

## WOODINSITU – Recognising physical-mechanical properties as a basis for evaluating wood in old buildings

### Summary

The objectives established in the WOODINSITU Project involved the large research area of estimating the mechanical characteristics of wood in service (in situ) of old buildings, through the establishment of laboratory correlations.

It was assumed that the efficiency and reliability of non-destructive methods used in situ could be increased by obtaining laboratory correlations with the mechanical characteristics of wood.

Correlations were then sought for healthy wood, in order to be able to recognize in situ mechanical characteristics of applied wood, by simply using non-destructive techniques.

This involved three main strands of scientific work:

#### Development of laboratory work

This work was carried out by the four researchers at the LMC-ADEC/ISEL in partnership with the LR-ADF/ISEL, but more intensively by the principal investigator and the BIC:

1. Selection of 17 wooden structural elements from demolished buildings in the city of Lisbon (dating from the mid-18th century to the mid-20th century). All the elements were identified as being of the species *Pinus sylvestris*, L. (Scots pine). Cut into 200x100x50 mm specimens.
2. Indirect reading of properties based on non-destructive and semi-destructive NDT/SDT laboratory tests (ultrasound, pilodyn and resistograph) on the specimens.
3. Direct reading of physical and mechanical properties, based on non-destructive (humidity meter, scale) and destructive laboratory tests (compression press).

4. Analysis of the readings based on univariate or multivariate empirical models, such as regression analysis, linking the desired properties obtained in 2) to the direct measurements obtained in the laboratory campaign referred to in 3).

#### Development of on-site work

This work was carried out by the principal investigator and her master's student:

5. In situ testing of wooden structural elements of the species *Pinus sylvestris*, L. from the National Palace of Sintra: visual strength grading, NDT/SDT tests (ultrasound, pilodyn and resistograph).
6. Combining, calibrating and discussing wood properties in service, based on the average values obtained by the analyses referred to in 4).

#### Dissemination

This task was completed with great success, exceeding the objectives initially set. It was mainly carried out by the principal investigator:

- Two master's dissertations currently being written.
- Two articles in international scientific journals (one of them in press).
- Four articles in scientific conference proceedings (two national and two international).
- Two lectures in technical-scientific dissemination sessions (one organized by ISEL's management and the other co-organized by the head of the WOODINSITU Project).



(a)



(b)

Figure 1. (a) Wooden elements from old buildings; (b) Preparing the wood beams for testing.

### Project Reference

IPL/2016/WOODINSITU

### Leading Institution

ISEL – Instituto Superior de Engenharia de Lisboa (Portugal)

### Partners

-

### CERIS Principal Investigator

Maria Dulce Henriques  
([mfhenriques@dec.isel.ipl.pt](mailto:mfhenriques@dec.isel.ipl.pt))

### CERIS Research Team

-

### Funding

IPL – Instituto Politécnico de Lisboa

### Period

2017-2018

### Total

4 997.00€

### CERIS

-

### Project Website

-



Figure 2. Lecture as part of the WOODINSITU research project on March 14, 2018.



Figure 3. Lecture as part of the WOODINSITU research project on April 21, 2018.

