15th International Congress of the Geological Society of Greece
Athens, 22-24 May, 2019 | Harokopio University of Athens, Greece
Bulletin of the Geological Society of Greece, Sp. Pub. 7 Ext. Abs. GSG2019-384

Response of Monumental Buildings during the Seismic Sequence in Peloponnesus Greece. Relation Parameters between Records and Analysis Seismic Loads

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In this work the response of the build environment, after four strong earthquakes, is observed in Peloponnesus, Greece. Particularly the research is focused on monumental and other masonry buildings with load carrying masonry walls. This response is correlated with the recorded accelerations of the ITSAK accelerograph network. These records are postprocessed and numerical values of effective accelerations and of spectral accelerations are given for comparison reasons. The considered earthquakes are Kythera Eq., Koroni Eq., Leonidio Eq. and Achaia – Ilia Eq. At the location of each record, various levels of accelerations were recorded. These values vary from low to high. The response of the build environment was examined and recorded by visual inspections from ITSAK research groups, at the stricken areas. The buildings under research are subdivided in five categories. In the first category are classified buildings with mudbrick masonry walls and clay mortar. The second category contains buildings with stone masonry walls and clay mortar. In third category are classified buildings with stone and/or brick masonry walls and lime mortar. In the fourth category are classified the temple buildings and the surrounding structures. In the fifth category are classified castles, ancient ruins and other structures build with stone and masonry walls with or without mortar. For Kythera, Koroni and Leonidio Eqs were observed only cracks on masonry buildings while for Achaia-Ilia Eq were additionally observed total and partial collapses.

It was found that in masonry buildings that are subjected to strong earthquakes first damages appear as cracks at the top floor. Probably this may attributed to the insufficient connection of the wooden roof with the walls. Also at the top storey the axial load of the piers are low and also the spandrels are not well wedged. The bell towers are usually constructed in contact with the building of the main temple. In these cases damages appear at the bell towers at the location of the top of the temple. This is justified by the consideration of the different way of oscillation of the two structural systems. Temple structural system is stiffer than the bell tower structural system. In many masonry buildings the distress and deformation of the walls are close to the failure values. This happen, mostly due to the absence of maintain in combination with antiquity. For these reasons after an earthquake usually appear cracks at the walls due to additional forces and deformations.

From the field observations and by the use of the postprocessed earthquake records, resulted that the analysis seismic accelerations for monumental masonry buildings should be significantly lower than the recorded ones. In this work are given scientifically validated reasons for the reduction of analysis seismic loads by the reassessment of material properties and appropriate values are proposed. Also case studies are given, from the analysis of different monumental masonry buildings that are simulated by finite element models and the considered assumptions are approved.

References

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