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Effect of grain orientation on the CFRP-to-LVL bond

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Abstract

In recent years, carbon fibre reinforced polymer (CFRP) was found to be an effective technique to strengthen or retrofit timber beams. One of the timber sub-products, laminated veneer lumber (LVL), has two different surfaces (laminate and grain face) in the direction of its grain on which CFRP is usually applied in order to increase its flexural strength. To enhance the shear strength of an LVL, CFRP is applied in the direction perpendicular to the LVL grain. In this study, the application of CFRP on different surfaces and grain directions of an LVL is analysed experimentally and theoretically. For the theoretical interpretation, the values related to the parameters that incorporate the effect of surface and grain direction are proposed and verified. Moreover, maximum bond strength, fracture energy and bond stiffness are determined to assess the bond strength between these two materials.

Keywords: A. Carbon fibre, A. Wood, B .Interface, C. Analytical modelling

1 Introduction

Timber is one of the most commonly used material in civil construction. A number of timber products have been developed in recent times to enhance the structural properties of timber materials from its natural defects, knots, etc. This includes, laminated veneer lumber (LVL), glue laminated timber (glulam) and cross-laminated timber (CLT). Although the strength of these products are comparable to concrete or steel to some extent, they suffer from few limitations. For instance, for multi-storey building or large span structures, it is required to have smaller cross-section for economical and handling purposes whereas timber's cross-sections are usually large. Accordingly, various studies reported on the use of different lightweight high strength composites, such as, carbon fibre reinforced polymer (CFRP) [1-5], glass fibre reinforced polymer (GFRP) [6-8], basalt FRP [9-12]

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