

Identification and Assessment of the Seismic Behaviour of the Giotto Bell Tower in Florence (Italy)

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ABSTRACT

Among the different typologies of historic buildings, masonry towers represent a hallmark of many European town centres and embody an important heritage to be preserved and passing on to future generations. The Giotto Bell Tower in Florence here discussed, together with the Leaning Tower of Pisa and the St. Mark's Tower in Venice (which collapsed in 1902), is one of the iconic masonry towers ever built in Italy.

The assessment of the structural behaviour of these structures, together with the development of proper preservation strategies, has attracted in recent decades the interest of a plethora of scholars (e.g. [1, 2]). Most of the studies on towers vulnerability focuses on the assessment of their seismic behaviour, since their slenderness exposes them to the dynamic effects induced by medium-to-severe earthquakes. As also demonstrated by recent Italian earthquakes and discussed by other authors (e.g. [1, 3]), the slenderness and base shear area are among the most important parameters ruling the structural response of masonry towers under seismic loading.

Given this background, this paper discusses the identification and the seismic behaviour of the Giotto Bell Tower in Florence. In a first part of the paper a refined numerical model, built through the finite element technique and based on a recent Terrestrial Laser Scanning survey, is reported together with the procedure adopted for its identification (according to the available experimental data). The finite element model accounts for the soil-structure-interaction. In a second part of the paper, by using natural accelerograms, the numerical model is employed to perform time-history analyses. The results of the analyses allow to assess the seismic behaviour of the Giotto Bell Tower and suggest preservation strategies.

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