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Stress-laminated timber decks in bridges: Friction between lamellas, butt joints and pre-stressing system

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Summary:

Stress-laminated timber (SLT) decks in bridges are popular structural systems in bridge engineering. SLT decks are made from parallel timber beams placed side by side and pre-stressed together by means of steel rods. SLT decks can be in any length by just using displaced butt joints. The paper presents results from friction experiments performed in both grain and transverse direction with different levels of pre-stress. Numerical simulations of these experiments in addition to comparisons to full-scale experiments of SLT decks presented in literature verified the numerical model approach. Furthermore, several alternative SLT deck configurations with different amounts of butt joints and pre-stressing rod locations were modelled to study their influence on the structural properties of SLT decks. Finally, some recommendations on design of SLT bridge decks are given.

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Withdrawal of Pairs of Threaded Rods with Small Edge Distances and Spacings

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Summary:

An experimental investigation on withdrawal of pairs of screwed-in threaded rods embedded in glued-laminated timber elements is presented in this paper. Specimens with varying angles between the rod axis and the grain direction (a = 15°, 30°, 60°, 90°) and 2 different configurations with respect to edge distances and spacings were tested. The diameter and the embedment length of the rods were 20 and 450 mm, respectively. The threaded rods were embedded in a row perpendicular to the plain of the grain. The edge distances and spacings were smaller than the minimum requirements according to Eurocode 5. The withdrawal capacity of pairs of rods was compared to the withdrawal capacity of single rods and the effective number, n ef , was found to be in the range 1.72–1.94, despite the small edge distances and spacings. Based on the experimental results obtained, a simple approximating expression was derived for n ef . An analytical model based on Volkersen theory with an idealized bi-linear constitutive relationship was used to estimate the withdrawal capacity and stiffness. The analytical estimations were in good agreement with the experimental results. Finally, the withdrawal stiffness was estimated by use of finite element simulations. The numerical estimations for the withdrawal stiffness were also in good agreement with the experimental results.

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