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FLEXURAL BEHAVIOUR OF GLULAM BEAMS FROM NOVEL SANDWICH PANELS

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Abstract. *This paper presents the flexural behavior of glue-laminated fibre composite sandwich beams for structural application. The building block of this innovative beam is a new generation composite sandwich structure made up of glass fibre reinforced polymer skins and high strength phenolic core material. The sandwich beam was fabricated by gluing layers of 18 mm thick composite sandwich panels in the flatwise, edgewise and a combination of flatwise/edgewise sandwich laminations to form a 150 mm deep x 230 mm wide beam section. Four-point static bending test was conducted to evaluate the stiffness and strength of the full-scale glue-laminated sandwich beams. The effects of the orientation of sandwich laminations and wrapping with one layer of glass fibres on the strength and failure behaviour of the glue-laminated composite sandwich beams were examined. The mechanical properties of the glued sandwich beams are then analyzed in the context of its potential application for a replacement railway turnout timber sleeper.*

The orientation of sandwich laminations has a significant effect on the structural behaviour of full-scale glue-laminated composite sandwich beams. The glued sandwich beams with laminations in the edgewise position showed the most efficient section in terms of strength and stiffness among the investigated sandwich beam configurations. Gluing the sandwich beams in the edgewise position could offer up to 25% increase in flexural strength, a similar bending stiffness and an almost double the shear strength than the other sandwich beam configurations. Moreover, this composite sandwich beam provides for a ductile failure due to the progressive failure of the vertical fibre composite skins.

The glue-laminated composite sandwich beams presented appropriate strength and stiffness for replacement turnout timber sleeper. The mechanical properties of this glued sandwich beams are far better than most of the available composite railway sleepers and are comparable with the existing timber turnout sleepers demonstrating that the innovative

sandwich beam is a viable alternative sleeper material.

While this study showed the great potential of glue-laminated composite sandwich structures for a replacement railway turnout sleeper, the results of this study contributed to a better understanding of the behaviour of fibre composite sandwich structures for the assessment of the material in future civil engineering applications.