hardwood_joint

Project objectives
Foster high-performance hardwood structures by developing economic, reliable and innovative joint technologies for hardwood members and the design thereof.

Tasks
(1) Joints with staples and nails
(2) Joints with axially loaded screws
(3) Joints with laterally loaded fasteners
(4) Joints with shallow grooves
(5) Modelling of joints

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hardwood_joint – innovative joints in hardwoods

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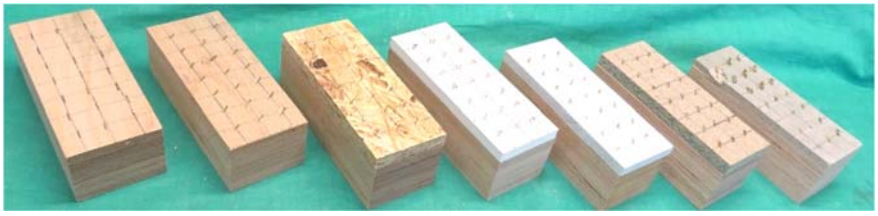
Partners:

Innovative joints in hardwoods

(1) Joints with staples and nails

The objective of the project is to thoroughly deepen the understanding of compounds for hardwood constructions, enabling a wider use of hardwood products in the construction sector. According to Eurocode 5, staples and nails may only be used with predrilling in structural members with a density larger than 500 kg/m³. This restricts their use considerably. In order to verify the manufacturability of joints with staples and nails in hardwood, a simple and easy-to-interpret test protocol was developed. Its aim is to assess which staples and nails can be inserted into hardwood without causing damage to the fastener, the wood or the wood products. OSB boards and gypsum fibre boards were investigated as wood products, as these are most used as sheathing in building construction. The study also included chipboard, gypsum board, cement-bonded chipboard and thin steel plates.



If a fastener can be inserted into beech LVL, then it can also be inserted into other wood species with a lower density (e.g. birch glulam), provided that these species do not have any wood imperfections. Wood imperfections such as knots, pith and heartwood can bend the shanks of the fasteners so that they do not enter straight into the wood but protrude sideways. The two most important factors that influence the feasibility of a connection with staples and nails are the length and diameter of the fasteners. Generally, staples and nails should not be longer than 50 mm (ringed shank nails with a diameter of 4mm not longer than 40 mm), and in addition, obtuse nail tips are favourable for insertion. Once the feasibility of staple and nail insertion is assessed, existing design rules can be applied as was shown by an extensive testing series (on hardwood joints with OSB and gypsum fibreboard sheathing and steel-to-hardwood joints). Ductile failure modes with two plastic hinges per shear plane were observed, where fastener spacing must be larger for gypsum fibreboards to avoid board failures.