Seismic response of unreinforced masonry buildings is strongly influenced by in-plane behaviour and damage of spandrels. In the last decade, this issue has been one of the most investigated topics in earthquake engineering research programmes dealing with masonry structures. Several working groups in different countries have focused on numerical simulation and experimental testing of spandrels, considering their variability in terms of masonry type, presence of tensile-resistant elements such as steel ties and reinforced concrete bond beams, magnitude of gravity loads, and spandrel geometry. Some research groups have also explored the role of innovative strengthening systems aimed at increasing strength and/or deformation capacity of spandrel panels above openings.

This report provides a comprehensive discussion of experimental researches carried out by four research groups in Italy, Switzerland and New Zealand. In all cases, most of experimental tests were carried out on full-scale masonry specimens, either focusing on spandrel panels or addressing the pier-spandrel interaction within in-plane laterally loaded walls. More in detail, this report is asimed at reflecting and presenting the complementary nature of recent researches on spandrels. Special emphasis is given to observed damage, force–displacement behaviour and nonlinear capacity measures of spandrels. Valuable data on energy dissipation capacity and ultimate drift of spandrel panels and perforated masonry walls are also reported and discussed. In-plane overstrength and displacement ductility capacity of masonry walls with single openings are characterised through bilinear idealisation of experimental force–displacement diagrams. All testing programmes show that the geometrical and construction features of spandrels significantly influence the in-plane seismic capacity of perforated masonry walls and their repairability after cyclic loading. The latter feature is measured through the ratio of residual drift to the maximum drift of each wall specimen. Rocking behaviour of piers notably increases demand on spandrel panels, inducing the formation of plastic hinges in reinforced concrete bond beams at spandrel-pier intersections. Finally, seismic capacity of perforated walls is also found to depend on the spandrel-pier connection, highlighting the influence of boundary conditions on nonlinear behaviour of spandrel panels.

The type and amount of experimental data collected in this report can support the improvement of macro-element capacity models and building codes for seismic performance assessment of masonry buildings. Several issues require further numerical and experimental investigation and are identified in each section of the report. The extension of experimental testing to full-scale perforated masonry walls with multiple storeys and openings is one of those research needs, starting from preliminary findings on half-scale specimens presented herein.

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