

USE OF MARBLE POWDER AS A PARTIAL REPLACEMENT OF CEMENT

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ABSTRACT

Improving the properties of concrete by addition of waste marble powder is becoming more popular now a day because it helps in achieving the economy and is a superior alternative for the concrete ingredient, which offers high strength. In this project we are going to test the cubes with varying percentage of waste marble powder and then test them on Compression Testing Machine (CTM). The focus of our project will be strengthening concrete by replacing cement by marble powder in the most economical way by using the proper grade of concrete for increasing Load Carrying Capacity.

Keywords: *Waste Marble Powder, Compression Testing Machine, Load Carrying Capacity*

I. INTRODUCTION

Improving the properties of concrete by addition of waste marble powder is becoming more popular now days because it helps in achieving the economy and superior alternative for the concrete ingredient, which offers high strength. This project deals with the casting of the concrete cubes with varying percentage of waste marble powder and then testing them on Compression Testing Machine (CTM). The focus of our project will be replacing cement. The advancement of concrete technology can reduce the consumption of natural resources and energy sources and also lessen the burden of pollutants on environment. Presently large amounts of marble dust are generated in natural stone processing plants with an important impact on environment and humans. This project describes the feasibility of using the marble sludge dust in concrete production as partial replacement of cement and to reduce the cost of the concrete by marble powder in the most economical way.

II. OBJECTIVES

1. To study the influence of partial replacement of cement with waste marble powder, and to compare it with the compressive strength of ordinary M20 concrete.
2. To determine and find the percentage of marble powder replaced in concrete that makes it economical.
3. As marble powder acts like a pollutant so by partially replacing cement with marble powder there will be reduction in pollution.

III. EXPERIMENTAL INVESTIGATION

The testing program has been decided based on literature survey & the objective of the proposed work. The experimental work includes testing of every material that are being used in the experiment Standard test with reference to I.S. code were performed on materials like cement, sand, aggregates and marble powder. A proper mix design of marble powder concrete was made.

IV. EXPERIMENTAL SETUP

All the specimens were tested in the Compressive Testing Machine. The testing procedure for the entire specimen was same. After the curing period of 28 days was over, the cube was washed and its surface was cleaned for clear visibility of cracks.

Compressive strength of concrete was undertaken on 15 cm cube specimens. At 7 days and 28 days of age. All specimens were removed 48 hours after casting, and then transferred to regular conditions (interior of the laboratory) till testing.



Photograph 1: Compressive testing of concrete block

V. SELECTION OF MATERIALS FOR CASTING OF CUBE

Cement:

Ordinary Portland cement (OPC) - 43 grade (Zuari Cement) was used for the investigation. It was tested for its physical properties in accordance with Indian Standard specifications.

Fine aggregate:

The fine aggregate used of a river sand which is, clear from all sorts of organic impurities was used in this experimental program. The fine aggregate was passing through 4.75 mm sieve and had a specific gravity of 2.75. The grading zone of fine aggregate was zone III as per Indian Standard specifications.

Course aggregate:

The coarse aggregates used were of two grades, non-reactive and available in local quarry. One grade contained aggregates passing through 12 mm sieve and retained on 20 mm size sieve. Another grade contained aggregates passing through 10 mm sieve but retained on 20 mm sieve.

Water:

Ordinary tap water used for concrete mix in all mix ratios.

Marble:

Waste Marble powder of 90Micron passing is used having specific gravity of 2.76. This waste marble powder is replaced in increasing percentage from 0% to 25%.



Photograph 2: Sieving of Marble Powder

VI. TESTING PROGRAM

The analytical study on Cubes with waste marble powder and conventional cubes strength .To predict the Compressive behavior of cubes when the load applied on it and also to predict which type of crack is developed during testing. Also to see how much amount of strength increase by adding the waste marble powder in concrete with varying percentage of 0%,5%,10%,15% , 20% and 25% likewise as compared to conventional concrete cube. Also to increase the percentage of adding of waste marble powder up to best possible percentage to reduce the waste from cutting of marble at factory.

