Abstract

This dissertation deals with the analytical and experimental investigation of the behavior of a device of anchorage FRP's (Fiber Reinforced Polymer) on an existing concrete specimen. This idea was developed at the Laboratory of Material and Structure Strength under the supervision of Professor G. C. Manos, director of the Laboratory. As far as it concerns the analytical investigation a simulation of all the ways of fracture took place. Several models have been settled so as the parameters that the device is depended could appear. After the analytical investigation a developed device of anchorage is proposed.

Taking into consideration the useful results of the analytical investigation, a new model of the device is designed with real dimensions. This new device will be examined experimentally under cyclic loading. Several instruments are being used for the measurement of the displacements, loads and the developed strains. Furthermore a numerical model is settled with the help of an analytical program, ABAQUS. A comparison among the results of the experimental and the analytical process will take. An interesting point of this comparison is the reliability of the modeling of the anchorage system.

Moreover an attempt of using this system to a concrete pier specimen will be made. Some experimental tries will be executed under cyclic loading. The pier is strengthened with FRP's which is anchored with our system. The pier has a height of 1.82 m and rectangular cross-section of 20x50 (cm). The longitudinal reinforcement comprises of eight bars of smooth, soft steel. The bars' diameter is 6.00 mm and the steel's mechanical characteristics are known. The same type of steel is used for the transverse reinforcement, in the form of rectangular hoops at 10.00 cm spacing. A heavily reinforced rectangular foundation is formed at the base of each wall.

Each specimen is placed vertically on the steel reaction frame located in the Laboratory of Mechanics. The foundation is anchored in such a way as to produce fully fixed support at the base of the wall. As already mentioned, a gradually increasing horizontal cyclic displacement is imposed at a height of 1.42 m. At the same time, a constant vertical axial force is applied at the top of the wall. The horizontal and vertical loading is imposed using one horizontal and one vertical piston, which are properly attached to the steel reaction frame and are electronically controlled. Each piston has a Load Cell attached to it in order to measure the applied loads. The displacements of the wall are measured in fourteen selected locations, using the appropriate instrumentation (LVDTs). All instruments (Load Cells, LVDTs) are connected to a computer, in which the measured data are stored during the experimental procedure.

After the completion of the experimental tests, the concentrated diagrams of force-displacement will be compared with those of the analytical investigation of the Pier with the device of anchorage, with the help of ABAQUS. So it can be inferred that a numerical investigation of the Pier should take place. All the details of modeling this pier will be commented.

At the end of the dissertation a review will be made. Finally the general results with the good and the bad points of the device of anchorage will be mentioned.

A separate, finally, section which concerns the mechanical behavior of the FRP's under cyclic load is presented in this diploma thesis.