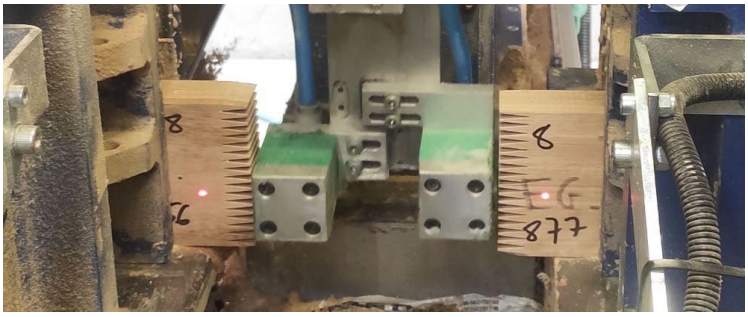
The specimens were subjected to the test cycle of B method.

For the selection of the adhesive of the cells, the results obtained in the different tests have been taken into account together with the criteria of the system's industrialization and the use of the adhesive in the factory.

Finger-joint testing

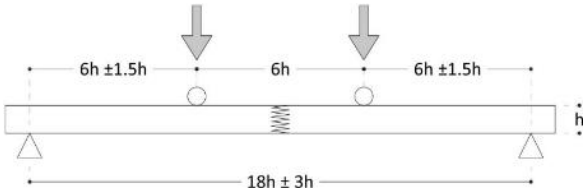
The finger-joint is the basic joint for joining pieces of sawn wood by the heads. This allows long pieces of wood to be obtained from short wooden boards and also allows elements that would be rejected, such as board knots, to be removed.

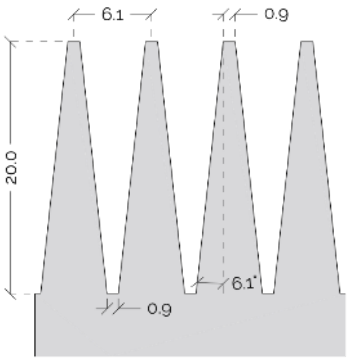
This connection is the basis for most structural wood products (KVH, glulam, plywood, duos...).



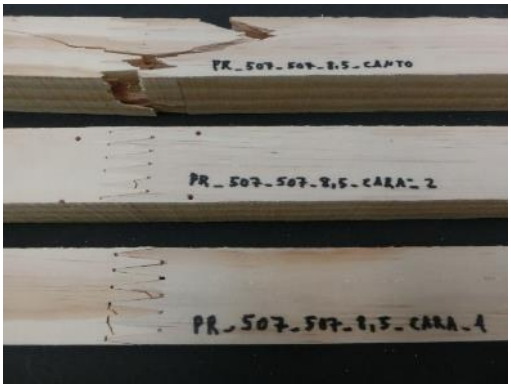
A **test campaign was carried out to evaluate the quality of gluing in the manufacture** of structural timber with finger-jointed joints as it is a necessary product for the formation of EcoTimberCell cells and systems.

The **standard UNE EN 15497** "Solid structural wood with splices by serrated joint" is used as a reference. Performance requirements and minimum manufacturing requirements".



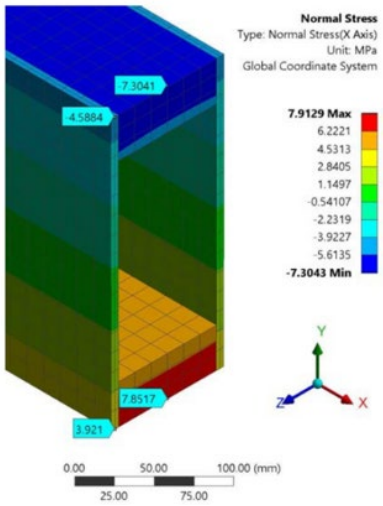


Breakage examples

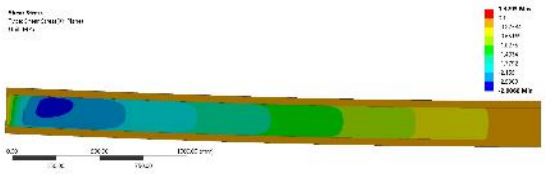


Numerical calculation

Once the available materials are known (spliced wood, boards and adhesives), the prototyping and calculation process of the ETC cell is started.



