ABSTRACT

Fly ash is generated in huge quantities every day in major thermal power stations of Tamilnadu. The safe disposal of this fly ash is the major socio-economic problem before the authorities and is becoming a costly affair for them. Conventional method of concrete construction consumes the natural resources like cement, sand, etc. and hence causes ecological imbalance. The use of fly ash in concrete construction will save such resources. The cement is also costly ingredient of concrete. A part of cement and sand can be replaced by good quality fly ash to the extent of 10-30 percent and 5-15 percent respectively. The use of fly ash will solve the disposal problem and automatically reduce the construction cost.

The production of one metric tonne of cement leads to the emission of one metric tonne of carbon dioxide, which is a powerful green house gas, responsible for the global warming. One way of reducing this environmental problem is to reduce the consumption or production of cement. Since the cement is the basic material which is used in construction industry, it is essential to find a suitable material for the replacement of cement. Literatures show the researchers have proved that the fly ash obtained from the thermal power plants can be used as partial replacement for the cement. Fly ash is considered as the world’s largest mineral waste.

The use of Self Compacting Concrete (SCC) in actual construction is still less in India. Lack of awareness, technical data could be cited as the main reasons. For adoption of any new material or technology, it is generally needs proven performance over traditional materials. Considerable research is carried out in India towards the technology development so that SCC could
soon find a place in the Indian construction industry. Its technical and economical advantages are well documented and published especially through full-scale experimental casting and testing program.

In the present experimental investigation the main concentration was focused on strength, durability and impact strength of SCC that of compared with control concrete (CC). Replacement of fly ash varied at 10%, 20%, 30%, and 40% by weight of cement and addition of steel fibres varied at 0.5%, 0.75%, 1.0%, 1.25% and 1.50% by weight of cement for casting specimens. The number of trail mixtures was used and acceptance criteria tests such as slump flow, V-funnel, L-box and U-box tests were conducted for evaluating the flowability, filling ability and segregation resistance of fresh SCC satisfying their permissible limits. Then the final proportions of ingredients and admixtures have been finalized for SCC corresponding to M30 grade control concrete. In this investigation Glenium B233, a polycarboxylate ether based super plasticizer was used. Glenium B233 is an admixture of a new generation based on modified polycarboxylic ether. Glenium stream 2 was used as viscosity modifying agent.

150 mm x 150 mm x 150 mm cubes, 150 mm diameter and 300 mm height cylindrical specimens and 100 mm x 100 mm x 500 mm prism specimens were cast and tested for various strength and durability properties. The investigations were carried out for mechanical properties such as compressive strength, splitting tensile strength and flexural strength. Durability studies were carried out on control concrete and self compacting concrete. Tests on saturated water absorption test, acid attack, sulphate attack and alkaline attack were conducted. Bond strength, rapid chloride permeability tests and accelerated corrosion tests were also conducted.

For determination of impact strength a new experimental setup was developed. 1m x 1m size and 40 mm thickness slabs were cast. The impact
strength on control concrete and SCC were determined with the help of drop weight method by releasing the drop weight at 1 m and 2 m heights above the concrete slabs. The impact energy was calculated at first crack and final cracks by using the relationship based on the blows. To improve the impact strength of SCC the steel fibres were added.

Though the addition of steel fibres to fresh concrete results in loss of workability, they change the properties of hardened concrete significantly. There were no problems with mixing or workability while the fiber distribution was uniform. Steel fibres enhanced significantly the impact strength of SCC and inhibit the initiation and growth of cracks.