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Structural Behaviour of Hybrid Timber-Steel Diagrid Systems for Tall Buildings in Conakry, Guinea

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ABSTRACT

Background: The development of sustainable, resilient tall buildings in West African coastal cities presents unique challenges due to high wind loads and material availability. Diagrid systems offer efficient lateral load resistance, but their application with hybrid materials in this specific context is underexplored.

Purpose and objectives: This study investigates the structural performance and feasibility of a hybrid timber-steel diagrid system tailored for the seismic and wind conditions of Conakry. The primary objective is to quantify the system's lateral stiffness, strength, and material efficiency compared to conventional steel-only diagrids.

Keywords: *Hybrid structures, Diagrid systems, Tall buildings, Wind engineering, West Africa, Structural optimisation, Timber-steel composites*

Article Highlights

- Hybrid timber-steel diagrids offer a 40% reduction in embodied carbon for tall buildings.
- Parametric FE modelling reveals a positive link between timber proportion and drift performance.
- System maintains competitive lateral stiffness (85% of steel-only) under Conakry's wind loads.
- Connection detailing between materials is identified as the critical design challenge.

Methodological Note

Performance was evaluated via non-linear static analysis of a 30-storey prototype, with efficiency quantified using a regression model of the timber-to-total area ratio.

This study presents a viable structural alternative for sustainable high-rise construction in West African coastal cities.