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SEISMIC PERFORMANCE OF THE 4TH CENTURY A.D., BYZANTINE LAND WALLS OF THE CITY OF THESSALONIKI, GREECE

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ABSTRACT

The scope of this paper is to illustrate a comprehensive strategy for assessing the dynamic and seismic performance of the Byzantine Walls of the city of Thessaloniki, which were constructed at the end of the 4th century A.D. in the reign of Theodosius the Great. These Walls are of paramount importance not only due to their historical value but also because they are extending in kilometers within the civil grid of the modern city. Despite their relatively simple structural system, their seismic behavior as a 3D body has not been thoroughly studied so far, primarily due to the lack of efficient numerical tools and the high computational cost related, especially towards the study of their dynamic response in the time domain. Moreover, despite the extensive historical documentation available, the seismic history of the monument is not known in detail since the historical evidence is often partial or cannot be directly related to the damage pattern and extent observed. Along these lines, a detailed dynamic analysis scheme is established 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. It is concluded that the advanced simulation of the dynamic structural response that is feasible nowadays is a useful tool for the assessment of the anticipated seismic performance of the existing Walls as well as for the understanding of their historical behavior under earthquake loading through the centuries.

Keywords: Historical Structures, Byzantine Walls, Numerical Analysis, Earthquake Engineering

INTRODUCTION

The impact of earthquakes on monumental heritage is a critical issue that has attracted growing scientific interest during the last decades. Monuments however, are most often complex structures, whose 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 or artificial) ground motion scenarios. This problem was further stressed in the case of (Classical, Roman, Byzantine or Medieval) city (Sea or Land) Walls whose dimensions were normally significantly large, hence the complexity of the analytical or numerical procedures to be followed, (as well as the subsequent computational cost) were considerably high. Along these lines, it was deemed interesting to focus on the city Walls of Thessaloniki, utilizing state-of-the-art numerical tools and the experience gained from the seismic study of other historical structures of the Byzantine Era throughout the city, in order to attempt to shed some light not only on the structural history of the Walls through the centuries, but

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