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To Check the Characteristics Strength of Self Compacting Concrete after partial replacement of Cement with Marble Dust and Sand with Iron Slag

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Abstract - This research study examines the characteristics strength of self compacting concrete on partial replacement of cement with marble dust and sand with iron slag. For this study, cement has replaced with marble dust by 20 % kept constant and sand has replaced with iron slag at 10, 15, 20, 25 %. After that on fresh concrete, slump flow test and L- box test are conducted. Then, compressive strength, flexural strength and split tensile strength tests are conducted on the hardened concrete at the end of 7, 14 and 28 days. From the test result, it was concluded that the compressive strength and split tensile strength is slight increased and then decreased and flexural strength is decreased at the end of 7, 14 and 28 days.

Key Words: Self-Compacting Concrete, Marble Dust, Iron Slag , Slump Flow, Compressive Strength, Flexural Strength, Split Tensile Strength.

1. INTRODUCTION

Self-Compacting Concrete (SCC) is a flowing concrete mixture that can combine under its own particular weight. The highly mobile nature of SCC makes it suited for situating in difficult conditions and in sections with congested reinforcement. Utilization of SCC can also help minimize hearing- related damages on the work site that are caused by vibration of concrete. The other advantage of SCC is that the time taken to place large sections is considerably shortened.

When the construction industry in Japan saw a fall in the availability of skilled trade union movement in 1980s, a demand was felt in a concrete that could master the problems of defective workmanship. This contributed to the development of self compacting concrete mainly through the work of Okamura. A council was made to examine the attributes of self-compacting concrete, letting in a fundamental investigation on the workability of the concrete, which was taken out by Ozawa et al. at the university of Tokyo. The first operational relation of self-compacting concrete was completed in 1988 and was named "High Performance Concrete" and later mentioned as "Self Compacting High Performance Concrete".

1.1 Current Studies in Self-Compacting Concrete

It can be break down in to following classifications:

a. Use of thermometers to obtain information about flow behavior of cement paste and concrete,

b. Mixture proportioning methods for SCC

c. Characterization of SCC using laboratory test methods.

d. Durability and hardened properties of SCC and their comparison with normal concrete

e. Construction issues related to SCC

These will be relevant to immediate demands.

In summation the following question also require particular consideration from a long-term perspective:

a. Development of mixture design guideline tables similar to those of normal concrete.

b. To shift to more 'normal' powder contents in SCC, from the existing high powder mixtures

c. Better understanding of the problem of autogenous and plastic shrinkage in the SCC, and

d. Development of site quality control parameters such as in "all-in-one" acceptance test.

2. OBJECTIVE OF THE STUDY

The objective of the study is to get self compacting concrete with different percentage replacement of cement with marble dust and sand with iron slag. The main objectives of the project are:-

1. To study the effect on compressive strength of concrete by replacement of cement with marble dust and sand with iron slag for different proportions.

2. To study the effect on split tensile strength of concrete by replacement of cement with marble dust and sand with iron slag for different proportions.

3. To study the effect on flexural strength of concrete by replacement of cement with marble dust and sand with iron slag for different proportions.

3. LITERATURE REVIEW

The following are the some past research survey:-

Ilker Bekir Topcua, Turhan Bilira and Tayfun Uygunoglub (2009):

According to this research paper, the author utilized the marble dust(MD) as a replacement of binder of SCC at certain contents of 0, 50, 100, 150, 200, 250 and 300 kg/m^3. After then, he performed the slump flow test, L-Box test and V-funnel test on fresh concrete. At the end of 28 days, he determined the compressive strength, flexural strength, ultrasonic velocity, porosity and compactness for the hardened concrete specimens. He additionally researched the impact of waste MD utilization as filer material on capillarity properties of SCC. As indicated by the test outcomes, he concluded that workability of fresh SCC has not been influenced up to 300 kg/m^3 MD content and the mechanical properties of hardened SCC have decreased by utilizing MD, particularly simply over 200 kg/m^3 content.

Rahrjo D. Subakti, A. Tavio (2013):

According to this research paper, the author determined the SCC's optimal composition and the requirements of passing ability, filling ability, viscosity and segregation. For this purpose, the author utilized some trial mixtures containing fly ash, polycarboxylate, silica fume based of superplasticizer and iron slag. The author conducted the slump cone, L-box and V-funnel tests for determining the concrete's passing ability, filling ability, viscosity and segregation. The author also tested cylindrical sample of 20 cm in height and 10 cm in diameter of hardened SCC at 3, 7, 14, 28 and 56 days of concrete age. The author tested the 33 variations of concrete mixture using 495 samples total mixture. Each composition contained various superplasticizer dose from

0.5 to 1.8 % of cementitious weight. The dose of silica fume was additionally fluctuated at 0% , 10% and 20% of fly ash weight. The author expected from the study, to obtained the optimal material composition of the mixture that produced the maximum compressive strength but cheaper and competitive in price.

