RESEARCHERID
THOMSON REUTERS

[I-CONCEPTS-18]

ISSN 2348 – 8034
Impact Factor- 5.070

GLOBAL JOURNAL OF ENGINEERING SCIENCE AND RESEARCHES

EXPERIMENTAL INVESTIGATION ON PARTIAL REPLACEMENT OF CEMENT WITH MARBLE POWDER IN CONCRETE

Ganta Mounika[*1] & C. V. Siva Rama Prasad[2]

[*1&2]Assistant professor, Vignana Bharathi Institute of Technology, Hyderabad

ABSTRACT

Marble has been widely used in structures since the earliest times. Nowadays, marbles are used for various purposes, such as the construction of floors, walls, countertops, columns, etc., which increase their demand on the market. Marble dust is the waste product that is obtained during the process of sawing and stamping marble with the original marble rock, contains heavy metals and can cause serious environmental problems. Due to environmental problems, it has a major impact on human health and on nature. Thus, the reuse of this waste material can be emphasized. In this research work, the marble powder is replaced with concrete in various percentages, such as 5%, 10%, 15%, 20% and 25% for M20. The sequence of tests is carried out to study the consequences of 5%, 10%, 15%, 20% and 25% of the substitution of marble cement in the compressive strength and in the split tensile strength and corresponds to the conventional concrete.

Keywords: *Marble Powder, Cement, Compressive strength, split tensile strength, workability*.

I. INTRODUCTION

Marble is a metamorphic rock deriving from the transformation of a pure limestone. The purity of the marble is responsible for its color and appearance: it is white if the limestone is composed only of calcite (100% CaCO3). Marble is used for construction and decoration; Marble is durable, has a noble appearance and therefore has a great demand. A large amount of dust is generated during the cutting process. The result is that the mass of marble waste, which accounts for 40% of the marble quarries, has reached millions of tons. This huge unattended mass of marble waste made up of very fine particles is today one of the environmental problems in the world. Leaving these waste materials directly into the environment can cause environmental problems. Thus, the reuse of waste material has been underlined.

Research Significance

After a thorough review of the literature, it emerged that many researchers studied the behavior of concrete by substituting the fine aggregate with marble dust. Therefore, there is a wide field in the field of concrete substitutions with different percentages of marble dust (ie, the substituted cement%, 10%, 15%, 20%, 25% with marble dust are compared with conventional concrete). To study the influence of the partial substitution of the cementwith marble dust and to compare it with the compressive strength and the breaking strength of the concrete. Also to determine the percentage of marble dust that needs to be replaced in concrete, so that it provides maximum strength.

II. MATERIALS AND METHODS

Summarized information about materials used in the present study and their characteristics are presented herein.

Cement

In this experimental survey, ordinary Portland cement (grade 53) was used. The cement obtained was tested for physical properties according to IS: 4031-1988.

Water

The water to be used in concrete work must be free of a harmful amount of soil, free from acids, alkalis and inorganic impurities and free iron, a plant material that probably has a negative effect on concrete or reinforcement.

ISSN 2348 – 8034
Impact Factor- 5.070

Coarse aggregate
The properties of the raw aggregate such as the size of the aggregate, the shape, the classification, the texture of the surface, etc. they play an important role in the workability and strength of concrete and the size of the raw aggregate used was 20 mm.

Fine aggregate
Locally available river sand was used. The sand was dried before used to avoid problem of bulking. The sand is tested according to IS 2386-1963.

Marble Powder
Marble powder was collected from nearby alkapuri, nagole x-road, Hyderabad.

Compression test
The 150 x 150 x 150 mm steel mold is tight and well oiled. The concrete is poured into the mold and properly tempered so as not to leave empty spaces. After 24 hours, these molds were removed and allowed to cure in a hardening tank. They have been tested on a 200-tonne electro-hydraulic closed circuit machine. The test procedures were used according to IS: 516-1979.

Split tensile strength test
Concrete cylinders of 15 cm in diameter and 30 cm in length are used. The concrete is poured into the mold and properly tempered so as not to leave empty spaces. After 24 hours, these molds were removed and left to cure in a hardening tank and tested on a 200 ton electro-closed circuit machine.

Figure1. Compressive strength test specimen

ISSN 2348 – 8034
Impact Factor- 5.070

Figure2.Split tensile strength test specimen

III. MIX PROPORTIONING

The selection of materials and their required quantities was determined using IS 10262: 2009. A rotary drum mixer was used. All the ingredients were put into the mixer and the water was added during the rotation.

IV. RESULTS

The following results were obtained after perfoming the required tests.

Table 1: Compressive strength of cubes for 7days

Sl.No	Percentage replacement of marble powder	Compressive strength in N/mm^2
1	0	30.25
2	5	30.66
3	10	31.02
4	15	32.28
5	20	30.88
6	25	31.02

Table 2: Compressive strength of cubes for 14days

Sl.No	Percentage replacement of marble powder	Compressive strength in N/mm^2
1	0	34.96
2	5	35.15
3	10	35.50
4	15	36.11
5	20	35.05
6	25	35.5

Table 3: Compressive strength of cubes for 28 days

Sl.No	Percentage replacement of marble powder	Compressive strength in N/mm^2
1	0	38.5
2	5	39
3	10	39.2
4	15	42.2
5	20	38.9
6	25	38.85

Table 4: Split tensile strength of cylinders for 7 days

Sl.No	Percentage replacement of marble powder	Split tensile strength in N/mm^2
1	0	2.01
2	5	2.31
3	10	2.07
4	15	2.61
5	20	2.52
6	25	2.38

Table 5: Split tensile strength of cylinders for 14 days

Sl.No	Percentage replacement of marble powder	Split tensile strength in N/mm^2
1	0	2.68
2	5	2.70
3	10	2.96
4	15	3.03
5	20	2.86
6	25	2.84

Table 6: Split tensile strength of cylinders for 28 days

Sl.No	Percentage Replacement of marble powder	Split tensile strength in N/mm^2
1	0	3.11
2	5	3.16
3	10	3.27
4	15	3.53
5	20	3.40
6	25	3.35

V. CONCLUSION

The paper concluded that With the substitution of cement with 5%, 10%, 15% marble powder, the compressive strength of the concrete has gradually increased and, with a substitution of 20% and 25%, has started to decrease. With the substitution of cement with 5%, 10%, 15% marble powder, the concrete breakage strength of the concrete gradually increased and for 20% and 25% of the substitution started to decrease. The optimal replacement percentage was decided as 15%.

ISSN 2348 – 8034
Impact Factor- 5.070

REFERENCES

1. *Baboo Rai, et.al (2011) Influence of Marble powder/granules in Concrete mix. ISSN 0976 – 4399,PP 827-834.*
2. *Abrar Awol (2011) Using Marble Waste Powder in Cement and Concrete Production.*
3. *Nagabhushana, H. Sharada Bai (2011)Use of Crushed Rock Powder as Replacement of Fine Aggregate in Mortar and Concrete.ISSN: 0974-6846,PP-917-922.*
4. *Ahmed N. Bdour et.al (2011) Utilization of Waste Marble Powder in Cement Industry he feasibility of using Waste Marble Powder (WMP) in cement industry as a substitute limestone. http://www.eco-web.com/edi/111216.html*
5. *Omar M. Omar et.al (2012) Influence of lime stone waste as partial replacement material for sand and marble powder in concrete properties. HBRC Journal, PP 193-203.*