RELEVANCE of STAR 245-RTE

RILEM has a long history of Technical Committees working on subjects related to timber. The first one was in the very early days of RILEM, namely TC 003-TT: *Testing methods of timber*. Many more TCs followed after that one. In 2011, Dr Jorge Branco and Dr Philip Dietsch set up TC 245-RTE: *Reinforcement of Timber Elements in Existing Structures.* The establishment of this TC was triggered by the significant widening in the range of structural applications of timber over the past decades on one side, and, on the other side, by the acknowledgement of the need for the maintenance and upgrading of existing buildings for economic, environmental, historical and social concerns. The State-of-the-Art Report of RILEM TC 245-RTE *Reinforcement of Timber Elements in Existing Structures,* edited by J. Branco, P. Dietsch and T. Tannert was published in April 2021.

STAR in a nutshell 245-RTE
"Reinforcement of Timber Elements in Existing Structures"

Existing timber structures, and their reinforcement, need continuous assessment for motivations such as change of use, upgrade to better seismic performance, extreme events and/or poor maintenance that might damage them. The existing design standards and building codes lack rules and guidelines on this matter. Nevertheless, the practice of reinforcing structural timber systems can be considered a common one as there are plenty of existing techniques that are adopted and put into practice everyday around the world.

TC 245-RTE: *Reinforcement of Timber Elements in Existing Structures* was established in 2011 with the aim of reviewing the existing reinforcement practices, highlighting their limitations, and suggesting their improvements. This work was carried out over 8 years by 16 RILEM members and 1 contributor, from all over the world. A particular emphasis was given to the work done by the standardization committee responsible for drafting the European Timber Design standard, Working Group 7 "*Reinforcement*", of Eurocode 5, CEN/TC 250/SC 5. In 2021, the TC members released the State-of-the-Art Report of RILEM TC 245-RTE *Reinforcement of Timber Elements in Existing Structures.*

Part I of this document presents the currently available tools to reinforce existing timber structures: self-tapping screws, glued in rods, fibre-reinforcement polymers, and nanotechnology. For each of these reinforcement methods, their properties are reviewed together with the design approaches, the areas of application, the surface preparation procedures, and the factors that will affect their performance, like timber creep, shrinkage, and moisture content, to mention a few.

In Part II of this document, several applications of reinforcement are discussed. These include traditional structures, traditional timber frame walls, light-frame shear walls, roofs, floors, and carpentry joints.

One chapter is dedicated to the seismic reinforcement of traditional timber structures. Examples of successful and catastrophic past interventions are used to identify effective and economical strengthening solutions.

Still with a focus on their seismic performance, also timber frame walls are analysed. Their performance under horizontal actions, and the reinforcement of their joints, are crucial when these walls are used as shear walls.

Light frame wood lateral structural systems, very common in North America, are susceptible to collapse during an earthquake, as many of the modern existing buildings were designed before the introduction of seismic building codes. Conventional and novel retrofit solutions are discussed to improve the seismic behaviour of these systems.

The retrofitting techniques used on historic timber roofs are also the subject of an extensive review that highlights how critical the phase of the assessment of the state of the timber system and elements is, as well as the need of using reinforcements that are compatible with the intervention.

Timber floors are found in historic and modern structures and retrofitting them is a very active area of research. They cannot be analysed as isolated elements as they are part of a more complex system made of their supports and connections with vertical elements.

The reinforcement of traditional timber carpentry is discussed in the last chapter of this document. Their failure mechanisms, such as compressive crushing, shear and tensile cracks, are presented in the context of reinforcing methods.