ABSTRACT

Cement is one of the most extensively used versatile materials in construction industry. The development of the construction industry at a global level needs more and more amount of portland cement for sustainable development. Manufacturing of portland cement is an energy intensive process and releases large amount of greenhouse gases into the atmosphere, which affect the earth’s ecosystem. Efforts are being carried out to conserve energy by means of promoting the use of industrial wastes like Ground Granulated Blast furnace Slag (GGBS), silica fumes, flyash, etc., which show chemical properties similar to cement. Use of such materials as cement replacement will simultaneously reduce the cost of concrete and helps to reduce the rate of cement consumption. This research evaluates the behaviour of concrete with GGBS in different proportions with respect to age of concrete.

The entire study was divided into three distinct phases. In the first phase, tests on compressive strength, split tensile strength and flexural strength were conducted with 30%, 40%, 50%, 60% and 70% GGBS. From the experimental results, it is found that up to 50% replacement of GGBS, the compressive strength, split tensile strength and flexural strength values are
equal or comparable with that of concrete specimens without GGBS. But there is a gradual decrease in the mechanical properties above 50% cement replacement level with GGBS. The relationship between split tensile strength and flexural strength with that of compressive strength is obtained.

In the second phase, a total of 24 reinforced concrete beam specimens comprising of 8 control beams, 8 beams with 40% GGBS and 8 beams with 50% GGBS were cast and tested. The specimens are designed as per IS 456:2000 codal provisions. The specimens were tested at 28\textsuperscript{th}, 56\textsuperscript{th}, 90\textsuperscript{th} and 120\textsuperscript{th} day from the date of casting. Data presented include cracking behaviour, load-deflection, moment-curvature relationship, load-strain and displacement ductility.

In the third phase, the experimental results were compared with the analytical results obtained by ANSYS analysis and it is found that the analytical results were in good agreement with the experimental values.

Results of this investigation suggests that replacement of OPC with 50% GGBS can be used in reinforced concrete specimens as it shows good strength, moment carrying capacity and ductility.