ABSTRACT

Ferrocement is a versatile construction material formed by using hydraulic cement mortar into closely spaced layers of a small sized wire mesh. The mesh may be of metallic or other materials. It has a high tensile strength to weight ratio and better cracking resistance behaviour when compared to reinforced concrete. It requires less skill and provides low cost serviceability without loss of structural integrity. These potential advantages and the novelty of the concept, make ferrocement attractive for construction purpose. A complete understanding of ferrocement material behaviour will lead to an innovative technique for the rehabilitation of existing damaged structures, and building structures as per new era without compromising strength. The main aim of this research work is to estimate the strength properties and predict flexural behaviour of ferrocement laminates by replacing cement with industrial wastes to some extent. Portland cement is a high energy intensive material but the production of one tonne of Portland cement releases almost an equal amount of CO$_2$ into the atmosphere, thereby impacting the environment. An effort has been made to use industrial by-products as substitutes for partial replacement of cement in ferrocement laminates to reduce consumption of cement.

The main outcome of the study is consolidated and presented as follows: The salient features of the constituents for composition of ferrocement laminates were studied and suitable materials were chosen. The selected materials were silica fume and fly ash as both, when replaced
optimally by weight of cement, exhibited a higher strength enhancement of conventional cement mixture. The most favourable cement mortar with optimum replacement of fly ash together with silica fume was identified by preparing different specimens with varying ratios of fly ash and silica fume. The flexural and impact characteristics of various specimens were obtained experimentally. The specimens for the flexural and impact test were reinforced with different volume fraction of chicken mesh, as well as weld mesh, and formed by different replacement proportion. A mathematical model was formulated to compare the value of ultimate moment capacity in flexure tests from the experiment. The proposed model would estimate the ultimate moment capacity of ferrocement laminates, reinforced with chicken mesh and weld mesh. The flexural behaviour of strengthened reinforced concrete beams with optimized ferrocement laminates was obtained with respect to the control beam. A mathematical model was formulated to compare the value of ultimate moment capacity in flexural behaviour of strengthening of beams from the experiment.

The research work on ferrocement with industrial by-products pave way for the effective utilization of fly ash and silica fume in ferrocement laminates with high strength. So these materials can be adopted for new structures where high strength is required and also to strengthen the existing flexural members to enhance their moment carrying capacity. The effective utilisation of fly ash and silica fume in the various applications of ferrocement in the construction industry will further expand its range of applications to a new and undeveloped avenues and areas.