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An Experimental Study on the Effect of Industrial Waste on Compressive Strength of Self Compacting Concrete

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INTRODUCTION

Self-compacting concrete (SCC) is a special type of concrete which can be placed and consolidated under its own weight without any vibration effort due to its excellent deformability, and which at the same time is cohesive enough to be handled without segregation or bleeding. Self-compacting concrete (SCC), which was initially introduced in Japan, is a unique type of concrete that can flow and fill into every corner of formwork, even in the presence of congested reinforcing, entirely by its own weight and without the use of vibrating compaction, tamping, or other techniques. As the name implies, self-compacting concrete is identical to regular concrete. SCC behaves differently than standard composites due to the addition of extra admixtures (super plasticizers and viscosity modifying admixtures) and varying proportions of composite ingredients SCC has a large amount of extra cementitious ingredients, up to 70% of the overall powder volume. Fly ash, silica fume, blast furnace slag, and other additional materials are commonly used. SCC saves time, labor, and energy because it does not require compaction. A nice surface polish is also achieved. The high powder content of self-compacting concrete (SCC) distinguishes it. The water-powder ratio is the most essential metric in SCC, while the water-cement ratio is largely neglected. Fly ash content, sand- aggregate ratio, paste %, types of admixture utilized, and so on are all essential characteristics. The aggregate content of SCC is lower than that of traditional concrete, which necessitates the use of vibratory equipment. In SCC, the degree of coarse aggregate packing is roughly 50%. When concrete deforms, it's to lessen the interaction between coarse aggregate particles. The fine aggregate packing in SCC mortar is roughly 60%, limiting shear deformability when the concrete deforms. The viscosity of the paste in SCC, on the other hand, is the highest among the other forms of concrete due to the lowest water-powder ratio. This property is crucial in preventing segregation.

Test on Self Compacting Concrete

Slump flow test. The slump flow test is used assess the horizontal free flow of self- compacting concrete in the absence of obstructions. The test method is based on the test method for determining the slum. Recommended limit (760mm – 850mm (SF-3)

V Funnel Test. V funnel test on self-compacting concrete is used to measure the flow ability. But the follow ability of concrete is affected by its other properties as well which may affect the flow ability of the concrete during testing. Recommended limit (Less than 8.0 sec.)

L Box Test. This test assesses the flow of the concrete and also the extent to which it is subjected to blocking by reinforcement. Recommended limit (Between 0.8 to 1.0)

U Box Test. U Box test is used to measure the filing ability of self-compacting concrete. U box test was developed by the Technology Research Centre of the Taisei Corporation in Japan. Sometime the apparatus is called a “box shaped” test

Fill Box Test. Fill box test is also known as ‘Kajima test’ is used to measure the filling ability of self-compacting concrete with a maximum aggregate size of 20 mm

Objectives
To study the compressive strength of SCC with lime and fly ash as fine material.

To study the compressive strength of SCC with replacement of rice husk ash and marble powder as industrial waste fine

material.

To study the compressive strength of SCC with tyre rubber for coarse aggregate.

EXPERIMENTAL WORKS AND METHODOLOGY

Material Testing
Before starting any research work some preliminary test or work has to be done in lab or at site. The detailed experimental procedure is discussed below:

- Collecting all the basic materials like cement, sand and aggregate as per Indian Standard Specification.
- Finding all the basic properties of cement, sand and aggregate by performing basic tests on it.
- Getting cement: sand: aggregate ratio by defining w/c ratio by IS 10262-2019 mix design procedure.
- Casting of concrete cubes without addition of fibers of size 150mm×150mm×150mm for performing different tests of 7 and 28 days.

Procedure of Test
For this test mainly 150mm * 150 mm * 150 mm cubes are used

- Clean the moulds properly and apply oil inside the cube frame
- Fill the concrete in the molds in layers approximately 50mm thick
- Level the top surface and smoothen it with a trowel
- The concrete cubes are removed from the moulds between 16 to 72 hours, usually this done after 24 hours.

Remove the specimen from water after specified curing time and wipe out excess water from the surface. Take the dimension of the specimen to the nearest 0.2mm and then place the specimen in the machine in such a manner that the load shall be applied to the opposite sides of the cube cast. Align the specimen centrally on the base plate of the machine.

Rotate the movable portion gently by hand so that it touches the top surface of the specimen.

Apply the load gradually without shock and continuously at the rate of 140 kg/cm^2/min. till the specimen fails Record the maximum load and note it.

Fig Cube testing

CONCLUSIONS

The compressive strength of cubes was increase a lit bit after addition of Rice Husk Ash by 2% then decreasing further increase of Rice Husk ash.

The compressive strength of cubes was decrease after addition of Tyre Rubber.

The compressive strength of cubes was increase considerably on adding of 5% Marble Powder and increase in the percentage of Marble Powder then the compressive strength was decreased but found higher than the controlled cubes.

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