In this project phase, the first part includes general considerations for the calculation of timber structures and derivatives and a more specific part is developed about the cell's specific calculation process.



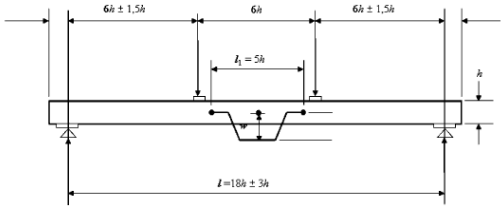
Validation Tests

Prototype development

It started with the first prototypes, starting with material already classified and carrying out the assembly in the laboratory.

The main objective of these first tests was to **detect the difficulties inherent in the manufacturing process, to start detecting failure modes** and to validate the calculation methods used.

For these first tests, a 4-point bending was performed directly using the methodology proposed in the **UNE EN 408** standard, obtaining the resistance and rigidity to bending.

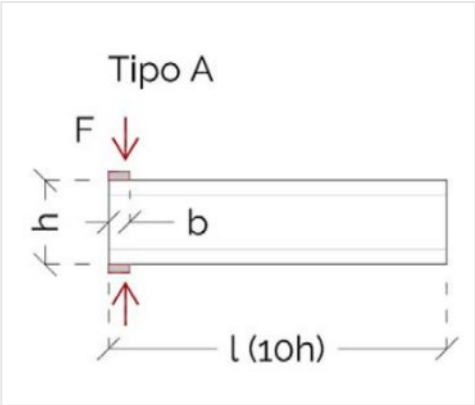


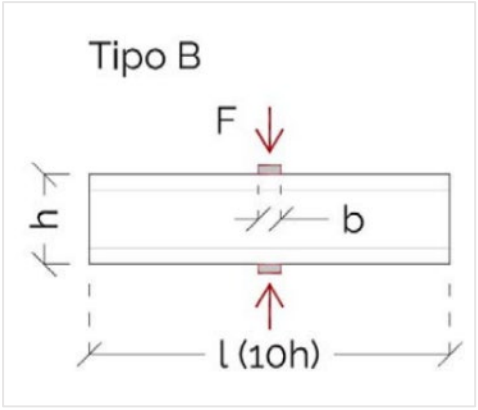
Ensayos

The validation tests correspond to the final phase of **action C3**, in which once the calculation and prototyping part has been developed, a representative number of specimens are manufactured in order to validate the results obtained in the calculation and therefore produce the corresponding product certifications (CE Marking).

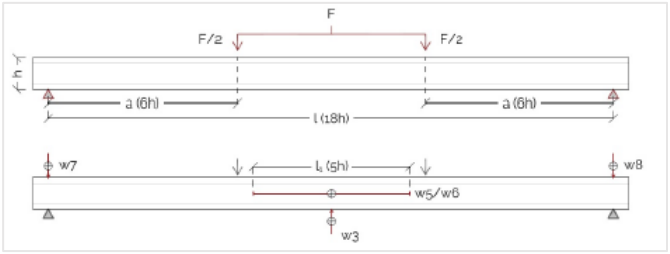
At this stage the following tests were carried out according to Annex A of EAD 130367-00-0304.

- Determination of support resistance.

