EXPERIMENTAL INVESTIGATION OF MECHANICAL AND DURABILITY PROPERTIES OF SCC WITH SILICA FUME AND QUARTZ

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Abstract— This project deals about the self compacting concrete (SCC) developed by using quartz, silica, fly ash and crushed sand. This project focuses on the workability characteristics and strength parameters of SCC containing quartz, silica fume, fly ash and C-sand. Since the mechanical and durability properties of the concrete are reported to be considerably improved. SCC containing different proportion of silica fume and quartz that have been tested for V-funnel, U-Box, L-box, sorptivity, sulphate resistance, Rapid chloride penetration test, Compression and Flexural have been carried out to determine the behaviour and the flow of self- compacting concrete along with the characteristic compressive strength. Self−compacting concrete is one of "the most revolutionary development" in concrete research; this concrete is able to flow and to fill the most difficult places of the form work without vibration. It is able to flow under its own weight, completely filling formwork and achieving full compaction, even in the presence of congested reinforcement. The Csand is produced by impact crushing rock deposits to obtain a well graded fine aggregate. Characterization studies of all the ingredients of SCC have been carried out.

To study the effective utilization of Silica fume and Quartz in self-compacting concrete by conducting the following tests Workability.(V- funnel, L- box, U-box), Compressive strength, Flexural strength and Split tensile strength. To study the durability characteristics of the proposed concrete by conducting the Water absorption, RCPT(Rapid Chloride Penetration Test) and sorptivity test

Key Words: Fly ash, Csand, Quartz, silica fumes, Compression, Admixtures, flexural strength.

I. INTRODUCTION

Self-Compacting Concrete (SCC) has successfully met the challenge and is now increasingly being used in routine practice. Self-Compacting Concrete (SCC) is considered as a concrete with high workability that is able to flow under its own weight and completely fill the formwork, even in the presence of dense reinforcement, without vibration.The use of fly ash, blast furnace slag and silica fume in SCC reduces the dosage of super plasticizer needed to obtain similar slump flow compared to concrete mixes made with only Portland cement. In this project, an attempt has been made to use Csand and fly ash in SCC. Characterization of all ingredients of SCC has been performed. Various durability aspects have been examined for all SCC mixes in the present investigation

II. LITERATURE REIVEW

Magudeaswaran, Eswaramoorthi: (June 2013) "Experimental Investigations of Mechanical properties on Micro silica (Silica Fume) and Fly Ash as Partial Cement Replacement of High Performance Concrete" This work primarily deals with the strength characteristics such as compressive, Split tensile and flexural strength. High performance concrete a set of 7 different concrete mixture were cast and tested with different cement replacement levels (0%, 2.5%, 5%, 7.5%, 10% 12.5% and15%) of Fly ash (FA) with silica fume (SF) as addition (0%,5%,10 % ,15% ,25and 30%) by wt of Cement Its use will lead to a reduction in cement quantity required for construction purposes and hence sustainability in the construction industry as well as aid economic construction.

III. EXPERIMENTAL PROGRAM

The following materials are used for our experiment in M40 grade concrete:

A. Cement:

Ordinary Portland cement of specific gravity equaling 3.145 was used as binder material. Cement qualifies the Indian specifications as per IS 12269:1987.

B. Coarse Aggregate:

Crushed angular granite material was used as coarse aggregate for our investigation. The sizes vary between 10mm and 20mm by the sieve analysis and fineness of 7.45. The specific gravity was found as 2.65 and bulk density of 1556Kg/m^3 by IS 383:1970.

C. Fine aggregate:

Finely sieved river sand conforming to IS 383:1970 was used as fine aggregate with a specific gravity of 2.55 and fineness modulus of 2.95 and bulk density of 1717.64Kg/m^3.

D. Fly ash:

The quality of fly ash is governed by IS 3812-part 1-2003. Class F fly ash normally produced by burning anthracite or bituminous coal ,usually has less than 15% cao. class F fly ash has pozzolanic properties only shows the fly ash used.

