Wooden Blocks' Shear Wall
- Utilization of hygro-mechanical properties of wood to improve the strength -

B. Ivón Hassel
Laboratory of Structural Function, RISH, Kyoto University

In forestry regions of Latin America, traditional houses are built of a reinforced concrete frame and masonry infill, non-autochthonous materials that require high transportation and energy production costs. Although masonry walls are deeply-rooted in this society as part of its traditional construction system, there can be a sustainable, cost effective alternative in the use of wooden blocks to build shear walls [1]. This construction method uses no steel elements as connectors, which is of interest at the time of disposal [2], and moreover, allows readjustments and recycling of materials after seismic impacts.

The objective of this research is to study the performance of a *Wooden Blocks' Shear Wall* that incorporates 63% compression ratio's sugi (*Cryptomeria japonica D. Don*) element without fixation treatment. These elements recover their radial dimension when absorbing humidity from the air, improving the stiffness of the wall by adding stress to the neighboring blocks when expanding [3][4][5]. Utilization of the *diamond key* allows the structure to be readjusted and reused after the occurrence of earthquakes.

The blocks are made of glued laminated timber (GLT) European red pine, with dimensions of 60cm length by 22cm height and 9cm width. Shaped with tongue and grooves on their sides with a 45 degree angle cut at each corner, enabling to fit the *diamond key* perpendicularly to the surface of the wall.

The study of the shear wall was done by performing both full scale cyclic shear tests and finite elements method analysis. The mechanical properties of the materials were obtained using Digital Image Correlation (DIC) [6] in combination with the single cube method, rosette strain gauges and the model of Guitard for resinous trees [7]. Two sample configurations (1P (91cm length x 273cm height) and 2P (182 x 273cm)) were tested with a full scale cyclic shear test, with and without keys. The strength of 2P was 1.71 times higher than that of 1P. The stiffness of 2P was 6 times higher than 1P. Comparing samples with and without keys, 1P+keys presented 1.5 times higher stiffness than 1P-keys, and 2P+keys presented 2.6 times higher stiffness than 2P-keys. The monotonic shear test showed a displacement difference of +1.13mm with respect to the FEM analysis, and +1.94mm with respect to the proposed mechanical model when applying the yielding load. The displacement difference between the FEM for the cyclic shear test and the experimental one was +0.24mm in the elastic zone. This study showed the interest of this innovative and sustainable shear wall. Its efficiency in terms of stiffness have has been successfully tested using experiments and numerical methods.

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