Study On Strength and Behavior of Self Compacting Concrete Using Quarry Dust and Steatite Powder

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Abstract- *Self Compacting Concrete which flows under its own weight and homogeneity while completely filling any formwork and passing around congested reinforcement. The experimentation is performed in with M25, M35 and M45 grade concrete, by replacement of Natural Steatite Powder and Quarry dust were 0%, 5%, 10%, 15%, 20% and 25% by weight of cement and Fine aggregate content respectively with polycarboxylic ether based superplasticizer and Viscosity modifying agent in SCC. Many different fresh concrete test methods slump flow, v-funnel and L-box have been developed in attempt to characterize the property of Self-Compacting concrete. The specimens of size 150mm x 150mm cube. Then the specimen is to tested on 7th and 28th days. The compressive strength is being determined. The fresh and mechanical properties are determine for checking the feasibility of Steatite Powder & quarry dust in concrete.*

Keywords- Self-Compacting Concrete, Steatite Powder, Quarry Dust, polycarboxylic ether, Viscosity modifying agent.

I. INTRODUCTION

Self-compacting concrete is basically a concrete which is capable of flowing in to the formwork, without segregation, to fill uniformly and completely every corner of it by its own weight without any application of vibration or other energy during placing. There is no standard self compacting concrete. Therefore each self-compacting concrete has to be designed for the particular structure to be constructed. However working on the parameters which affect the basic properties of self-compacting concrete such as plastic viscosity, deformability, flowability and resistance to segregation, self-compacting concrete may be proportioned for almost any type of concrete structure. To establish an appropriate mixture proportion for a self compacting concrete the performance requirements must be defined taking into account the structural conditions such as shape, dimensions, reinforcement density and construction conditions. The construction conditions include methods of transporting, placing, finishing and curing. The specific requirement of self-compacting concrete is its capacity for self-compaction, without vibration, in the fresh state. Other performances such as strength and durability should be established as for normal concrete.

II. MATERIAL USED

1. Cement

Ordinary Portland cement (53 Grade) used in this study, Which has specific gravity 3.15.

2. Steatite Powder

Steatite is a type of metamorphic rock, largely composed of talc ore, rich in magnesium. It is composed of hydrated magnesium silicate: MgSi4O10(OH)2. Steatite is the softest known mineral and listed as 1 on the Mohr's hardness scale.It is already used in paint industry, particularly in marine paints and protective coatings. This is used in ceramics due to its high resistivity, very low dielectric loss factor, and good mechanical strength. Addition of steatite powder increases the viscosity and mechanical properties of feed stock. The thermal properties of steatite are also good.

3. Quarry dust

During quarrying activity it is obtain as a by product. Quarry dust is the smaller aggregate particle. Hence was sieved and then used for the replacement of fine aggregate.

4. Aggregates

A. Fine Aggregate

Locally available sand passing through 2.36 mm sieve with specific gravity of 2.60 which falls under grading zone II were used for the entire investigation.

B. Coarse Aggregate

Coarse aggregates consist of aggregates larger than fine aggregates and their sizes vary from 2.0 to 4.75mm. These tend to improve quality and bond characteristics and

generally results in a higher flexural strength of concrete. It also helps in reducing shrinkage. These aggregates occupy 70-80% of volume of the concrete. It is having specific gravity of 2.80 and it is subjected to the sieve analysis the maximum size of large is 150 mm.

5. Superplasticizer

Master Glenium SKY 8233 is an admixture of a new generation based on modified polycrboxylic ether. The product has been primarily developed for applications in high performance concrete where the higest durability and performance is required. It is free of chloride & low alkali. It is compatible with all type of cement.

6. Viscosity Modifying Agent

Viscosity modifiers are high molecular-weight, water-soluble polymers used to raise the viscosity of water. Such compounds increase the cohesiveness of fresh concrete, reducing its tendency to segregate and bleed**.**

7. Water

Water is the most important and least expensive ingredient of concrete. Potable water free from organic substance is used for mixing as well as curing of concrete.

III. METHOD

This work includes the various test methods available for testing the fresh concrete mix and for testing the hardened concrete mix are studied in detail.

A. FRESH CONCRETE TESTS

The measured slump flow, v-funnel and L-Box test for various volume fractions of 0% to 25% of steatite powder and Quarry dust by weight of cement and sand respectively with Chemical Admixtures are in the acceptable range.

B. HARDENED CONCRETE TESTS

Specimen Details are

- Size of cube -150mm x 150mm

The specimens are carefully casted and demoulded after 24 hours, without disturbing the specimen and these were cured in curing tank for 7 days and 28days and determine the compressive strength.

1. Compressive test

The uniaxial compression test on cube specimens was performed with reference to IS-516 (Load increasing (@ 14 MPa/min.). Compressive loading was applied to the cube specimens 150 X 150 X 150. Three cubes were tested at each stage of curing for each type of mix design. In this paper the compressive strength demonstrated by concrete prepared 15% of cement and sand replacement and compared for three grades M25, M35 & M45 at 28 days.

