

Abstract

The aim of the present thesis is the study of the inelastic seismic response of a neoclassic masonry building, before and after its strengthening with the use of concrete jacket. Manios Panagiotis and Strakalis Zafeirios, graduated A.U.Th Civil Engineers, elaborated the study within the scope of the post-graduate studies programme in *Earthquake Resistant Design of Structures*, established by the Civil Engineering Department of Aristotle University of Thessaloniki.

The building in issue is a two-storey construction with basement. It was erected within 1920 – 1930, is located at the city centre of Heraclion, Crete and belongs to the category of neoclassic mansions.

In the *1st Chapter* there is the description of the building. There is also a reference to the materials and their mechanical properties, as they are evaluated with the use of the Former German Code. The vertical loads and masses of the masonry walls, the wooden floors, the wooden roof and balconies are calculated.

The *2nd Chapter* discusses the theoretical basis of the analyses held. The performance of the material, named as “concrete” is described at the beginning of the chapter. “Concrete” is included at the library of program **ADINA, ver. 8.1.1**, that is used for the analyses. The 27node 3D solid finite element is described along with the elements used for the strengthening. The analyses held are sorted out and the methods used are mentioned. At the end of the chapter some parameters of the analyses are discussed.

The *3rd Chapter* provides the analytical description of the model’s geometry and discretization process. The results of elastic analyses are presented, in order to examine the contribution of mesh density in the sensitivity of the results. Furthermore, there is a detailed reference to the way the material, the masses, the loads, the boundary conditions and the load functions are determined in ADINA. A final point is the presentation of the way the elements used for strengthening are inserted, as well as the specification of the form of the analysis. All the above are rendered with a wide variety of pictures and a detailed reference to the demandable commands of ADINA.

In the *4th Chapter* elastic analyses are carried out at two programmes, ADINA and SAP2000, and the results are juxtaposed so as to ascertain the soundness of the creation and the discretization of the model in ADINA. An idiomorphic analysis is also conducted as well as a static analysis for the seismic combination of vertical loads and a dynamic analysis for a linear increasing base acceleration, towards the two horizontal directions, x-x and y-y. The results of the analyses of the two programmes converge satisfactorily enough.

In the *5th Chapter* inelastic dynamic analyses for linear increasing base acceleration towards the two horizontal directions x-x and y-y are conducted in ADINA. Distortions and horizontal shifts of the conveyor are presented and the construction’s resistance curve is deduced. There are also pictures of the cracked conveyor, time histories of stresses, stresses – distortions diagrams and representations of the building’s walls’ stresses. At the conclusion of the chapter the results of inelastic and elastic analyses are compared at the areas of elastic and inelastic distortions.

In the *6th Chapter* the construction of a perimetric one-sided reinforced concrete jacket is selected as a method of strengthening and there is a description of its modeling process in ADINA. An idiomorphic analysis of the retrofitted model is realized as well as a non-linear dynamic analysis for a linear increasing base acceleration towards the direction x-x. From the results we conclude that the addition of the jacket increases considerably the resistance and the inflexibility of the building and there is a general improvement of its response against the horizontal loads.

Appendices are also included. In the first appendix there is a number of plain examples by which the accuracy of insertion of certain software parameters is checked. In the second appendix we examine a simple structural element whereas, in the third one the provisions of Former German Code are briefly presented.