VII. RESULTS AND DISCUSSION

The test results conducted on the conventional concrete cube as well as the cube with varying percentage of marble powder and the strength at end curing days of 7, 14 and 28.

Compressive Strength – 7 days:

Percentage Replacement of Marble Powder (%)	1. Load in (kN)	2. Load in (kN)	Compressive Strength in (MPa)
0%	606.5	616.5	21.175
5%	487.5	611	21.40
10%	537.6	540	23.5
15%	569.5	547.5	24.82
20%	494.5	525.5	22.66
25%	482	460.5	20.94

Table: Compressive Strength – 7 days

Compressive Strength – 14 days:

Percentage Replacement of Marble Powder (%)	1. Load in (kN)	2. Load in (kN)	Compressive Strength in (MPa)
0%	762.5	771.5	34.08
5%	698	703	31.13
10 %	716	703	31.5
15%	571	728.5	28.87
20%	626	636	28.04
25%	577	594.5	26.03

Table: Compressive Strength – 14 days

Compressive Strength –28 days:

Percentage Replacement of Marble Powder (%)	1. Load in (kN)	2. Load in (kN)	Compressive Strength in (MPa)
0%	874.5	905	39.54
5%	815.5	835.5	36.68
10 %	799	771	34.88
15%	727.5	728	32.34
20%	713.75	715.2	31.5
25%	699.5	680.5	30.66

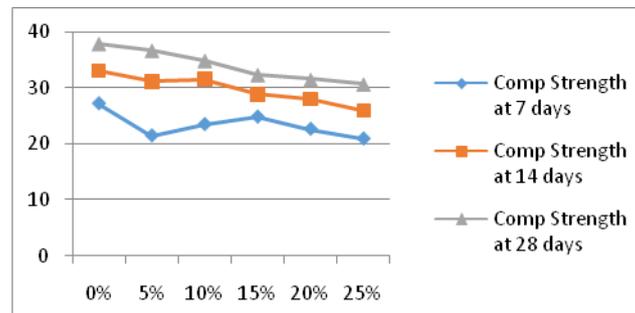
Table: Compressive Strength –28 days

The above table shows the compressive strength of concrete at the end of 7, 14 and 28 days of curing. According to tabular results; the result of 5 and 10 percentages replacement of marble powder is successfully run and also replacement up to a 20% is acceptable because at the end of curing of 28 days it give targeted mean strength as about 26.6Mpa. The result of 5 and 10 percentage replacement of marble powder is accepted. We also found that the there is sudden increase in the strength of concrete as the percentage of marble powder increases above the 10% and after replacement of 20% of marble powder there is reduction in strength.

Graphical Representation of Compressive strength:

In this topic the variation in compressive strength of concrete is seen graphically to improve the detailed information of it. Also it helps us to conclude the specific result about the strength.

Graphical representation of Compressive strength:



Graph: Graphical representation of Compressive strength

From above graph we get clear idea about the compressive strength variation of concrete.

VIII. CONCLUSION

The compressive behavior of Concrete of cube was studied. The Cubes of varying percentages like 0% 5%, 10%, 15%, 20% and 25% were casted and cured at specific days of internal and tested on Compressive Testing Machine. After the testing the result analysis is made and cost analysis is made from that result following Conclusion is made.

1. Due to waste marble powder, it proved to be very effective in assuring very good cohesiveness of mortar and concrete.
2. From the above study, it is concluded that the waste marble powder can be used as a partial replacement material for cement; and 20% replacement of marble dust gives an excellent result in strength aspect and quality aspect and it is better than the conventional concrete.
3. The results showed that the substitution of 20% of the cement content by waste marble powder induced higher compressive strength, and improvement of properties related to durability.
4. The best possible way of disposal of waste material like waste marble powder can be by using it in concrete, which will reduce environmental burden.

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