

SHAKING TABLE TESTS OF A 2-STOREY R.C. BUILDING WITH FIBER-REINFORCED ELASTOMERIC ISOLATORS

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Abstract

The Turkey-Syria earthquake on February 6, 2023, reaffirmed that residential buildings in less developed countries exhibit higher vulnerability, resulting in disproportionate fatalities compared to those in developed countries. Due to the well-known effectiveness of base isolation in seismic risk mitigation, recent decades have seen concerted research efforts to drastically reduce the cost of isolation units, making them affordable for housing projects. In this context, fiber-reinforced elastomeric isolators (FREIs) emerged as a promising option to reduce both the cost and weight of rubber bearings by replacing the steel shims conventionally used in laminated bearings with fiber mesh fabric. Although a number of previous studies explored the mechanical behavior and the design process of FREIs, showcasing their effectiveness, experimental validation on a full-scale prototype building subjected to tri-directional excitation remained elusive, thus hindering further development and real-world application.

The project ERIES-FREISUST (Fiber-Reinforced Elastomeric Isolators for seismic resilient structures with SUSTainable Solutions) aims to demonstrate the reliability of FREIs in limiting damage to structural and nonstructural components and contents. Two FREI systems were designed for a 2-story reinforced concrete infilled frame, differing in standardization and cost levels, namely a Virgin-rubber Carbon-fiber FREI (VC-FREI) and a Reclaimed-rubber Polyester-fiber FREI (RP-FREI). These isolation systems were installed in an unbonded configuration at the base of the prototype building and tested at the ST3D shaking table facility of Laboratório Nacional de Engenharia Civil (LNEC), Lisbon, Portugal. This paper reports the preliminary results of the experimental investigation on the base isolated prototype subjected to 3D shaking table tests. The novel base-isolation systems demonstrated lateral stability and re-centering capability, as well as adequate vertical stiffness and load-bearing capacity under different loading conditions.