Abstract

The present dissertation was elaborated as part of the Post Graduate Program of studies entitled ‘Seismic Design of Technical Constructions’. The main objective of this work is to investigate the seismic behaviour of multi-storey reinforced concrete building structures taking into consideration the influence of the infill masonry walls. Moreover the objective of this work is also to asses a number of rehabilitation technics. For the scope of this dissertation an 8-storey reinforced building, established in 1960’s -1970’s in Thessaloniki, was examined. For the elastic analysis of the structure, a program capable of performing static, dynamic analysis together with design of reinforced structural members was used, ETABS Nonlinear v8.2.6.

At the first part of this study, a parametric study was performed where a number of construction practices were examined with respect to their influence on the dynamic performance of the structure (floating columns on beams at an intermediate storey that do not extend up to the foundation and the loft constructed at the ground storey). Moreover an investigation was performed to quantify the influence on the dynamic performance of the height of the structure. In order to achieve this last goal a number of different models were constructed, where each storey was added to a new different model starting with analyzing the model of structure containing the basement and the ground storey (with the loft). A parametric study was also performed with reference to the modeling of the shear wall of the ground storey. Having come to a conclusion about the modeling of the ground shear wall the final model was constructed (not taking into consideration the masonry infill panels). This is the model that is going to be used for further study.

In this study, there was also an investigation to employ a model for simulating the behavior of the masonry infill panels together with the surrounding mortar joint using equivalent diagonal compression struts. For this study the program named ‘LUSAS’ was used. This investigation took place using single storey, one bay, masonry infilled frames that are subject to monotonous horizontal loading. The interaction of frame with the infill was taken into account by using joint elements with enhanced non-linear properties in order to model the surrounding mortar joint. The aim of this study is to propose geometric properties for the diagonal struts that can be used for modelling the masonry infill panels of the 8-storey R.C. building.

The results of the previous parametric analysis were used for modelling the masonry infill panels of the 8-storey reinforced concrete building in Thessaloniki. At first a model was constructed, where no masonry infill panels were simulated (‘bare’ structure). Afterwards a new model was employed having the infills modelled as diagonal struts, for estimating the influence of the masonry infill panels. A dynamic analysis was held to determine the dynamic characteristics as resulted for these two cases. A comparison of these dynamic characteristics took place as well as a stress comparison for these two cases under seismic loading. Next three new models were constructed that simulates the reinforced structure. A dynamic analysis was also held to determine the dynamic characteristics as resulted for these three cases and then a comparison of these dynamic characteristics took place. At the end one of these three models was chosen to hold a response spectrum analysis. The results of this analysis are compared to the ones from the response spectrum analysis that was held for the model that had the infills simulated as diagonal struts.