ABSTRACT

Title

Study on seismic behavior of a three-aisled basilica church of masonry

Surname Name
Koutsianou Anastasia – Lipiridou Parthena

Text

This thesis includes analyses that focus on the dynamic and seismic behavior of three-aisled basilica churches, in the district of Kozani and Grevena, Greece. A first objective of this study is to propose various ways of restoration in order to improve the seismic behavior of these churches. A second objective is to predict the initiation and propagation of failure at various structural elements under several load combinations.

First, a visit to the churches, **St. Paraskeui in Palaioxwri, Grevena, Virgin Mery in Knidi, Grevena, St. Nikolaou in Sarakina, Grevena and St. Prodromou in Levkopigi, Kozani**, was carried out, and the geometry were recorded. These churches were heavily damaged after the earthquake of Kozani, in 13 May, 1995. The visited churches had many common characteristics and the differences in their dimensions were unconsidered, so a typical church was designed. The model has typical dimensions and geometrical features.

Next, a modal analysis was performed on initial, typical, model, using the program SAP2000 as well as the program LUSAS (chapter 5).

An elastic analysis was carried out, using the program SAP2000. In the beginning, gravitational and/or earthquake loads were applied in order to identify the deformation of the model, which was used in the modal analysis. The earthquake forces in both directions, are found as a product of the masses with an assumed normalized acceleration equal to 1g (acceleration of gravity). Afterwards, an elastic analysis using the design spectrum, specified by the Greek Seismic Code (EAK 2000), and a dynamic analysis were performed. During these analyses the gravitational loads and the earthquake forces were applied simultaneously, in order to identify certain areas of the load-bearing system that exhibit stress concentration and reaches critical tensile compressive and shear strength values for the stone masonry. The stress fields obtained in this way were combined with a Mohr-Coulomb (σ-τ) failure criterion in order to identify the failure areas (chapter 6).

Also, a parametric investigation was performed by studying the behavior of walls after their separation and methods of improvement their strength capacity (chapter 7).

Finally, elastic analyses were carried out on various models which represent solutions of restoration, using the program SAP2000. Afterwards, an elastic analysis using the design spectrum, specified by the Greek Seismic Code (EAK 2000), and a dynamic analysis were performed on the final model for the restoration of the church. All these analyses were carried out like they have mentioned in chapter 6, (chapter 9)