Gurpreet Singh, Rafat Siddique Ph.D. (2016):

According to this research paper, the author investigated the durability characteristics of self-compacting concrete (SCC) made with iron slag (IS). For this purpose, the author initially designed a control SCC, and then fine aggregates were partially replaced with iron slag in a proportion of 0, 10, 25 and 40%. The author performed the different tests for fresh SCC properties, durability properties and compressive strength, such as rapid chloride permeability, resistance to sulphate attack, water absorption and ultra-sonic pulse velocity up to age of 365 days. The author also performed the Scanning Electron Microscopy (SEM) and X-ray Diffraction (XRD) analysis test. As indicated by the test outcomes, he concluded SCC incorporating iron slag gives better durability and strength than control mixture of SCC, and can be suitably utilized in SCC.

4. RESEARCH METHODOLOGY

Self Compacting Concrete is characterized by filling ability, passing ability and resistance to segregation. Many different methods have been developed to characterize the properties of SCC. No single method have been found until date, which characterizes all the relevant workability aspects, and hence, each mix has been tested by more than one test method for the different workability parameters. Table below gives the recommended values for different tests given by different researchers for mix to characterized as SCC mix.

S.No.	Property	Range
1.	Slump Flow Diameter	500 – 700 mm
2.	$T_{50\ cm}$	2-5 sec
3.	L-Box H2/H1	less than equal to 0.8

5. FINDINGS OF THE STUDY

In order to achieve the objectives of present study, an experimental program was planned to investigate the effect of Marble Dust and Iron Slag on flexural strength, compressive strength and split tensile strength of concrete so as to assess its feasibility for use in structure building. The experimental program consists of casting, curing and testing of controlled marble dust and iron slag concrete specimen at different ages.