IV. TEST RESULTS

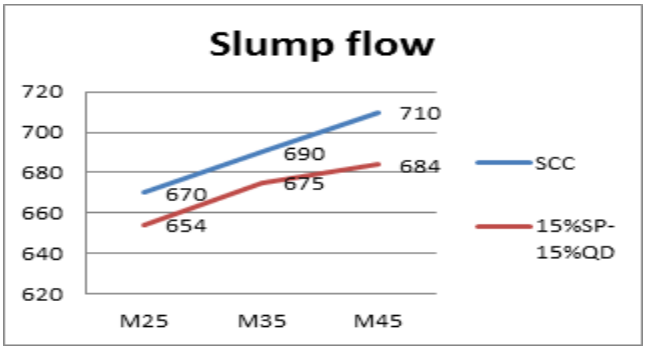
A. Fresh Concrete Test Results

In order to study the effect on fresh concrete properties when Steatite powder added as the concrete as cement replacement and Quarry dust added as the sand replacement in concrete, the SCC containing different proportion of Steatite powder and Quarry dust were tested for Slump flow, V-funnel, L-box.

The results of fresh properties of all self-compacting Steatite powder and Quarry dust concretes are included in followings Tables for M25, M35, and M45. The table shows the properties such as Slump flow, V-funnel flow times, L-box. In terms of slump flow, all sccs exhibited satisfactory Slump flows in the range of 550–800 mm, which is an indication of a good deformability.

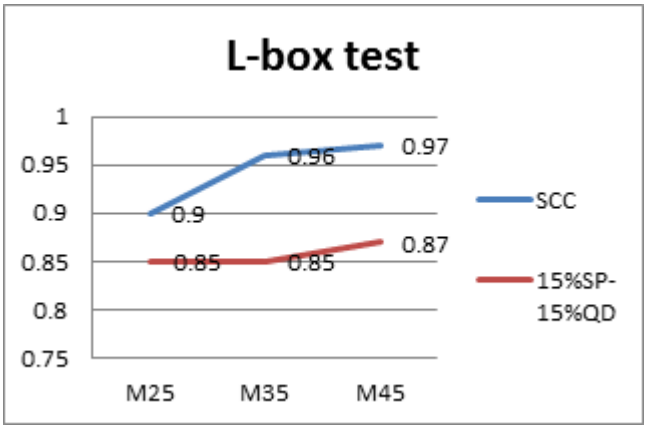
i. Slump Flow Test Results

Chart 1- Slump flow test Result



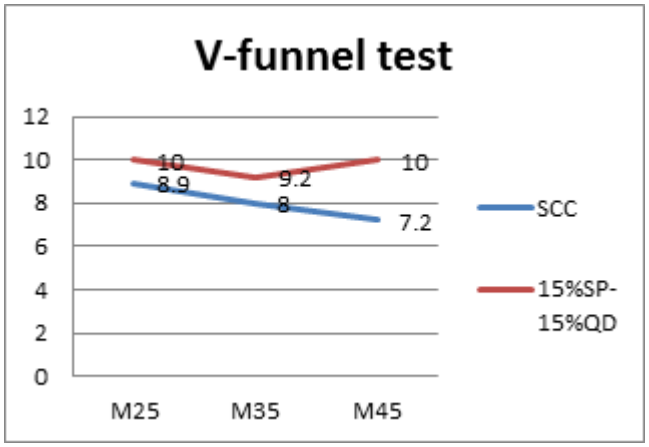
ii. L-box Results

Chart 2- L-box test Result



iii. V-funnel Test Results

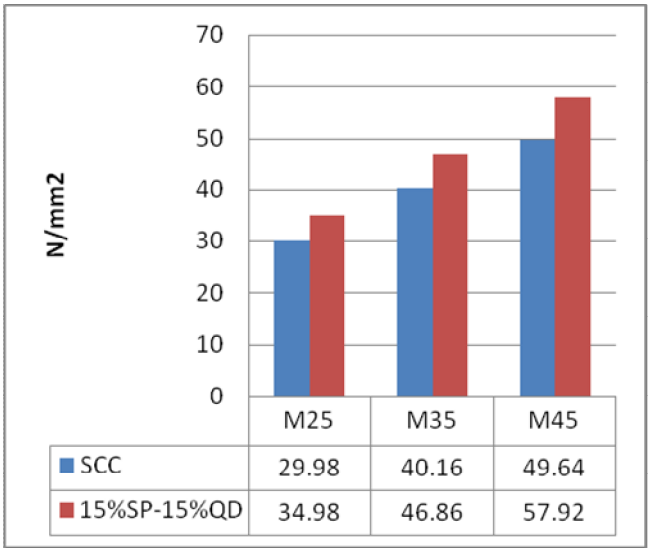
Chart 3- V-funnel test Result



2. Hardened Concrete Test Results

Test results for the compressive test for the M25, M35, and M45 grade with replacement of cement by steatite powder and sand replacement by quarry dust will shows results at 28 days are as shown below.

Chart 4- Compressive test Result at 28 Days



V. CONCLUSION

i. The percentage of Steatite powder and Quarry dust in the mix will affects the workability, mechanical and durability characteristic of SCC.
ii. Physical property of quarry dust is nearly same as sand.
iii. In present study fresh property of concrete test are slump flow exhibited satisfactory slump flow in rang of 650-800mm. In L-box test exhibited satisfactory results in range of 0.8-1.0. In V-funnel test exhibited satisfactory result in rang of 8-12sec for all mix in M25, M35 & M45 which indicate of a good workability
iv. Workability characteristics i.e., slump flow, L-box and V-funnel of the SCC mixes are linearly decreasing with increase in percentage of Steatite powder and Quarry dust.

v. The Compressive Strength is maximum for mix proportion 15% steatite powder and 15% Quarry dust for M25, M35 and M45 grade.

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