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FLEXURAL CAPACITY OF RC PLATES WITH DIFFERENT REINFORCEMENT RATIOS USING ANSYS

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ABSTRACT

The analysis of RC structures by using finite element techniques got great attentions through the last two decades. A lot of finite element packages like ANSYS, ABAQUS, COSMOS, DYNA-3D, and NASTRAN were modified to be used in the analysis of different elements of RC structures. In this paper, Also ANSYS finite element technique was used for analysis the structural behaviour of high strength RC plates. The analysis of RC plates was considered in three dimensions finite element analysis, where the effects of material and geometric nonlinearities are taken in the consideration to increase the accuracy of the results. Flexural capacity of RC plates are measured experimentally and are calculated analytically using ANSYS. The comparisons between experimental and analytical results were performed.

Keywords: flexural capacity, high strength concrete, material nonlineaities, reinforcement ratio, silica fume, deflection, finite element, ANSYS.

INTRODUCTION

The beginnings of the finite element method surfaced in the early 1940s but it did not become a concept until the 1960s. Nowadays, the finite element method is the most accepted technique for numerical analysis in structural mechanics (or in civil engineering structures). The finite element method is essentially means for finding an approximate solution for partial differential equations. ANSYS is a complete FEA software package is used by engineers worldwide in all fields of engineering virtually, like structural, electrical, mechanical and electromagnetic. Saifullah et al, and Nguyen et al used ANSYS analysis to do comparison between experimental and analytical investigation of flexural behaviour of reinforced concrete elements. El Nawawy et al used a developed 3-D finite element model for analysis of RC structures. Salah used 2-D finite element analysis to describe the structural behaviour of reinforced concrete beams. Since the comparison of obtained results indicated that main reinforcement, strengths of concrete, stress yielding of steel may affect to the ductility of RC beams. The nonlinear behaviour of RC beams with moderate shear span and without strirrups was studied using ANSYS. By using 3-D ANSYS modeling designers can simulate the nonlinear behaviour of RC beams without shear reinforcement has a moderate shear span.

RESULTS AND CONCLUSIONS

Figure 1 illustrates the load deflection behaviour for RC plate HSR1; the initial cracking load was (14 KN) and the ultimate load (28 KN), the maximum deflection recorded at point (1), (2), and (3) were 5.93 mm, 4.22 mm, and 2.53 mm respectively at ultimate load (28 KN).

From the experimental and theoretical investigation carried out in this study, it can also be concluded that:

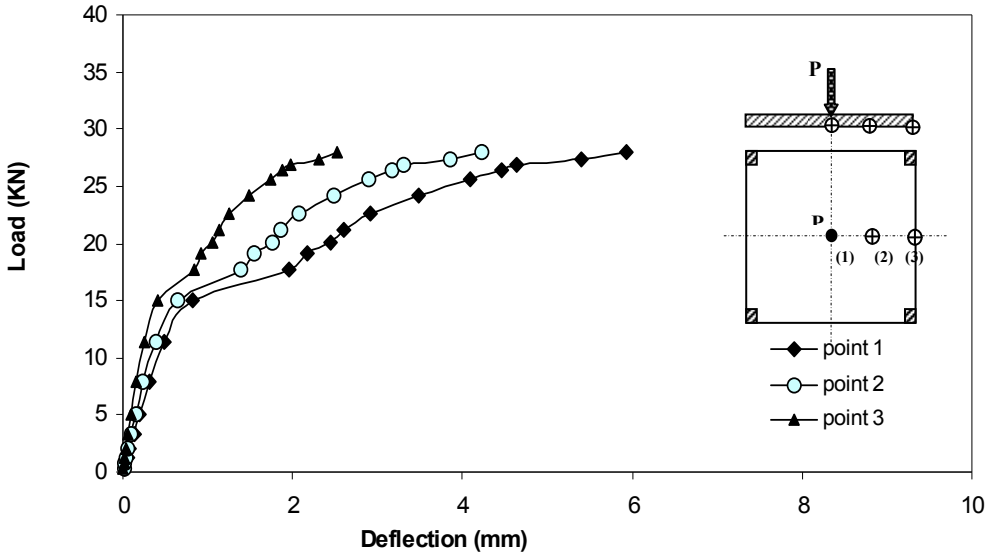

Fig. 1 - Load - Deflection Curves of RC Plate HSR1 by ANSYS

- The nonlinear three dimensional finite element model used in this study predict with acceptable accuracy the structural behaviour of the high strength reinforced concrete plates with different reinforcement ratio.
- There is a quite agreement and harmony between all experimental and theoretical results by using ANSYS, especially till the initial cracking loads.
- There is a quite agreement and harmony between all ANSYS results proposed in this study and 2D finite element results, especially till the initial cracking loads.
- Load - deflection curves of all RC plates at different locations were linear till first cracking load. After cracking, deflections increased rapidly as the load increased.

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