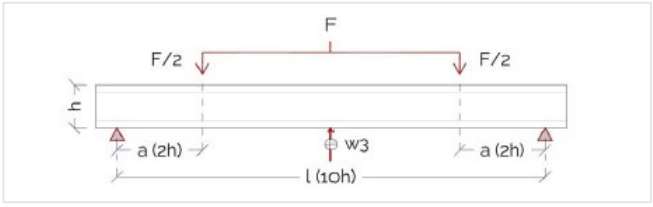




- Determination of maximum moment, bending rigidity and shear stiffness of beams



- Determination of shear resistance

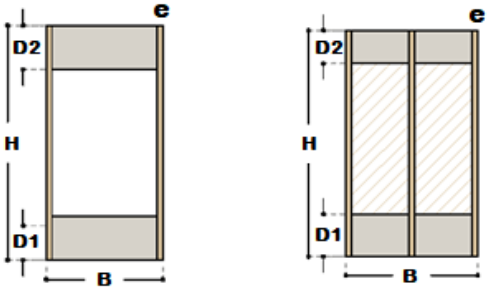


Thermal simulation

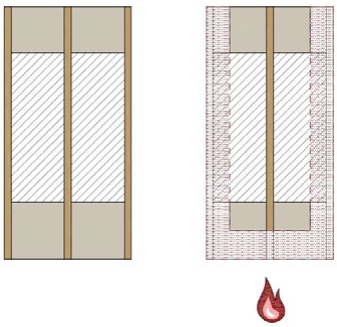
At this point, using **thermal simulation** by numerical methods based on the **UNE-EN ISO 6946 and UNE-EN ISO 10211-1 standards**, it was proposed to detect the difference in resistance and thermal transmittance obtained by **varying different parameters** such as the section, the type of wood and the inclusion or not of thermal insulation within the ETC cells.

Different typologies of ETC cell section were evaluated, all of them formed by wood of different species, high density Betanzos HB board and the presence or not of insulator filling in the interior hole.

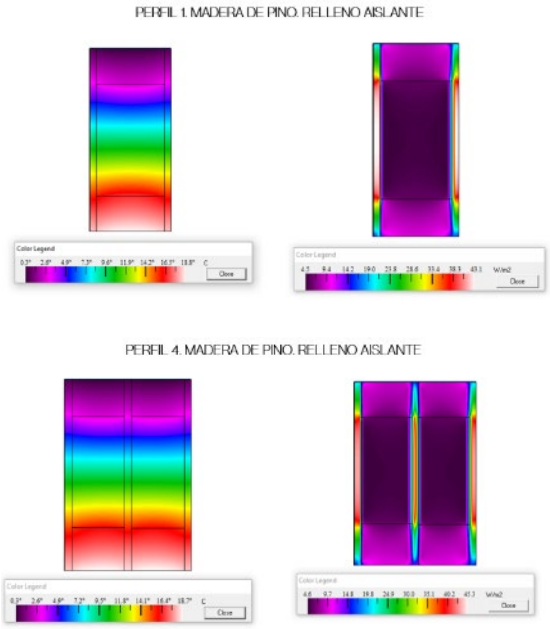
For visible elements where a fire **resistance of 30 minutes** is required, it is considered necessary to include a **protected central core**.



By incorporating 3 cores and insulation on the inside, the cell is able to work as an I-profile, once the outer boards are charred.



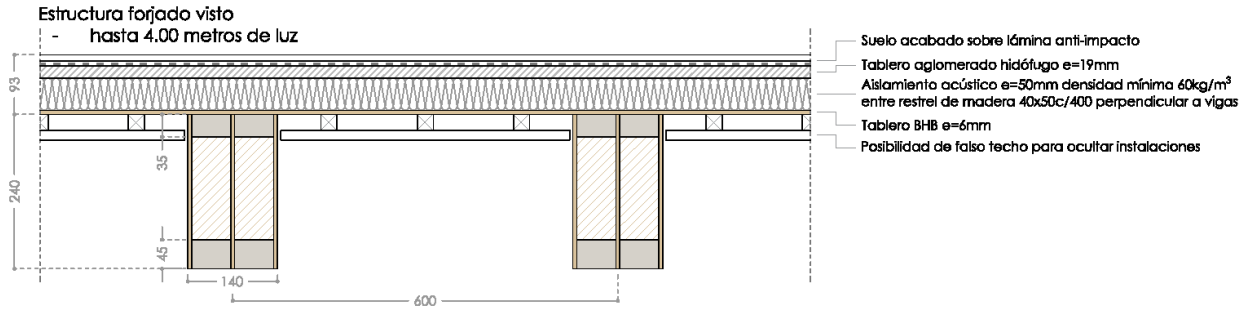
The **resistance and thermal transmittance values** were calculated using spreadsheets developed for this purpose, combined with the heat flow values obtained in the simulation using finite elements.



