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Seismic Retrofit of Reinforced Concrete Structures by Highly Dissipative Technologies

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Abstract : The prolonged earthquake sequence that struck several urban agglomerations and villages in Central Italy, starting from 24 August 2016 through January 2017, highlighted once again the seismic vulnerability of pre-normative reinforced concrete (R/C) structures. At the same time, considerable damages were surveyed in recently retrofitted R/C buildings too, one of which also by means of a dissipative bracing system. The solution adopted for the latter did not expressly take into account the performance of non-structural elements, and namely of infills and partitions, confirming the importance of their dynamic interaction with the structural skeleton. Based on this consideration, an alternative supplemental damping-based retrofit solution for this representative building, i.e., a school with an R/C structure situated in the municipality of Norcia, is examined in this paper. It consists of the incorporation of dissipative braces equipped with pressurized silicone fluid viscous (FV) dampers, instead of the BRAD system installed in the building, the delayed activation of which -caused by the high stiffness of the constituting metallic dampers- determined the observed non-structural damages. Indeed, the alternative solution proposed herein, characterized by dissipaters with mainly damping mechanical properties, guarantees an earlier activation of the protective system. A careful assessment analysis, preliminarily carried out to simulate and check the case study building performance in originally BRAD-retrofitted conditions, confirms that the interstorey drift demand related to the Norcia earthquake's mainshock and aftershocks is beyond the response capacity of infills. The verification analyses developed on the R/C structure, including the FV-damped braces, highlight their higher performance, giving rise to a completely undamaged response both of structural and non-structural elements up to the basic design earthquake normative level of seismic action.

Keywords : dissipative technologies, performance assessment analysis, concrete structures, seismic retrofit
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