

## Structural Assessment of Low-Rise Reinforced Concrete Frames under Tsunami Loads

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**Abstract :** This study examines the effect of tsunami loads on reinforced concrete (RC) frame buildings analytically. The impact of tsunami wave loads and waterborne objects are analyzed using a typical substandard full-scale two-story RC frame building tested as part of the EU-funded Ecoleader project. The building was subjected to shake table tests in bare condition and subsequently strengthened using Carbon Fiber Reinforced Polymers (CFRP) composites and retested. Numerical models of the building in both bare and CFRP-strengthened conditions are calibrated in DRAIN-3DX software to match the test results. To investigate the response of wave loads and impact forces, the numerical models are subjected to nonlinear dynamic analyses using force-time history input records. The analytical results are compared in terms of displacements at the floors and the 'impact point' of a boat. The results show that the roof displacement of the CFRP-strengthened building reduced by 63% when compared to the bare building. The results also indicate that strengthening only the mid-height of the impact column using CFRP is more efficient at reducing damage when compared to strengthening other parts of the column. Alternative solutions to mitigate damage due to tsunami loads are suggested.

**Keywords :** tsunami loads, hydrodynamic load, impact load, waterborne objects, RC buildings

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