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Tools and strategies for the performance-based seismic assessment of masonry buildings

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ABSTRACT

Performance-based earthquake engineering became popular in the last decades for both assessment and design of structures. This new trend in research determined the innovation of design codes for all structural typologies with the incorporation of seismic assessment procedures based on pushover analysis and the identification of damage states in terms of displacement thresholds. Within such a framework, the application of performance-based engineering to masonry structures requires the solution of specific problems and the development of suitable methods and dedicated computational tools. Indeed, in existing masonry buildings the lack of proper connections between orthogonal walls and between walls and floors is rather common and can facilitate the activation of local failure modes, mainly related to the out-of-plane response of walls. Early local damage modes may prevent the development of a global building response governed by the in-plane behaviour of masonry walls and the floor in-plane stiffness. On the other hand, the presence of very flexible diaphragms (i.e. timber floors and roofs) makes the adoption of nonlinear static analysis procedures more complicated and requires to take into account specific issues which can be normally neglected for the global capacity assessment of buildings belonging to other structural typologies. All these issues, together with some lack of experimental information on the capacity limits of different masonry typologies, make dealing with the extension of performance-based seismic assessment approach to masonry buildings a more complex subject than its application to other structures. Recent research advances and the availability of computational tools based on frame-type macro-element modelling suggest possible strategies for a consistent evaluation of the seismic performance of masonry buildings. The need for further experimental, numerical and theoretical research on this topic is still evident.