E. Silica Fumes And Quartz

Silica fumes improves the durability of the concrete by reinforcing the microstructure through filler effect and thus reduces segregation and bleeding.Silica fume of specific gravity 1.85 was used in this studyQuartz has a hardness of 7 on Mohs scale and a density of 2.65 g/cm³.. It has a hexagonal crystal structure and is made of trigonal crystallized silica. In present investigations the size of quartz sand is 0.3 to 0.8 mm and Quartz powder is in order of 0 -10 µm. Quartz powder is used a fine aggregate with Specific gravity of 2.65.

F. Csand

Fine aggregate is crushed sand which has been washed and sieved to remove particles larger than 150micron. C-sand used in the study is shown in fig 3.4. That the particles which are between 2mm to 4.75 mm are termed as fine aggregates with a specific gravity of 2.58

G. Water:

Potable fresh water conforming to IS 456:2000 was used throughout the project.

H. Casting details:

Casting was carried out with the selected materials in proper mix proportions. The Indian Standards IS 10262: 2009 was used as a guidelines for proportioning. Fly ash was replaced for cement in 25% percentage by weight of cement. The adding constant % of fly ash (25%) carried out at various levels of silica fumes and quartz powder (7.5% and 15%) of cement content. The specimens were taken under the guide lines of IS 516:1999. Cylinders of 150mm diameter and 300mm height, prisms of size 100mm x 100mm x 500mm and Cubes of size 150mm x 150mm x 150mm were adopted. Concrete was prepared in proper proportions under clean dry environment. They are poured into the specimen in three layered compaction and demoulded 24 hours after casting. They are placed in curing tank undisturbed till the day of testing. The mix proportions are tabulated below in Table 1.

Table 1- Control Mix proportions

Type Of Mix	Binder (%)				Fine aggregate (%)		Coarse aggregate (%)
	Cement	Fly ash	Silica Fumes	Quart	River sand	c sand	12 mm
Control mix(M	75	25	-	-	50	50	50
M1	75	25	7.5	-	50	50	50
M2	75	25	15	-	50	50	50
M3	75	25	-	7.5	50	50	50
M4	75	25	-	15	50	50	50
M5	75	25	7.5	7.5	50	50	50

I. Testing:

Specimens were taken from the curing tank on their 28th day testing. They are taken and placed in a dry environment for 4 hours and wiped well. Cubes and cylinders were tested on Compression testing Machine. Prisms were tested in flexure Testing Machine with a simply supported end conditions and two-point loading setup. The various test results are tabulated below in Table 2.

Table2 – Strength characteristics of M40 concrete

Mix Proportion	Compressive Stress (Mpa)	SplitTensile (Mpa)	Flexural Strength(Mpa)
M1	44.29	2.78	12.69
M2	42.1	3.74	11.33

M3	47.9	3.46	11.46
M4	37.2	2.278	7.54
M5	39.6	3.706	7.73
M6	41.5	3.975	10.69

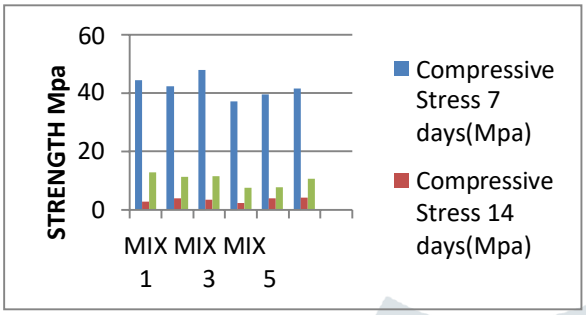

Figure 1- strength characteristics 28th day

IV. DISCUSSIONS AND CONCLUSIONFrom the above Figure 1, Increase in the level of silica fume, quartz and Fly ash replacement between 7.5% to 15% led to a reduction in the compressive strength of hardened concrete when compairing with control mix.Hence, Admixtures are highly advisable. Further investigations may be done for 56 days and 90 days.

V.REFERENCE

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