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Study On Concrete Using Marble Powder Waste As Partial Replacement Of Sand.

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Abstract
Marble Waste (Marble sawing powder, and marble sludge or slurry) is a widespread byproduct of marble processing industries. All these wastes are thrown away in the areas near the factories and cause severe environmental problems. The main objective of this study is to explore the possibility of using marble powder waste as partial replacement of fine aggregate in concrete. Since this concrete is prepared with marble powder as a partial replacement of fine aggregate (Sand) in four different proportions i.e. 10%, 20%, 30% and 40% and tested for the period of 7days, 28days, 90days curing. This compressive strength compared with the conventional concrete i.e. concrete prepared without marble powder.
Keywords: - Marble powder, Portland Pozzolana Cement, Sand, concrete, compressive strength.

I. Introduction

These day marbles are widely used in construction work. A large amount of waste is generated during sawing, grinding and polishing process. The result is that the marble waste which is 20% of total marble quarried has reached as high millions of tons. Generally the marble wastes are being dumped in any nearby pit or vacant space near the marble processing industries, although notified areas have been marked for dumping the same. This leads to increased environmental risks as dust pollution spreads alongside for a large area. In the dry season, the dust dries up, floats in the air, flies and deposits on crops and vegetation. In addition, the deposition of such generated huge amount of fine wastes certainly creates necrotic ecological conditions for flora and fauna changing landscapes and habitats. The accumulated waste also contaminates the surface and underground water reserves. Now a day's marble waste is one of the causes of environmental problems around the world. Therefore, max. Utilization of marble waste in various industrial sectors, especially the construction, agriculture, glass and paper industries would help to protect the environment. Concrete is the most widely used construction material in the civil construction work because of its high structural strength and stability. Concrete is a heterogeneous mix of cement, aggregate (coarse and fine aggregate) and water. Aggregate can not only limit the strength of concrete also affect the durability and performance of concrete. The worldwide consumption of sand as fine aggregate in concrete production is very high, so maximum areas are facing acute shortage of good quality of sand. The main objective of the present work is to investigate the usability of the marble powder as partial replacement of fine aggregate instead of sand in concrete. Effect of waste marble powder in concrete has been investigated by experimental tests on conventional concrete without marble powder with varying quantities of marble powder by replacing the sand partially.

II. Material Used

2.1 Cement

Portland Pozzolana Cement (ACC) used in this study, which has specific gravity 3.10.

2.2 Marble Powder

The specific gravity of marble is 2.577. Local available Marble powder used as Partial replacement of fine aggregate in concrete.

2.3 Aggregates

Aggregates are the important constituents in concrete. They give body to the concrete, reduce shrinkage and effect economy. The coarse aggregate passing through a 20 mm and retained on 10 mm sieve is used. Its specific gravity of 3.0. Good quality Narmada River sand used as a fine aggregate conforming to Zone- II of IS: 383 – 1970 have a fineness modulus of 2.72 and a specific gravity of 2.64.

2.4 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

Based on the Indian Standard (IS: 10262 – 1982), design mix for M30 grade of concrete was prepared by partially replacing fine aggregate with five different percentages by weight of marble powder (0%, 10%, 20%, 30%, and 40%,) and 150x150x150 mm concrete cubes were casting. The nine specimens of each mix were prepared. After 24 hrs the specimens were removed from the mould subjected to water curing for 7, 28 and 90 days. After curing, the specimens were tested for compressive strength using a calibrated compression machine.

Figure 1. Compression Testing Machine

Table No.1: Details of Replacement of Sand By Marble Powder as Fine Aggregate

Sr. No.	Cement	Sand	Marble Powder	Aggregate
1	100%	100%	0%	100%
2	100%	90%	10%	100%
3	100%	80%	20%	100%
4	100%	70%	30%	100%
5	100%	60%	40%	100%

Table No.2: Mix Proportion for concrete M30

Material By Weight			Mix Proportion C:Sand:Wm:Ca:water
Marble %	Sand (Kg)	Waste Marble (Kg)	
0	600	0.000	1:1.40:0.00:2.96:0.43
10	540	60	1:1.26:0.14:2.96:0.43
20	480	120	1:1.12:0.28:2.96:0.43
30	420	180	1:0.98:0.42:2.96:0.43
40	360	240	1:0.84:0.56:2.96:0.43

IV. TEST RESULTS

A series of test was carried out on the concrete to obtain the strength characteristics of concrete with and without waste marble powder as fine aggregate, which is a replacement for sand in various percentages. The result of compression tests has been given in table no.3.

Table No. 3: Compressive Strength

Sr. No.	% Replacement	7 Days Strength N/mm2	28 Days Strength N/mm2	90 Days Strength N/mm2
1	0	27.04	39.55	54.08
2	10	27.11	40.59	54.67
3	20	27.18	41.04	54.81
4	30	25.92	36.15	45.33
5	40	23.85	33.48	43.85

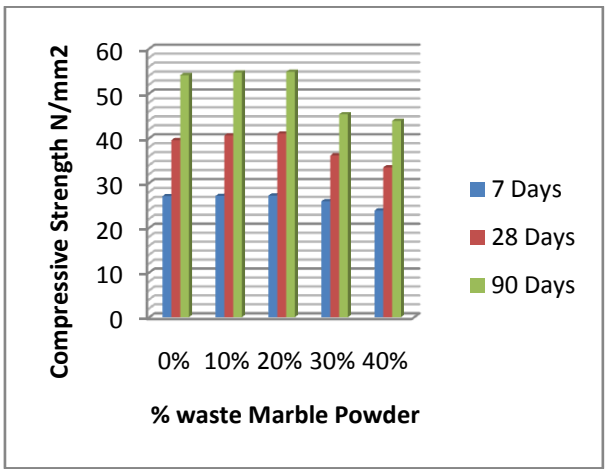

Figure 2. Average compressive strength of different percentage of waste marble powder.

V. CONCLUSIONS

From the test result (shown in fig. 2), the following conclusion can be drawn :-

- The compressive strength of concrete is increased when the percentage of marble powder waste is increased up to 20% and by further increasing the percentage of marble powder waste compressive strength gets reduced.
- Test also indicates that the waste marble powder can be successfully utilized as partial replacement of fine aggregate in concrete production. Their use in concrete will alleviate the problem of their disposal and environmental pollution.

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