INDUSTRIALIZATION AS AN ALLY FOR TIMBER STRUCTURES

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Abstract

The prefabricated construction method inherits concepts that integrate environmental aspects in the product development process, hence holding potential to reduce negative environmental impact across its life cycle stages. Through modular design and dry production (Lean Construction), a wide array of sustainability goals can be achieved. By promoting the update, adaptation, and modification of components for extended lifespan and influencing component disassembly, prefabrication leads to a reduction in the environmental impact of industry.

Building modular structures with timber in contemporary standards represents a pioneering effort enabled by innovations in the timber industry, both at the product and process levels. The introduction of Engineered Wood Products (EWPs), such as glued laminated timber (glulam), laminated veneer lumber (LVL), and cross laminated timber (CLT), has optimized the structural properties of wood, surpassing many of its limitations. This reinvention has propelled the industry by offering products with high stability, stiffness, and competitive mechanical properties compared to concrete and steel.

Simultaneously, the advancement of digital design and production technology employing Computer-Aided Engineering (CAE), Computer-Aided Design (CAD), Computer-Aided Manufacturing (CAM), combined with Computer Numeric Control (CNC) processing, and the integrated application of various specialties within the Building Information Modelling (BIM) methodology, has elevated the precision and quality of wood products.

The use of structural timber in modular construction has proven successful in various European countries such as Sweden, Austria, France, Germany, among others, showcasing the manifold possibilities of timber and its technologies. This has reinstated confidence in the material, as depicted by the increasing interest in such projects.

Some of the tallest examples in Europe affirm the material's capabilities and potential, even for complex and impressive structures. For instance, the Treet, a truss structure made of glulam by Artec, in which prefabricated modular rooms with a timber structure were installed, which reached 14 floors, in Bergen, Norway. Additionally, the Mjøstårnet building, standing at 18 floors and 85.4 meters intended for various uses, located in Brumunddal, and the HoHo hybrid residential-commercial project comprising wood and concrete, spanning 24 floors and 84 meters in Vienna, further exemplify the versatility and capacity of timber for such significant and multifunctional structures.

Prefabrication represents a unique opportunity for timber-based solutions to lead the transformation of the high consumption, high-waste, and labour-intensive construction sector towards a more industrialized and sustainable approach. However, despite continuous

advancements in materials, prefabrication technologies, and assembly methods, the design and installation procedures of multi-story timber buildings still lag the technological progress observed in other construction materials.

About the Author

Jorge Branco is Assistant Professor in the Department of Civil Engineering, University of Minho, Portugal, where he has been developing research in the field of timber constructions.

Jorge Branco is experienced in the fields of timber structures, from wood and wood–based products characterization, design of connections, to the diagnosis and strengthening of timber elements and joints. The robustness and resilience of timber structures, in particular, the ones located in seismic regions, are one of his research topic.

Jorge Branco is Chair of the RILEM Technical Committee 310-TPT: Tests methods for a reliable characterization of resistance, stiffness and deformation properties of timber joints, member of the WG8 for the seismic performance of timber structures and member of the Portuguese standardization committee CT14.