



## **TECHNICAL REPORT:**

**RT/SERQ-AZORINA/1**

**Promotion of Cryptomeria wood in construction.  
New products, opportunities and markets.  
Plan of activities to be developed by SerQ.**

Co-financed by:



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## SCOPE

This report intends to fulfil the objectives of the studies to be carried out under the contract between Azorina - Society for Environmental Management and Conservation of Nature, S.A and the Innovation and competence forest centre, Association (SerQ). This contract signed on April 16, 2018, with a duration of 18 months, is based on the development of innovative products for the construction based on Cryptomeria wood (*Cryptomeria japonica* (Thunb. Ex L.f.) D. Don) produced in the autonomous region of Azores.

## INTRODUCTION

The agreement between Azorina and SerQ establishes the main obligations in clause 5:

- Definition of products (floor covering and glued laminated timber), requirements to achieve and performance evaluation systems (e.g. CE marking).
- Wood modification by densification, including studies on process optimization to guarantee wood stability (reduction of the recoverability of the densified material). Development of new technical products incorporating densified wood (including studies on bond quality and dimensional stability).
- Production of mixed glued laminated beams (combination of species) and type I beams.
- Cost analysis associated with the technical implementation of the proposed products in the Azorean timber industry.
- Testing of natural durability / resistance to termites of dry wood, new products.
- Participation, at least, in two actions of promotion/dissemination of knowledge within the scope of the project.

The work program to be implemented by SerQ, to fulfil the objectives described above, is divided into three axes.



Figure 1. Activity axes

Wood products have been evolving rapidly in recent years, with quality assurance being a crucial parameter in the successful introduction of innovative products on the market. Cryptomeria wood presents annual growth rates that can vary between 21 and 26 m<sup>3</sup>/ha/year, thus being a species of rapid growth but presenting technological characteristics (low density and modulus of elasticity) that limit its use for application in traditional products, where performance characteristics such as hardness (floor coverings) or strength / stiffness (glued or solid beams) have minimum requirements (described in European standardization). In this way, the structural and non-structural use of the cryptomeria wood is a challenge, which can only be overcome by acting on the three axes described above.

This report presents the planned activities for the three axes, along with its schedule, assuming the delivery of the wood in SerQ facilities will occur one month after the beginning of the project.

## EXPECTED ACTIVITIES

All the activities will be carried out considering a volume of cryptomeria wood of around 60 m<sup>3</sup>, according to the conditions indicated in the table below.

Table 1. Conditions for the supply of cryptomeria wood

Dimensions (mm) Thickness x width x length	Quantities		Tolerances (mm) – EN 336		Water content	Surface quality
	Number of Boards/Beams	Volume (m <sup>3</sup> )	Width and thickness (Tolerance class 1)	Length		
50 x 120 x 3600	500	11	-1/+3	-0/+5	15%  Tolerance: 2,0%/+1,5%	Planed square-sawn timber
80 x 160 x 4800	312	19				
100 x 200 x 6000	250	30				

The delivery of acacia wood at SerQ facilities is also agreed upon. This and other species of wood to be delivered shall comply with the requirements mentioned in Table 1 for Cryptomeria wood.

## INNOVATION AT THE MATERIAL LEVEL

The innovation that will take place at the material level will undergo densification testing of wood, aiming to achieve a surface hardness above 10N / mm<sup>2</sup>, thus qualifying the material for flooring applications.

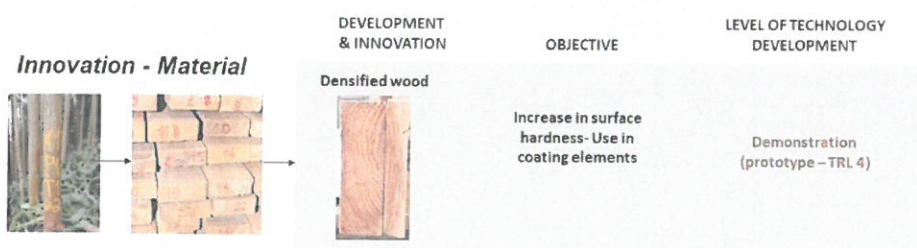
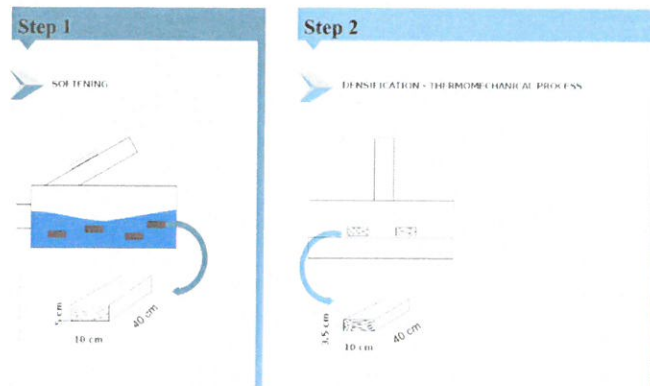


Figure 2. Scheme of the desired innovation regarding the material

In this activity several schemes of thermomechanical treatment will be studied, whether or not including a phase of softening of the wood. The studies to be carried out will include the densification of pieces of wood of different thicknesses, with defects and without defects, with a maximum dimension of 150x400mm<sup>2</sup> (width x length) and with thickness between 6 and 50mm.





