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# A new concrete-glulam prefabricated composite wall system: thermal behaviour, life cycle assessment and structural response

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## Abstract

This study analyses a new hybrid construction system, the CGFP - Concrete Glulam Framed Panel - that merges the two mostly used materials in frame technology. It is a prefabricated composite wall made of a reinforced concrete slab and a glulam frame.

The strength and stiffness of CGFP have been investigated by load-displacements tests and thermal performance was evaluated by means of a hot-box apparatus. Moreover, the environmental impacts of the system are verified defining its Carbon Footprint and Embodied Energy.

The efficacy of the proposed system was validated by experimental and numerical analysis. Mechanical and thermal properties have been evaluated by means of experimental and numerical tests whose results have been compared showing a good agreement. By structural point of view, the strength and the deformation capacity are ensured through the consecutive and interactive structural response between the wood frame and the concrete slab. By the thermal and environmental point of view, thermal resistance obtained with different kind of insulation materials have been analysed and a calculation of the amount of the Carbon Footprint and Embodied Energy was already performed.

The CGFP panel shows a good thermal performance, a low environmental impact respect to similar construction systems and promising structural behaviour.

Keywords: Timber-concrete composite (TCC); Structural behaviour; Thermal behaviour; Life Cycle Assessment (LCA); Prefabrication

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## 1. Introduction

The wood construction system is still one of the best technologies for building, in terms of sustainability, thermal behavior and structural performance. Traditionally in Europe the wood material has been coupled with brickwork or stone. The use of wood was related to the improvement of seismic performance of masonry buildings [1].

This study proposes a new hybrid construction system, the CGFP (Concrete Glulam Framed Panel) that merges the experiences of the two mostly used materials in frame technology, wood and

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