# EMPIRICAL USABILITY FRAGILITY CURVES FOR UNREINFORCED MASONRY BUILDINGS AFFECTED BY THE 2009 L'AQUILA EARTHQUAKE

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## Abstract

Recent earthquakes occurred in Italy highlighted the great vulnerability of the Italian building stoke that registered significant economic losses. In this context, many vulnerability models were developed in the literature to obtain a reliable loss assessment. Many models focused on damage fragility curves definitions, intending to estimate the damage suffered by the buildings after the seismic events. Nevertheless, in the last years, the attention of different research groups is moved toward the prediction of the building usability, i.e. the condition of a building being habitable or occupiable after a seismic event. In fact, recent researches highlighted that usability is stronger correlated with direct and indirect costs than structural damage. Consequently, the prediction of usability performance represents a valid indicator for the economic funding distribution after an earthquake. In this perspective, this paper aims to develop typological usability fragility curves for Italian unreinforced-masonry buildings. The proposed empirical model was calibrated from the observed data collected after the 2009 L'Aquila earthquake, including more than 59 000 unreinforced-masonry buildings. The database was increased to estimate the effective number of usable buildings present in the study area. Then, the structural parameters affecting the usability assessment were investigated, and three parameters (construction timespan, number of stories, and state of repair), available both on the post-earthquake database and Italian census, were selected to define different typological classes. The usability fragility curves were defined as a function of peak ground acceleration for two building usability states: partially unusable and unusable. The results underline the great importance of the state of repair parameter, followed by the construction timespan and finally by the number of stories.

## REFERENCES

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