ABSTRACT

Ferrocement has been widely accepted as a construction material for roof slabs. Many investigations have been done on the behaviour of ferrocement roof slabs. But only limited research has been done on the flexural behaviour of ferrocement hollow slabs. Ferrocement hollow slabs have lesser self weight compared to reinforced cement concrete slabs and hence attract lesser inertia force during earthquake. The hollow portion provided in the slab restricts the passage of heat from outside and it can also be used for utility services. In this work, experimental investigations were carried out to study the behaviour of ferrocement hollow slabs with various percentages of reinforcement and to compare their performance with reinforced concrete slab.

To avoid collapse during major earthquake, structural members must be ductile enough to absorb and dissipate energy by post elastic deformations. In this work, an attempt has been made to study the effect of alkali resistant polyester fibres in improving the ductility of ferrocement hollow slabs. The polyester fibres were mixed in the cement mortar matrix. They also serve as tensile reinforcements bridging the cracks and prevent the formation of secondary cracks. The performance of polyester fibre reinforced one way ferrocement hollow slabs with chicken mesh and skeletal steel reinforcement, designated as hybrid slabs, was investigated by applying cyclic
loading. When these slabs are subjected to repetitive stresses in cyclic loading, it was observed that there was no significant variation in the failure load as that obtained in monotonic loading.

Polyester fibre reinforced ferrocement hollow slabs of length 3 m were subjected to different types of loading and their performance with reference to stiffness, ductility and energy absorption capacity were investigated. The slabs were provided with both tension and compression reinforcements and shear reinforcement in the ribs between hollows. Also, chicken mesh layers were provided in the top and bottom layers of the slab and in the rib portions. The slabs were subjected to one way cyclic loading by applying two line loads at one third span. The experiment was conducted using data logger system for recording the load and deflection readings. The first crack and ultimate strengths were found. The crack patterns and crack widths were measured. It was observed that these slabs carry large amount of post elastic deformations and can withstand earthquake/wind forces without collapse.

The ductile steel wire meshes impart ductility to the brittle cement mortar matrix. Also adding discontinuous short polyester fibres to cementitious matrix could bring significant improvement in ductility as well as moderate increase in tensile strength and can solve the problem of spalling of matrix cover under service loads. The limit state of serviceability of deflection and cracking was verified as per the ferrocement model code for the hybrid slabs.
Investigations on the durability of the hybrid ferrocement hollow slabs was also undertaken subjecting them to alternate drying and wetting cycles. About fifteen slabs measuring 2000 mm × 540 mm × 140 mm with circular cores were cast, cured, subjected to alternate drying and wetting cycles and tested to study their flexural behaviour under cyclic loading. Their first crack strength, ultimate strength, deflection, propagation of cracks and the crack width were also observed.

A theoretical model was developed for the deflection of polyester fibre reinforced ferrocement hollow slabs and it was validated by the experimental data. The experimental results are very close to the analytical values especially at the service load. Also a numerical model was developed and finite element analysis was done using ANSYS software and the results were compared with the experimental values.

It is concluded that alkali resistant polyester fibre reinforced ferrocement hollow slab possess more strength, durability, ductility and serviceability and can be conveniently used for structures constructed in earthquake prone areas.