FE Modelling of Notched Connections for Timber-Concrete Composite Structures

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Summary:

Notched connections are extensively used in timber-concrete (TC) composite beams and floors. Their main advantage is a significantly higher shear strength and stiffness compared to mechanical fasteners. Several mechanical and geometrical aspects, however, should be properly taken into account for design optimization of notched connections, as they strongly affect their structural performance and the corresponding failure mechanisms. In this paper, a preliminary Finite-Element (FE) numerical investigation is carried out by means of full 3D numerical models. The mechanical behaviour of each connection component (e.g. the reinforced concrete topping, the steel coach screw, the timber beam) is properly implemented. Shear or crushing failure mechanisms in the concrete, possible plasticization of the coach screw, as well as longitudinal shear or tension perpendicular to the grain failure mechanisms in the timber beam are taken into account using cohesive elements, damage material constitutive laws and appropriate surface-tosurface interactions. The results of parametric FE studies are compared to experimental data derived from literature, as well as to the results of simplified analytical models, demonstrating that the FE model is capable to capture the experimental behaviour of the connection including the failure mechanisms.

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