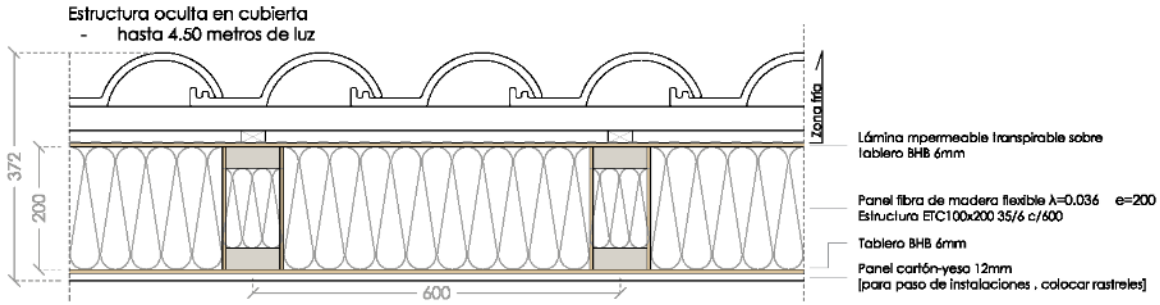
The **assessment of the ETC system** has the final objective of obtaining the **CE marking** by the manufacturer. This complete development and evaluation phase has allowed to check the calculation model that makes the **use of the ETC system as a structural element** a reality.

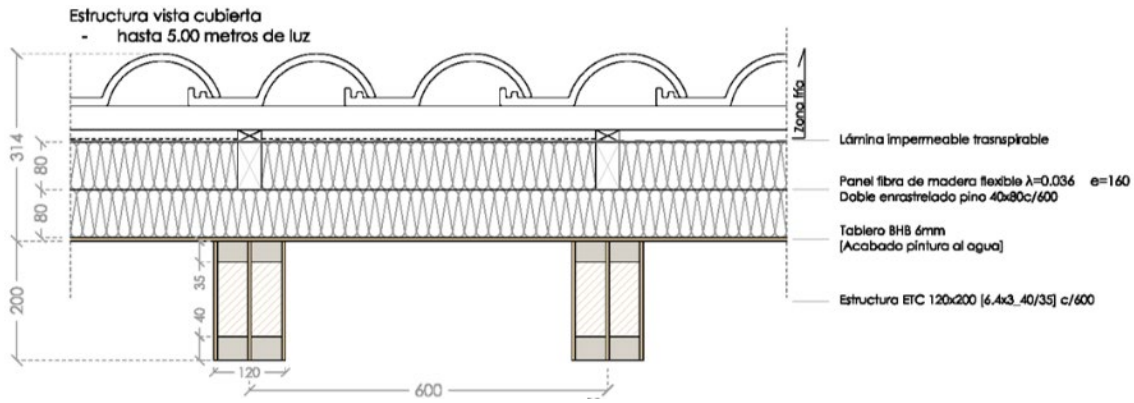
Some possibilities of the system's use are presented below.

Forged



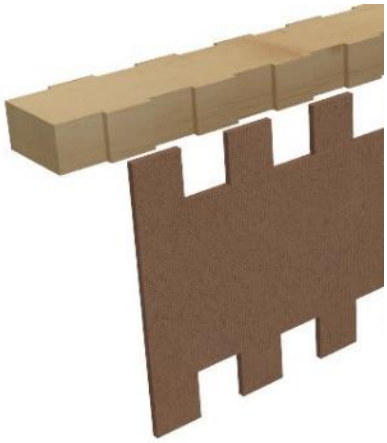
Cover





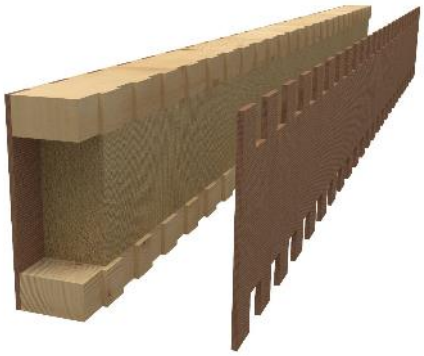
ETC+ Cell Development

The ETC+ is conceived as an ETC in which the connection between the board and the wood is made by means of an interlacing, **avoiding the use of structural adhesives.**



