Research Article

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# Strength Characteristics of Self-compacting Concrete partially replaced with Waste Marble Powder

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## ABSTRACT

Self-compacting concrete is one of the most revolutionary developments in concrete research; this concrete is able to flow and fill the most congested places of the formwork without vibration. The properties of self-compacting concrete after the replacement of fine aggregate with waste marble powder at different percentages (0, 10, 20, 30, 40 and 50%) have been investigated in this work. The waste marble powder, finer than 4.75 mm, was used for the replacement of fine aggregate. With the increment in the dosage of waste marble powder, the workability of self-compacting concrete has increased. For the dosage of 30%, the properties observed were better than other dosages. The compressive strength tests were conducted at different mix proportions and the highest compressive strength was found at 30% dosage at 7-day and 28-day ages.

**Keywords:** Self-compacting concrete; Waste marble powder; Workability.

## 1. INTRODUCTION

The ability of self-compacting concrete lies not only in its high deformability mix but also in its resistance to segregation between coarse aggregate and mortar when the concrete flows through the confined zone of reinforcing bars (Arivalagan S, 2013). Self-compacting concrete (SCC) is an innovative concrete that does not require vibration for placing and compaction. It is able to flow under its self-weight, completely filling formwork, and has the ability to achieve full compaction. SCC is one of the most revolutionary developments in the field of concrete research. This concrete is able to flow and fill the most restricted places of the formwork without vibration (Zoran Grdic *et al.* 2008). SCC is a new category of high-performance concrete characterized by its ability to spread into a heavily reinforced area under its self-weight without the need for vibration and has excellent deformability and high resistance to segregation. There are numerous advantages of using SCC: (i) fast placement of concrete (ii) better consolidation around the reinforcement (iii) easily placed in thin-walled elements with limited access (iv) improves the quality, durability and reliability of concrete structures and (v) ease of placement results in cost-saving through a reduction in equipment and requirement of labor (Aggarwal Paratibha *et al.* 2005). SCC is an innovative development in the field of conventional concrete, which requires high binder content to increase its segregation resistance (Mahajan Sumit and Singh Dilraj, 2013). SCC can be defined as fresh concrete which possesses superior flowability and under-maintained stability. SCC was first developed in Japan in 1988 in order to achieve durable concrete structures by improving quality in the construction process (Goodier C I, 2003). SCC has the unique capacity of consolidation under its self-weight.

## 2. MATERIALS AND METHODS

**Cement**: Ordinary Portland Cement (OPC) of 43 grade and Shree brand conforming to IS- 8112-1989 were used throughout this research. The normal consistency of this cement was 28%. The physical properties of used cement are given in Table 1.

**Fine aggregate**: Locally available sand of River Ramganga conforming to IS: 383-1970, Zone-II, was used throughout this research. Specific gravity, bulk density and fineness modulus of used sand were 2.6, 1774 kg/m$^3$ and 3.18, respectively.

**Coarse aggregate**: Locally available crushed stone aggregates conforming to IS: 383-1970, of 10 mm maximum size was used as coarse aggregate throughout this research. Specific gravity, bulk density and fineness modulus of used coarse aggregate were 2.7, 1483 kg/m$^3$ and 6.45, respectively.

**Waste marble powder:** Waste marble powder was collected from the locally available manufacturing unit in Moradabad, U.P., India. It was initially in wet slurry form; by exposing it to sunlight and sieving by IS 4.75 mm sieve before mixing (Fig. 1), it was used in dry form. The physical properties of waste marble powder are given in Table 2.