Enhancing performance of timber-concrete composite floors by a dovetail splice joint

Title of the dissertation
Dovetail splice joint - a continuity connection for two-way timber-concrete composite plates

Contents of the dissertation
In modern timber construction, demand for long spans and light structures has led to floor serviceability issues. One solution is to design the floors as timber-concrete composite (TCC) structures, characterized by, for example, high stiffness. Recently, interest in two-way TCC plates has arisen due to potential for even higher stiffness and a larger freedom of support placement. The two-way plates can be fabricated by using cross-bonded wood panels. However, a stiff connection between timber panels is essential for effective two-way systems. In this thesis, a new stiff connection, a dovetail splice joint, that requires no use of steel or gluing, is proposed.

The main aims of the work were to investigate the mechanical behaviour of the new dovetail splice joint and its performance as a lateral continuity connection in two-way LVL-concrete composite floors. The research consisted of three main parts: (i) investigations of the shear behaviour of timber-concrete contacts and development of a related contact model, (ii) investigations of the behaviour of the dovetail splice joint under axial in-plane loads and (iii) investigations of the performance of two-way TCC floor plates with the dovetail splice joint. Methodologically, the work combines experiments and numerical modelling.

The results indicate that the joint can achieve a high stiffness, making it applicable for the intended purpose. Based on the experimental and numerical results, the jointed timber panels in a TCC plate could be treated as a continuous layer.

Field of the dissertation
Civil Engineering

Doctoral candidate
Joonas Jaaranen, M.Sc. (Tech.), born in 1983 in Savonlinna, Finland

Time of the defence
10 June 2022 at 13:00 hours

Place of the defence
Aalto University School of Engineering, Otakaari 1, 02150 Espoo, Finland, lecture hall M1

Opponent
Professor Stefan Winter, Technical University of Munich, Germany

Supervisor
Professor Gerhard Fink, School of Engineering, Aalto University, Finland

Electronic dissertation
https://aaltodoc.aalto.fi/handle/123456789/114151

Doctoral candidate’s contact information
Joonas Jaaranen, Aalto University, joonas.jaaranen@aalto.fi, phone +358 40 583 9018