Condition Assessment and Enhancing Seismic Resilience of an Existing Masonry Building in a Bradyseismic Region

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Abstract

Masonry structures differ significantly from modern constructions that utilise contemporary materials such as steel and reinforced concrete as their main bearing elements. Unlike these newer structures, masonry relies predominantly on compressive forces for stability, with limited tensile capacity. Over time, these buildings have demonstrated the ability to adapt to changing environmental conditions through the formation of cracks, which allow for minor displacements and the re-establishment of equilibrium. However, with modern expectations for buildings to not only withstand seismic events but also ensure occupants' comfort and serviceability, traditional masonry structures often don't meet current seismic performance requirements. As a result, retrofitting is essential to enhance their resilience and meet the demands of larger, more frequent seismic events.

This study focuses on the seismic performance assessment of a three-storey masonry building constructed in the 1920s, located in Pozzuoli, Italy-a region highly susceptible to the bradyseism activity. Given the building's significance and the seismic risks, a thorough structural investigation and visual inspection are conducted to document structural details, identify existing damage, and evaluate its current condition. Additionally, an extensive experimental campaign is carried out, comprising both in-situ non-destructive testing and laboratory-based sample tests, to gain a deeper understanding of the building's structural integrity and mechanical properties. Furthermore, the seismic vulnerability assessment is performed with nonlinear static analysis to evaluate the building's global performance. The analysis reveals the building's current capacity to withstand seismic demands.

Based on these findings, a tailored intervention plan is developed to seismically upgrade the building while preserving its origin. The proposed retrofitting measures aim to enhance the structure's resistance to both vertical and horizontal loads, ensuring its safety for future use under a new functional purpose. This research contributes to the growing field of seismic assessment and conservation of historic masonry buildings, offering insights into effective methodologies for balancing structural safety with heritage preservation.

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