Seismic vulnerability assessment of Romanian historical masonry building under near-field ground motion vertical component

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ABSTRACT

Timisoara is one of the largest cities of Romania located in the seismic area of Banat, Romania characterized by shallow earthquakes, that in the past produced considerable damages to the structures. In the present research work, the effect of ground motion vertical components in case of near-fault excitations has been analysed. The investigation has been made on the Banloc Castle, a historical masonry building damaged by the earthquake occurred on December 1991 in the Region of Banloc.

A FEM model of the building has been setup with the DIANA FEA analysis software and investigated in the non-linear dynamic field. The earthquake records have been selected considering the seismic events occurred in the Region. In particular, the records, processed using SeismoSpect software package, refers to the Timisoara site, located at 40 km from the epicenter (Banloc) with a moment magnitude of M_w=5.6. Consecutively, having defined a moment magnitude occurred in the study area (M_w= 5.6) and and the site-source distance, D, seismic attenuation laws (for both, horizontal and vertical accelerations, respectively) have been used to predict the expected effects of ground motion in the epicenter area.

The behaviour of the components of ground motion ischaracterised by the V/H peak ground acceleration ratio. In order to estimate the influence of the vertical seismic motion, two different scenarios have been analysed. The first scenario, named H, has taken into account the motion horizontal component only, whereas the second one (H+V) has analysed the simultaneous effects of three components of the seismic action.

From analysis results, the displacements induced from the combined effects, namely H+V, produced a significant increase respect to the other scenario, H, in which the vertical component was neglected. Analogously, referring to the structural resistence, a simplified ductility factors, μR, has been adopted. Finally, the damage correlation shown a good correspondence between numerical model damages to the occurred real in December 1991.

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