



Environmental Performances of a Timber-Concrete Prefabricated Composite Wall System

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Material: CLT (Cross-Laminated Timber)
 Glulam (Glue-Laminated Timber)
 Timber-Concrete Composite

Application: Walls

Topic: Environmental Impact

Keywords: Concrete Glulam Framed Panel
 Embodied Energy
 Carbon Footprint
 Cradle-to-Gate
 Prefabrication
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Summary:

The improvement of environmental performance in building construction could be achieved by prefabrication. This study quantifies and compares the environmental impacts of a Concrete Glulam Framed Panel (CGFP): the basic configuration of this precast component consists in a Cross-Laminated Timber (CLT) frame structure supporting a thin reinforced concrete slab with an interior insulation panel and covered by finishing layers. The research investigates also alternative design of configuration with the substitution of different insulation materials in order to minimize the Embodied Energy and Carbon Footprint values.

The boundary of the quantitative analysis is “cradle to gate” including the structural support system; an IMPACT 2002+ characterization methodology is employed to translate inventory flows into impacts indicators.

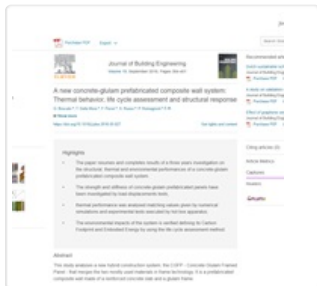
Results present very low values for carbon footprint (60.63 kg CO₂eq m⁻²) and the embodied energy values (919.44 MJ m⁻²) indicate this hybrid precast structure as a valid alternative building constructions and processes.

A detailed discussion of the outputs is presented, including the comparison of the environmental performances depending on different insulation materials.

Online Access: Free

Resource Link

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A New Concrete-Glulam Prefabricated Composite Wall System: Thermal Behavior, Life Cycle Assessment and Structural Response

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Format: Journal Article

Material: Glulam (Glue-Laminated Timber)

Application: Walls

Topic: Mechanical Properties
Environmental Impact

Keywords: Strength
Stiffness
Concrete Glulam Framed Panel
Thermal Behaviour
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Life-Cycle Assessment

Language: English

Research Status: Complete

Series: Journal of Building Engineering

Summary:

In a former paper by the authors [1], the elastic behavior of Cross Laminated Timber (CLT) and timber panels having periodic gaps between lateral lamellae has been analyzed. A thick plate homogenization scheme based on Finite Elements computations has been applied. The predicted behavior was in agreement with experimental results. In this paper, simplified closed-form solutions are derived in order to avoid FE modeling. Both cases of narrow gaps of CLT panels and wide gaps of innovative lightweight panels are investigated. CLT and timber panels with gaps are modeled as a space frame of beams connected with wooden blocks. The contribution of both beams and blocks to the panel's mechanical response is taken into account, leading to closed-form expressions for predicting the panel's stiffnesses and maximum longitudinal and rolling shear stresses. The derived closed-form solutions are in agreement with the reference FE results and they can be used for practical design purposes.

Online Access: Free

Resource Link

https://www.researchgate.net/profile/Fabio_Peron/publication/325406428_A_new_concrete-glulam_prefabricated_composite_wall_system_Thermal_behavior_life_cycle_assessment_and_structural_response/links/5c7c0647299bf1268d363649/A-new-concrete-glulam-prefabricated-composite-wall-system-Thermal-behavior-life-cycle-assessment-and-structural-response.pdf