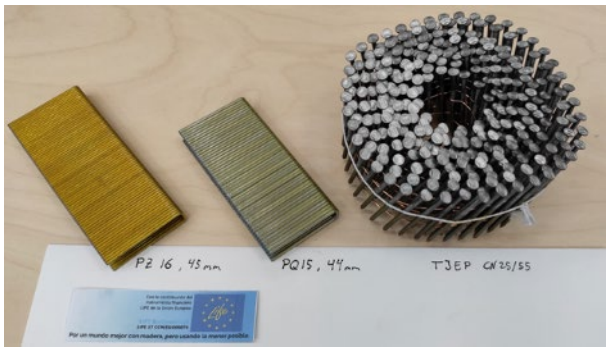
The difficulty lies in the transmission of the longitudinal shear between the wood and the board, without using a structural adhesive.

The first efforts in the development of ETC+ are focused on this connection through numerical simulation and mechanical testing.



Connection via metal bolt

Some tests with mechanical connection were carried out, in order to evaluate other types of force transmission. The tests are carried out in accordance with standard **UNE EN 26891**. Connections with clamps

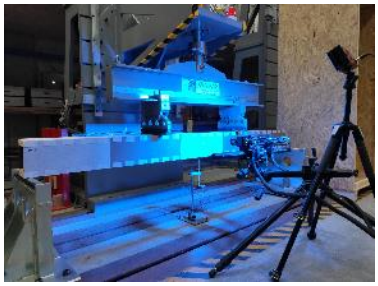


Production

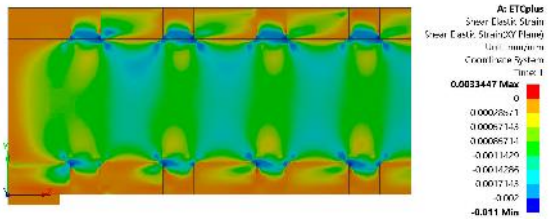
With the end of the initial tests, several prototypes are manufactured for testing. The **manufacture of the ETC+ cells** has been carried out thanks to the collaboration of Vocational Training in Carpentry and Furniture of the IES Politécnico de Lugo, which has made its **numerical control cutting** machine (CNC) available to the LIFE EcoTimberCell project, allowing precise manufacture with quality finishes for the ETC+ cell prototypes.

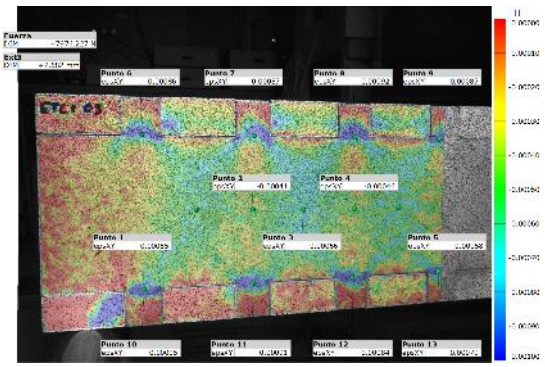
Bending test

Through the numerical simulation carried out previously, it can be seen that **we are approaching the mechanical behaviour of the structural element**. This simulation has been validated by means of laboratory tests together with measurements using digital image correlation techniques (ARAMIS).



The following image **compares the deformation field caused by the shear force** on the board in the ETC+ cells, obtained with the numerical simulation and with ARAMIS.





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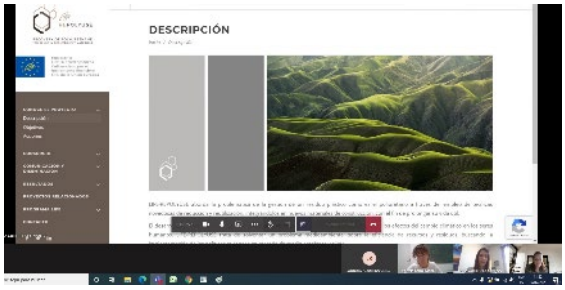
News

LIFE Repolyuse and synergies with LIFE EcoTimberCell [17/07/2020]

Last July, we met with the **LIFE Repolyuse** project to find out more about the work that each one is doing in favour of **climate action in Europe**, as well as to look for points of union and synergies that can be generated between the two projects, given the common points in both LIFE projects.



