CERIS Civil Engineering Research and Innovation for Sustainability

Seismic vulnerability assessment of mixed masonry-reinforced concrete buildings in Lisbon

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Period
2013-2019

Funding
FCT scholarship (SFRH/BD/102713/2014)

Summary

The old mixed masonry-reinforced concrete (RC) "Placa" buildings were built in Lisbon in the first half of the twentieth century. They represent the transition period from masonry to reinforced concrete buildings, during they were designed without consideration of seismic-design requirements; thus, they belong to the group of potential seismic vulnerable structures. The main goal of this work is the estimation of the seismic behaviour and improvement of the seismic resistance of these typologies based on a probabilistic approach. Hence, the main objectives are summarized as follows: (i) Seismic vulnerability and assessment of these building stock based on nonlinear static analyses to define the global behaviour; (ii) Nonlinear kinematic analyses to define the out-of-plane capacity curves of single parts of the structures; (iii) Execution of the seismic performance-based assessment by considering the uncertainties involved in the assessment, treated by aleatory and epistemic defined for these typology; (iv) Development of strengthening techniques to improve buildings' seismic resistance, taking into account cost-benefit analyses; (v) Definition of the fragility curves before and after strengthening.

Moreover, sensitivity analyses are performed to improve the seismic assessment under different points of view: to point out in an explicit way the influence each uncertain mechanical parameter (aleatory uncertainties) has on the structural response and to consider the influence in terms of the structural details (epistemic uncertainties). To the latter aim, results from these analyses are used to determine the parameters essential for definition of the fragility curves. In addition, nonlinear dynamic analyses are performed to refine some steps obtained by the nonlinear static analyses.

Keywords

Mixed masonry-RC buildings, aleatory and epistemic uncertainties, nonlinear static and dynamic analyses, kinematic analyses, in-plane and out-of-plane behaviour, seismic performance, sensitivity analyses, fragility curves.

Type of mixed masonry-reinforced concrete "Placa" buildings.