Proposal of Analytical Model for the Seismic Performance Evaluation of Reinforced Concrete Frames with Coupled Cross-laminated Timber Infill Panels

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Abstract : The utilization of new materials as an alternative solution to decrease the environmental impact of the construction industry has been gaining more relevance in the architectural design and construction industry. One such material is cross-laminated timber (CLT), an engineered timber solution that excels for its faster construction times, workability, lightweight, and capacity for carbon storage. This material is usually used alone for the entire structure or combined with steel frames, but a hybrid with reinforced concrete (RC) is rarer. Since RC is one of the most used materials worldwide, a hybrid with CLT would allow further utilization of the latter, and in the process, it would help reduce the environmental impact of RC construction to achieve a sustainable society, but first, the structural performance of such hybrids must be understood. This paper focuses on proposing a model to predict the seismic performance of RC frames with CLT panels as infills. A series of static horizontal cyclic loading experiments were conducted on two 40% scale specimens of reinforced concrete frames with and without CLT panels at Osaka University, Japan. An analytical model was created to simulate the seismic performance of the RC frame with CLT infill based on the experimental results. The proposed model was verified by comparing the experimental and analytical results, showing that the load-deformation relationship and the failure mechanism agreed well with limited error. Hence, the proposed analytical model can be implemented for the seismic performance evaluation of the RC frames with CLT infill.

Keywords : analytical model, multi spring, performance evaluation, reinforced concrete, rocking mechanism, wooden wall

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