We recommend you to visit their project because of its innovative approach and interest, especially in a topic as relevant as **plastic recycling and reuse.**

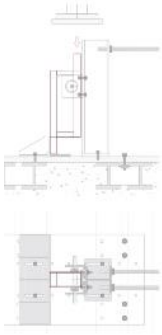
https://life-repolyuse.com/

Other commercial panels assessment for ETC [07/2020]

It is important to highlight the use of other boards, to **encourage the replication of the project with local materials**, avoiding the transport of raw materials and giving value to local forest resources. In this sense, **within the project different commercial boards of a structural nature were evaluated** for the manufacture of hollow beams, and the results were compared with those obtained in the manufacture of cells with BHB board.

Within the panels evaluated we will make special mention of the **Tricoya board** as it is a product developed within the **LIFE WOOD project** in which, through the **acetylation of wood** to modify fast growing softwoods, a resistant panel is created that can replace materials with a high carbon content (for example, aluminium and steel) that are currently used in applications such as façade cladding/coating, window, door, wall and ceiling components.

It is important to highlight that commercial boards incorporate resins so it is foreseeable that greater resistance will be achieved, but **the use of artificial adhesives deviates from the objectives of the LIFE project which is working to reduce them**.



The **results obtained in this action are consistent, and confirm the good performance of the BHB board**, which stands out for not containing adhesives other than the wood's own lignin.

LIFE EcoTimberCell publica la Guía de suministro y caracterización de la madera estructural [21/09/2020]

Considering the high variability of the characteristics and singularities of the wood, there is the necessity to carry out a process of classification that allows its characterization like structural wood. The recently published **"Guía de suministro y caracterización de madera estructural"** details this process based on the application of current regulations for the calculation of characteristic values and the assignment of qualities and class resistance to wood..

LIFE EcoTimberCell project is based on **certified local wood** in support of **sustainable forest management** that promotes economic, social and respectful use of our forests. The Guide reflects in data the relevance of this resource and the evolution of forest certification at both **regional and national level.**

https://cutt.ly/CjdIMI9

LIFE EcoTimberCell awarded in the VI Edición Concurso de Proxectos Empresariais Semente Ribeira Sacra [29/09/2020]

The business project **Timbersoul Innovations**, generated in the context of LIFE EcoTimberCell has been awarded in the **VI Edición Concurso de Proxectos Empresariais Semente Ribeira Sacra.**

This competition is organized by "**A Semente de Monforte**", an association whose objective is to promote solidarity in the Ribeira Sacra and "sow" initiatives that promote the development of the region. Therefore, this contest was born with the aim of rewarding the projects with the best ideas of business entrepreneurship.

Timbersoul Innovations has received the **third prize**, with an economic amount of 3.000€.

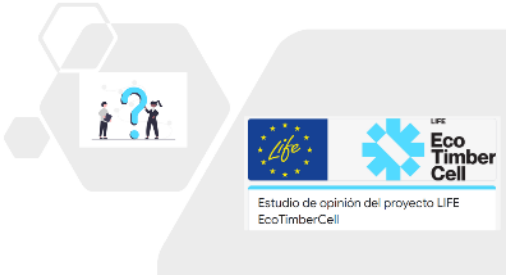
LIFE EcoTimberCell project participation in the CLIMATE NEUTRAL FOOD AND WOOD webinar [09/10/2020]

In **October** the LIFE EcoTimberCell project had the honour of participating as a speaker in the **Webinar "Climate neutral food and wood"**, organized by the Directorate General for Climate Action of the European Commission (DG CLIMA) and the Executive Agency for Small and Medium Enterprises (EASME), which will bring together for the occasion successful LIFE and Horizon 2020 projects in the areas of agriculture, food, forestry and bioeconomy.

This event was attended by project representatives, experts from EU institutions and agencies, as well as other key stakeholders, who were able **to discuss best practices and lessons learned** from relevant projects, as well as initiatives to promote future policies in this area.