1. Compressive Strength of Concrete

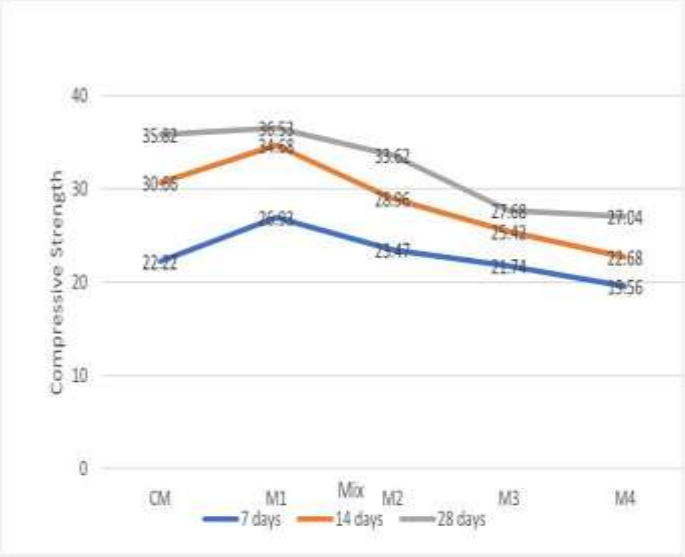

Figure 1- Variations in Compressive Strength

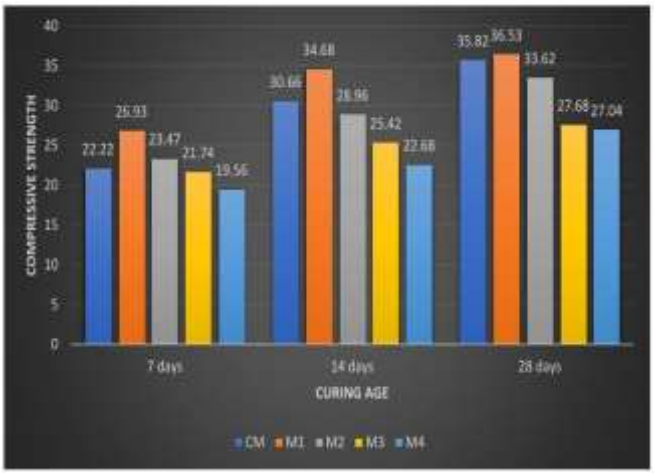

Figure 2- Variations in Compressive Strength with increase in curing age

2. Split Tensile Strength of Concrete

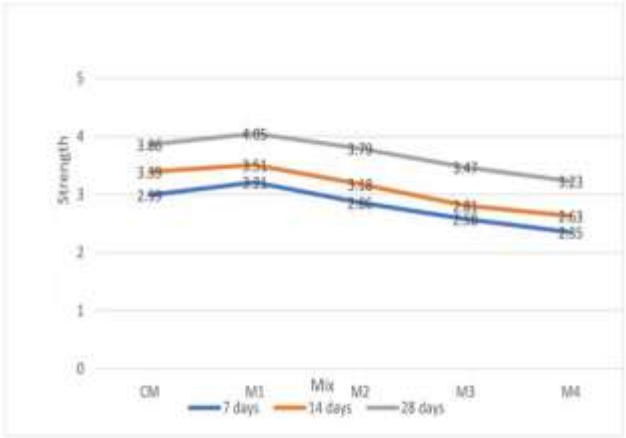

Figure 3- Variations in Split Tensile Strength

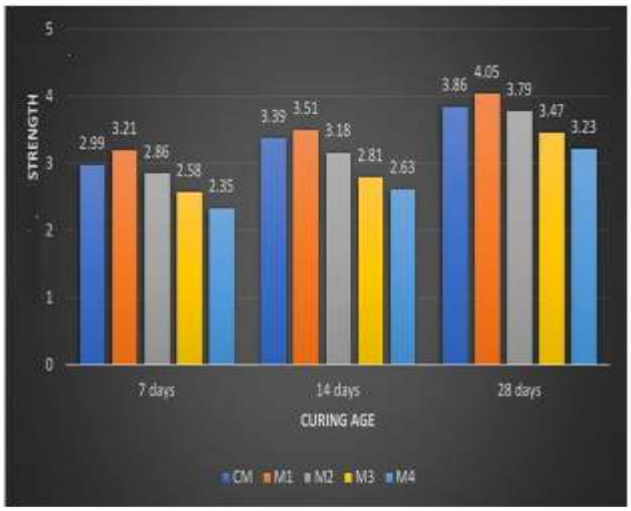

Figure 4- Variations in Split Tensile Strength with increase in curing age

3. Flexural Strength of Concrete

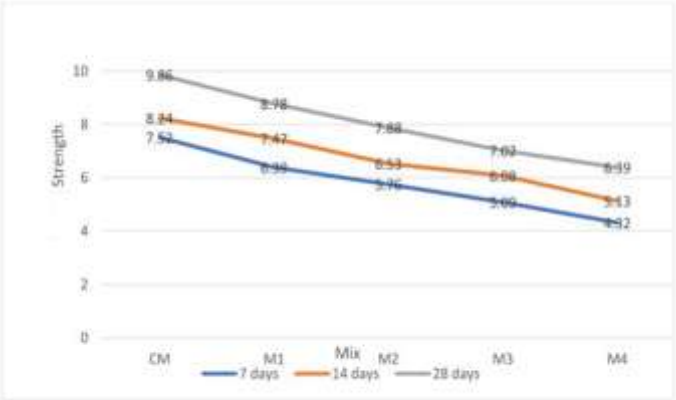

Figure 5- Variations in Flexural Strength

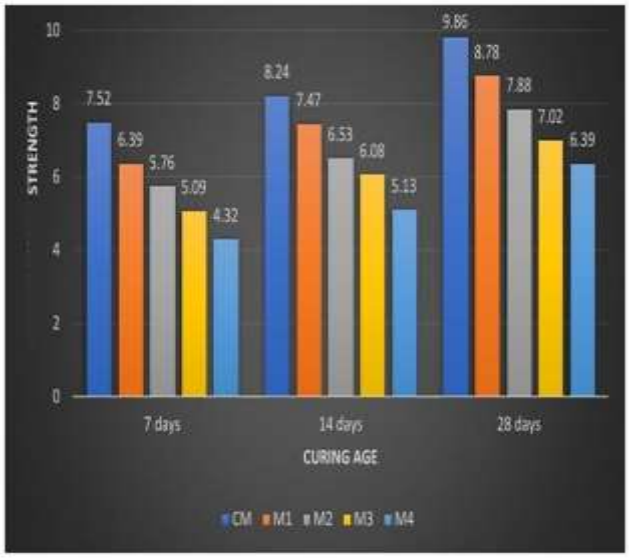

Figure 6- Variations in Flexural Strength with increase in curing age

6. CONCLUSIONS

Analyzing Compressive Strength:-

The graphs and bar chart of the compressive strength depicts that with the replacement of cement with marble dust and sand with iron slag there is an increase in the compressive strength of the concrete cubes at the 0.45 water cement ratio. The maximum compressive strength of the cubes is found at by replacing 20% of cement with marble dust and 10% of sand with iron slag. But further, compressive strength of the cubes decreases on replacement of cement with marble dust and sand with iron slag.

Analyzing Split Tensile Strength:-

The graphs and bar chart of the split tensile strength depicts that with the replacement of cement with marble dust and sand with iron slag there is an increase in the split tensile strength of the concrete cylinder at the 0.45 water cement ratio. The maximum split tensile strength of the cylinder is found at by replacing 20% of cement with marble dust and 10% of sand with iron slag. But further, split tensile strength of the cubes decreases on replacement of cement with marble dust and sand with iron slag.

Analyzing Flexural Strength:-

The graphs and bar chart of the flexural strength depicts that with the replacement of cement with marble dust and sand with iron slag there is decrease in the flexural strength of the concrete beam at the 0.45 water cement ratio. The maximum flexural strength of the beam is found in control mix only. But further, flexural strength of the beams decreases on replacement of cement with marble dust and sand with iron slag.

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