Applicability of FEM for nonlinear seismic analysis of URM structures with timber diaphragms

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ABSTRACT

The seismic behaviour of unreinforced masonry (URM) structures is generally governed by a complex interaction between the out-of-plane and in-plane responses of the walls, depending on the in-plane stiffness of diaphragms and the efficiency of wall-to-floor/roof connections. The presence of timber diaphragms, which are typically characterized by low in-plane stiffness and poor connection to the masonry walls, adds challenges to the numerical modelling and analysis as well as to the structural assessment of URM structures under seismic actions. This work aims at developing a numerical study to investigate the seismic behaviour of URM buildings with timber diaphragms accounting for wall-to-floor/roof connections.

The reference model used in this study is a full-scale two-storey prototype building which was subjected to shaking table tests at the European Centre for Training and Research in Earthquake Engineering (EUCENTRE), in Italy [1][2]. Refined finite element (FE) models have been developed in commercially available finite element environment DIANA under different modelling assumptions for the timber diaphragms and their connections to the masonry walls. Eigenvalue, nonlinear static and nonlinear dynamic analyses have been carried out to calibrate and validate the models with respect to the experimental data. The results of this study are discussed in terms of: (1) suitable modelling assumptions for the vertical structure and timber diaphragms; (2) accuracy in predicting the experimental behaviour of the prototype building when refined FE modelling is used; and (3) advantages and limitations of applying nonlinear static and dynamic analyses.

REFERENCES

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