Opinion surveys launched. [10/12/2020]

In LIFE EcoTimberCell we are currently working on **the different business and marketing lines of the structural systems** developed in the project. In order to do this, we consider it essential to know the perception of EcoTimberCell systems, as well as the possible social impact that projects such as this one can generate in mitigating climate change.



If you are a construction sector professional, forest owner, work in the public administration, research technology centres or real estate agencies, or if you are thinking about buying a sustainable home. **Your vision is very important to us, so we appreciate your collaboration in this survey that will only take a few minutes**.

https://cutt.ly/DhA8mS2

Collaboration for the manufacture of ETC+ [11/12/2020]

In November, thanks to the collaboration carried out by the IES Politécnico de Lugo which has made its **numerical control cutting machine (NCC) available to the LIFE EcoTimberCell** project, it has been possible to improve the manufacture of the ETC+ cell, obtaining better finishes and precision in the wood board joints.

On the occasion of the collaboration with the IES Lugo, a visit to the PEMADE facilities was organised, in which the **Vocational Training students in Carpentry and Furniture** were able to appreciate not only the bending test with digital image correlation (ARAMIS) of the ETC+ cells, but also to witness specific load tests on boards and tensile tests on sawn wood strips.

The visit was of **great interest to the students and teachers** of the centre, opening up the possibility of future collaborations and generating the dissemination of project results.

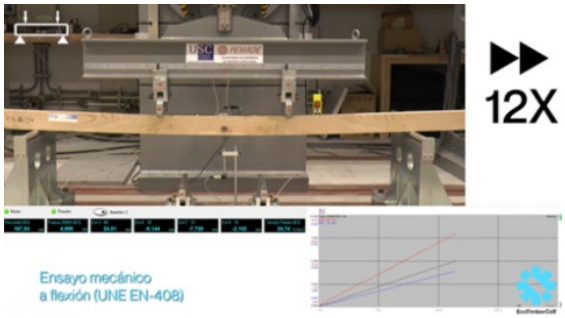
LIFE EcoTimberCell project participation in the "Wood for sustainable construction" conference" [15/12/2020]

As part of the activities planned by the employers' association ASMADERA, the **first edition of the MCS Asturias meeting, Wood for Sustainable Construction**, was held.

During this conference, a **table of analysis and opinion has been organized where the use of wood in construction has been commented. CETEMAS, a partner from LIFE EcoTimberCell project, has participated in this conference**, contributing with its knowledge in the field of innovation, efficiency and sustainability in wood construction.

Dissemination videos

Local wood characterisation in LIFE EcoTimberCell project



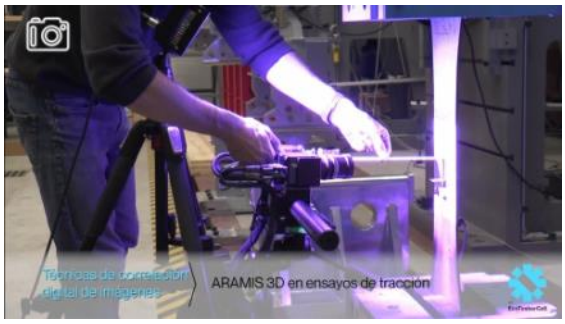
To understand the process of understanding the particular properties of the local wood from **sustainable forest management** that will be used in the manufacture of EcoTimberCell structural systems is possible through the short video published last September.

Click on the following link to see the video:

https://youtu.be/HaGBYF6ltxU

High density fibreboard characterisation of Betanzos HB in LIFE EcoTimberCell project

To determine the behaviour of **the board that will constitute the core of the EcoTimberCell structural cells**, a process of characterisation and improvement was carried out using non-destructive (wave propagation technique) and destructive methods (mechanical tensile testing, ...).



The results allow us to study the possibilities of improving both the board and its manufacture, which translates into the improvement of the EcoTimberCell products themselves thanks to the increased performance of their raw material.

The summary of the characterization process of the Tablex board can be seen in the following video:

https://youtu.be/HaGBYF6ltxU

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