The Structural Performance of RCC Beams Made With M30 Grade SCC Mix While Fine Aggregate Is Partially Replaced By Crystal Stones

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Abstract - The economy of a developing country depends to a great extent on the construction industry. Developing countries like India are investing heavily in infrastructure development. The excessive exploitation of natural resources for construction threatens the sustainability of aggregates and poses a number of serious problems. At the same time, the disposal of fly ash and stone residues in landfills cause several environmental crises and pollute the environment. This article deals with a study on the structural behavior of the partial replacement of fine natural aggregates by 0 -40% crystal stones in order to obtain the flow properties of fly-ash-based self-compacting concrete (SCC) by using super plasticizers. Many tests have been done to test the feasibility of using crystal stones in M30 grade SCC. On the basis of the results obtained, the optimum percentage of fine aggregates with crystal stone was calculated at 30% and it was concluded that the increasing percentage of crystal stone replacement by fine aggregates did not affect its workability. The structural performance of simply supported RCC beams of size 150 × 200 × 1500 mm made from SCC with crystalline stone was tested.

Keywords: Fly-ash based SCC, Crystal stone, Mechanical and Structural properties.

I. INTRODUCTION

Concrete that flows and settles under its own weight, even in the occurrence of heavy reinforcement without segregation, bleeding or external vibration, is termed as SCC[4].In this way, environmental difficulties could be avoided like noise and vibrations. Concrete mix is selected to satisfy visual stability index criteria for the concrete. No standard mix design is available for SCC mix design; SCC was produced in the construction field by keeping their own proportion of mix which satisfies VSI criteria.

Fly ash generated from thermal power plants meets the increasing demand on source materials of concrete, and serves as a better substitute for cement. In this study, fly ash was utilized as the source binding material in SCC, which could help reduce environmental problems like CO_2 emission on OPC production and disposal of waste. Due to scarcity and restrictions on river sand, its cost is increasing rapidly. Enormous depletion of the resource also causes soil erosion. To avoid such situations and to meet the demand, we have to consider a useful alternative or replacement material for natural sand. Some of the conventional options are crushed rock material, sea sand, fly-ash, marble dust powder, etc. In this study, crystal stone of varying percentage was used to replace the natural sand used in the fly-ash based SCC.

II. MATERIALS USED

The list of materials used in this study is given below:

a. Cement

For this study, an OPC grade of 53 was used, thus confirming IS: 12269 – 2004, and the basic properties of cement are illustrated in Table 1.

Table 1: Properties of Cement

Parameter	S.G*	Consistency	Fineness	Setting Time (min)	
				Initial	Final
Results	3.18	32%	6.10	38	568

[S.G* - Specific Gravity]

b. Fly ash

Pulverized fine-grained fly ash, dark grey in color and collected from the nearby power plant, was used in the study as per IS 3812:2003, which possesses specific gravity of 2.48.

c. Fine Aggregate (FA)

Fine aggregate used in this experimental study was conforming to zone II of IS 383-1970 (Part-4).

Table 2: Properties of Fine Aggregate

Parameter	S.G*	W.A*	F.M*
Results	2.52	6.6%	2.89

[W.A* - Water Absorption; F.M* - Fineness Modulus]

d. Crystal Stones

Locally available crystal stones taken from the nearby quarries were used in this study. The properties are mentioned in table 3.

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