15th World Congress on Computational Mechanics (WCCM-XV)
8th Asian Pacific Congress on Computational Mechanics (APCOM-VIII)
31 July – 5 August 2022, Yokohama, Japan

Unbonded Fiber Reinforced Elastomeric Isolators (UFREIs) made of high damping natural rubber blends

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Key Words: *Seismic isolation, Unbonded fiber reinforced elastomeric isolator (UFREI), High Damping Rubber, Finite Element analysis, nonlinear dynamic analysis.*

In the last four decades, some commercial base isolators have been introduced to protect buildings from vibration and earthquakes. Typically, they are constituted by several alternating layers of rubber pads and steel interposed by two continuous pads, having the role of limiting vertical deformability. At the same time, they exhibit good deformation capacity in the horizontal direction when subjected to a seismic load. A very effective seismic isolator shall satisfy the following functions: good performance under all service loads, vertical and horizontal; provide enough horizontal flexibility to reach the target natural period for the isolated structure; recentering capability after the ground motion, so that no residual horizontal displacement can downgrade the serviceability of the structure; provide an adequate level of energy dissipation (damping) to control the displacement that could damage other structural members. Steel-reinforced elastomeric isolators (SREIs) is the most used method of seismic isolation. Since these devices are generally too expensive due to the need to introduce thick steel plates for their supports and the high energy consumed for the manufacturing process, they are not suitable for ordinary residential buildings, especially in developing countries. Compared with SREIs, fiber-reinforced elastomeric isolators (FREIs) have considerably lower weight and can be manufactured through cold vulcanization [1][2]. They could be installed between the structure in elevation and the foundation without any bonding or fastening in the so called unbonded application (UFREI), reducing costs hugely [3][4][5][6]. Furthermore, without steel supports, the shear load is transferred through the friction generated between the isolator and the structure surfaces, improving the dissipation energy of the devices. The main feature of such a UFREIs is the large deformability thanks to the roll-over deformation and the favorably lower lateral stiffness compared to the bonded isolator [7]. In this paper, a series of experimental tests and numerical analyses have been performed to investigate the seismic behavior of UFREIs made of high damping rubbers (HDR) combined with glass fiber reinforcement. In particular, two HDR have been considered. The first one consists of a Natural Rubber and Bromobutyl (NR-BIIR) blend. Instead, the second one is constituted of a NR and Ethylene Propylene Diene Monomer (NR-EPDM) blend. Results obtained from FE cyclic shear tests analysis and nonlinear time history analyses of structural application have shown that the devices are suitable to isolate low-rise masonry buildings properly.

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