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BACK ANALYSIS OF THESSALONIKI BYZANTINE LAND WALLS AS A MEANS TO ASSESS ITS SEISMIC HISTORY

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This article aims at developing the tools and strategy for assessing the dynamic and seismic performance of the Byzantine Walls* (the Walls) *of the city of Thessaloniki, Greece, to estimate the seismic history of the city as a whole. The particular Walls were constructed at the end of the fourth century AD in the reign of Theodosius the Great. As such, their structural integrity and record of damage reflects to a certain degree the level of seismic forces that has developed during the centuries. Moreover, the fact that the Walls are extending in kilometers within the civil grid of the modern city allows the study of the role played by the local soil conditions for a given earthquake scenario. It is worth noting that despite their relatively simple structural system, their foreseen seismic behavior as a three-dimensional body has not been thoroughly studied so far, primarily due to the lack of efficient numerical tools and the high computational related cost, especially towards the study of their response in the time domain. Along these lines, a refined dynamic analysis approach is proposed and the structural performance of particular parts of the Walls complex is examined for a number of realistic earthquake scenarios, accounting for the site-specific soil conditions, the spatially variable nature of the incident seismic waves, as well as the overall geotechnical/geotectonic environment of the area. Through this advanced simulation scheme, an upper bound of the historical level of seismic forces for the city of Thessaloniki is traced (through back analysis), while the overall refined approach can be also used as a guide for the direct assessment of the existing seismic capacity of monuments as a whole.

KEY WORDS: monuments, seismic assessment, masonry, Byzantine Walls

1. INTRODUCTION

The impact of earthquakes on monumental heritage is a critical issue that has attracted growing scientific interest during the past decades. Monuments, however, are most often complex structures, for which the preservation and/or seismic strengthening heavily relies on the clear understanding of all factors affecting their vulnerability as well as on the accurate study of the effects of past earthquakes. Until recently, the investigation of the seismic performance of important and extended monuments was restricted by the inherent limitations of numerical analysis, thus preventing the engineers from the study of their dynamic response in the time domain under realistic (recorded, synthetic, or artificial) ground-motion scenarios. This problem was further stressed in the case of

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