Analysis of impact of adhesive types and bonding mistakes on glued-in-rod connections for timber structures

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Objectives / Description / Main outcomes

Glued-in rods (GiR) are one of the structural bonding connection type used for new timber structures and rehabilitation of existing timber structural members. Such connections make the transfer of loads within timber elements possible, especially when it comes to modern construction which requires the transfer of larger forces and new solutions in environmentally friendly construction.

The use and the design of glued-in rod joints is implemented in the European pre-standards, which specify the modification factors for accumulated duration of load in different climates (service classes), k_{mod}, irrespective of the adhesive type. In this study, tests of connections with bonded-in rod in different humid climates revealed significant strength and slip differences between different adhesives. Bonding effect was investigated with two different adhesive types, being a two-component polyurethane (LOCTITE PUREBOND CR 821) and a two-component epoxy (KGK EPOCON '88). Siberian larch (*Larix sibirica*) wood was used with moisture content between 9%, 18% and 27%.

In this study, an experimental campaign performed on eighty-four glued-in-rod connections allowed the accurate calibration of analytical model of such connection under different moisture content. The investigations revealed, as anticipated, significant differences of the mechanical behaviour of glued-in-rod connections with different adhesives when exposed to wet climate. The test set-up and use of DIC system, in particular, helped to get empiric results. The experimental study exhibits a failure of the connection in the wood in the vicinity of the wood-adhesive interface. Thus, a study of the stress field along this inter-face was performed from the model. Rheological behaviour indicates that, on the reliability side, special attention should be paid to joints exposed to extreme climatic conditions.

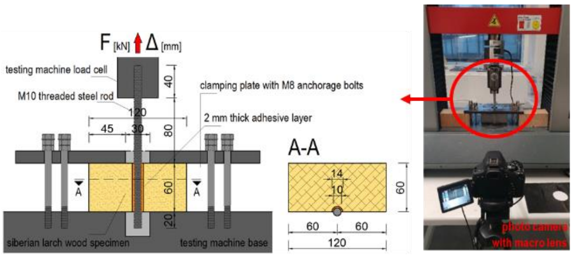

Figure 1: *Test set-up*

Figure 2: *Characteristic shear strain distribution obtained by DIC system*

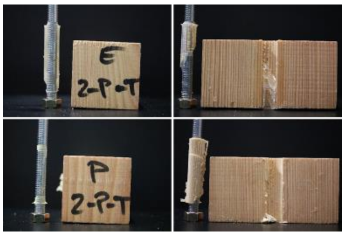

Figure 3: *Tested samples - epoxy (higher) and polyurethane (lower)*

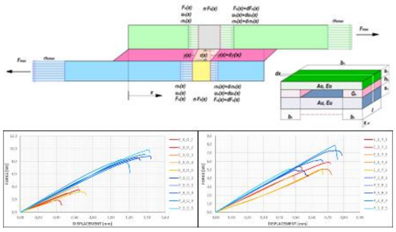

Figure 4: *Force transmission and deformation behaviour model*

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