**Figure 3. Density process scheme to implement**

The study will be supported by a survey of the state of knowledge regarding wood modification by densification.

After defining the treatment process, a report will be prepared establishing the principles for the industrial implementation of the densification process and the possibility of using densified wood in laminated products for floor and wall covering.

## INNOVATION AT THE PRODUCT LEVEL

This activity considers the developments that have occurred in the last decade regarding wood products and their penetration in the construction market. Thus, the work from the *European Committee for Standardization* (CEN) and from the *European Organisation for Technical Assessment* (EOTA) will be used as guiding documents for the work. The plan of activities includes the products displayed in figure 4.

The physical and mechanical characteristics of cryptomeria wood (i.e. low density and modulus of elasticity) mean that the products to be developed must consider:

- The ability to maximize the resistive capacity of the elements - aspect that will be studied through the application of the mechanical classification by using the MTG equipment, available at SerQ (figure 4).
- The ability to develop mixed or hybrid products with endogenous materials (e.g. acacia wood) or non-wood materials (concrete).



**Figure 4. MTG Equipment for Mechanical Classification**

The study of the mechanical classification of solid wood is a fundamental step towards the realization of products for structural purposes. The classified wooden beams will be inserted into products for use as linear (beam) or plate type (for floors), allowing an increase in the use of cryptomeria wood in the Azorean market or its export.

Currently the use of mixed (heterogeneous) wood technical products, such as glued laminated timber (Glulam or GLT) or cross-laminated timber (CLT), is quite frequent in order to optimize the use of woody resources, using each element according to its resistant capacity.

The present activity includes a study on the bonding quality of the cryptomeria wood, including gluing wood from other species (e.g. acacia, to be supplied by Azorina, and eucalyptus).

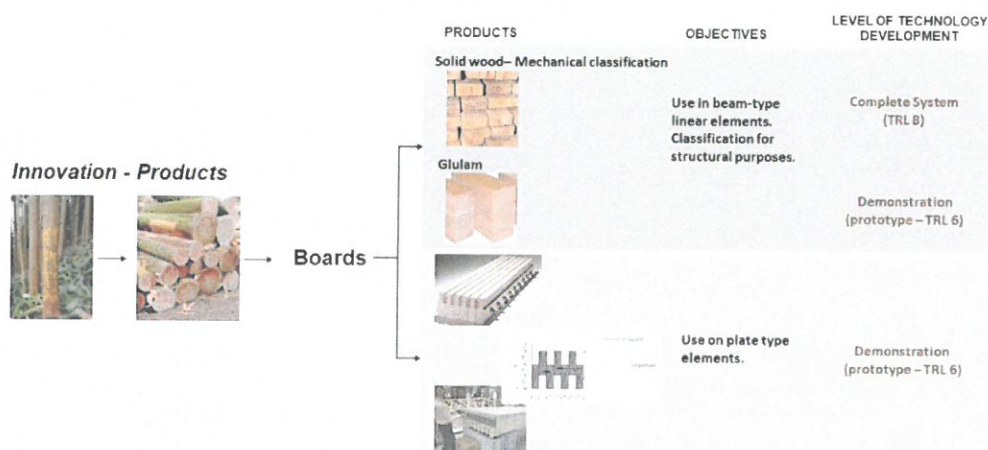


Figure 5. Schematics of the foreseeable product innovation

## DOCUMENTATION OF SUPPORT FOR PRODUCTS IMPLEMENTATION ON THE MARKET

The use of wood in construction has been supported by the growing development of new solutions (products and systems), based on work carried out by CEN, in particular by the technical commissions CEN / TC124 and CEN / TC175, and by EOTA. These products are covered by European regulations (defining mandatory requirements, e.g. CE marking according to the PRC or national regulations) or voluntary standardization (with the exception of products covered by harmonized standards cited in the Official Journal of the European Union).

Within the scope of the work commissioned to SerQ, a report describing European standardization in the area of the use of wood in construction, the CE marking process for wood products, the systems for assessing and checking the constancy of performance and the minimum content of the initial type tests for each type of product, will be produced.

## STANDARDS AND REGULATORY REFERENCES

CEN/TS 13307-2. Laminated and finger jointed timber blanks and semi-finished profiles for non-structural uses - Part 2: Production control

EN 13489. Wood-flooring and parquet - Multi-layer parquet elements

EN 14080:2013. Timber structures - Glued laminated timber and glued solid timber – Requirements

EN 14081-1:2016. Timber structures - Strength graded structural timber with rectangular cross section - Part 1: General requirements

EN 14081-2+A1. Timber structures - Strength graded structural timber with rectangular cross section - Part 2: Machine grading; additional requirements for initial type testing

EAD 130011-00-0304. Prefabricated wood slab element made of mechanically jointed square-sawn timber members for use as structural element in buildings

## SCHEDULE

Activity		Months																	
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
I	Definition of the work program																		
II	Innovation at the material level																		
III	Innovation at the product level																		
IV	Product Support Documentation																		

Milestone	Activity	Date (month)	Milestone
M1	I	1	Report on the work program
M2	IV	5	Report on the application of European standardization and regulation to wood and wood products
M3	II	6	Preliminary report on the densification of cryptomeria wood
M3	II	12	Report on the incorporation of densified wood into products
M4	II	18	Final reports on activities I, II e III

Sertã, 17th May 2018

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