Seismic Isolation of Existing Masonry Buildings: Recent Case Studies in Italy

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Abstract : Seismic retrofit of buildings through base isolation represents a consolidated protection strategy against earthquakes. It consists in decoupling the ground motion from that of the structure and introducing anti-seismic devices at the base of the building, characterized by high horizontal flexibility and medium/high dissipative capacity. This allows to protect structural elements and to limit damages to non-structural ones. For these reasons, full functionality is guaranteed after an earthquake event. Base isolation is applied extensively to both new and existing buildings. For the latter, it usually does not require any interruption of the structure use and occupants evacuation, a special advantage for strategic buildings such as schools, hospitals, and military buildings. This paper describes the application of seismic isolation to three existing masonry buildings in Italy: Villa “La Maddalena” in Macerata (Marche region), “Giacomo Matteotti” and “Plinio Il Giovane” school buildings in Perugia (Umbria region). The seismic hazard of the sites is characterized by a Peak Ground Acceleration (PGA) of 0.213g-0.287g for the Life Safety Limit State and between 0.271g-0.359g for the Collapse Limit State. All the buildings are isolated with a combination of free sliders type TETRON® CD with confined elastomeric disk and anti-seismic rubber isolators type ISOSISM® HDRB to reduce the eccentricity between the center of mass and stiffness, thus limiting torsional effects during a seismic event. The isolation systems are designed to lengthen the original period of vibration (i.e., without isolators) by at least three times and to guarantee medium/high levels of energy dissipation capacity (equivalent viscous damping between 12.5% and 16%). This allows the structures to resist 100% of the seismic design action. This article shows the performances of the supplied anti-seismic devices with particular attention to the experimental dynamic response. Finally, a special focus is given to the main site activities required to isolate a masonry building.

Keywords : retrofit, masonry buildings, seismic isolation, energy dissipation, anti-seismic devices
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