

Seismic response of Hagia Sofia church in Thessaloniki including soil-foundation-structure interaction

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This study investigates the behavior of “Hagia Sofia” church in Thessaloniki under seismic loading. It is one of the largest and most important Byzantine churches in the city, while it is inscribed on the World Heritage List. The main scope of this work is threefold: (i) to estimate the seismic response of this historic structure accounting for the actual foundation and soil flexibility at its base, (b) to find the locations in need of retrofit and finally, (c) to propose possible intervention methods. We simulate numerically the actual soil - foundation - structure system, and for the properties of the building materials we impair their strengths with the use of two codes, the EC6 and the Greek Regulation for the structural intervention of masonry. We simulate the soil-foundation flexibility using foundation impedance functions according to NIST2012 provisions. The influence of soil–foundation-structure interaction is investigated. As a reference case, we consider a fixed-base model to compare the output of the two analyses and highlight the influence of the soil and masonry foundation flexibility on the dynamic response of the church. Finally, we further analyze the intervention method of micropiles as a possible method of enhancement for the foundation of the monument, and we present results of the improved seismic behavior.