Influence of Fibre Angle on Beech Finger-jointed Lamellas for Tensile Strength

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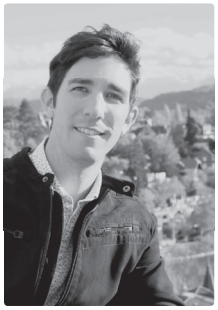
The need for renewable materials to replace the polluting contemporary ones is influencing wood industry for improvement. Research on non-traditional species for structural purposes has been done. Fagus Sylvatica represents a potential for glulam production. Finger joint connections on glulam beams, as well as fibre angle influence, are the inducement of this present study for further understunding on beech wood capabilities.

The construction industry is based on 3 main materials, concrete a compression holder material, steel a more tensional versatile material and finally wood as the multifunctional material with compression and tensional strength capacities. Throughout history, wood and cement/clay materials dominated construction solutions for societies. A condition that changed with the industrial revolution, was when steel overcame wood, due to several factors such as fire resistance, durability and limited technology for a wood solution at the time.
Later at the end of the XX century and the beginning of XXI, wood reappears as a renewable material, which can solve emissions originated from the construction industry. The implementation of technologies, such as adhesives for glulam production or finger-joint for connections between single lamellas, opened and broadened the possibilities of using timber as a material for industrial construction. Although timber is not a discovery, nor a new material, its use has been associated with tendencies or market access. Conditions which nowadays are no limitations anymore. Products such as glulam appear as the most versatile solution, with fair mechanical capacities, being able to replace steel or even concrete for compression stresses. The capacity of wood is narrowed down to only cross-sections and strong lamella-lamella connections, such as finger-joint. Hence, allowing timber design to expand and replace the use of other construction materials.
In the present thesis study, research on the mechanical properties of wood is taken further. Investigating capabilities from a non-conventional species, for structural purposes. Fagus sylvatica known as European Beech in English is widespread across Europe and has been used as thermic generation material and furniture since ancient times, thus not for structural use. This present work aims to analyse Beech capacities for structural purposes, therefore, tensile strength tests were being developed, as well as resistance influencing factors.
The effect of knots, the slope of the grain and ageing (regarding curing time) are investigated.
In partnership with an industry partner, 248 single finger-jointed lamellas (GL 48 categorized) were analysed and tested to prove 2 of the main objectives, regarding finger-joint connections. Furthermore, 73 (GL48) extra finger-jointed glulam beams were produced to compare resistance when volumetric influence is included in the equation.
Results from the present research work, comprehend an extra step to understand beech timber and its capacities, such as improvements over 30% in terms of resistance after ageing periods. Categorization of fibre angle influence, and improve industry knowledge for new technology development regarding volume (on cross-section) influence for glulam production.



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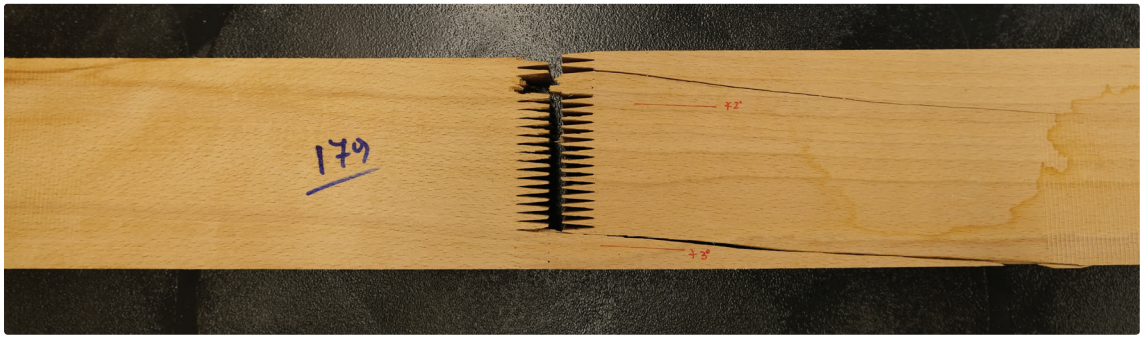

Presence of fibre angle on finger-jointed beech lamella