Partial Replacement of Cement by Marble Dust Powder for Ordinary Concrete (M20)

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***Abstract*—** Leaving the waste materials to the environment directly can cause environmental problem. Hence the reuse of waste material has been emphasized. Waste can be used to produce new products or can be used as admixtures so that natural resources are used more efficiently and the environment is protected from waste deposits. Marble stone industry generates both solid wastes and stone slurry. This paper focus on the utilization of waste of Marble dust powder in concrete and enhancement of strength of concrete more economically. The Marble dust powder was added in M20 grade of concrete at (0%, 5%, 10%, 15% & 20%) with partial replacement by weight of cement. Water/Cement ratio (0.50) was kept constant, in all the concrete mixes. The concrete samples (cube & cylinder) were tested for compressive strength & split tensile strength after 7 & 28 days of proper curing. Concrete mixtures were developed, tested and compared in terms of compressive strength and split tensile strength to the conventional concrete. The purpose of the investigation is to analyze the behavior of concrete while replacing the Marble Dust Powder with different proportions in concrete.

Index Terms *-Cement, Marble Dust Powder (MDP), Ordinary Concrete (M20), Compressive Strength, Split Tensile Strength*

I. INTRODUCTION

A. General

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 and cylinder 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.

B. Objective of investigation

In this project our main objective is to study the influence of partial replacement of cement with MDP. The compressive strength & tensile strength of ordinary M20 grade of concrete are obtained. Similarly compressive strength & tensile strength were obtained for 5%, 10%, 15%, & 20% replacement of cement with MDP by weight. The water cement ratio (0.50) kept constant throughout the investigation of this project work.

- To study the physical properties of Marble dust powder.
- To characterize the particle size of Marble dust powder.
- MDP as a replacement of cement material.
- To study the effect of MDP inclusion on the properties of concrete.

II. 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.

A. 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.

III.SELECTION OF MATERIALS FOR CASTING OF CUBE

A.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.

B.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 through4.75 mm

sieve and had a specific gravity of 2.75. The grading zone of fine aggregate was zone III as per Indian Standard specifications.

C. 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.

D. Water:

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

E . 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%.

IV. EXPERIMENTAL METHDOLGY

METHODOLOGY

A. General

This chapter deals with various studies that were carried out on plain concrete and concrete with CSA. Compression test is conducted on cube of standard dimensions respectively. Based on the result of the tests conducted in the laboratory, conclusions are drawn.

B Compressive Strength Test

General Compressive strength test is carried out as per Indian Standard code IS 516: 1959 on plain concrete and concrete with CSA and results are tabulated and conclusions are drawn.

C Weighing of materials -

Concrete is prepared for M20 mix, designed for plain concrete and concrete with CSA. Material such as cement, fine aggregate, coarse aggregate and CSA are free from impurities are weighed with an accuracy of 5%, 10%, 15% and 20% of weight of cement.

D Mixing of Materials-

Concrete is mixed in a non absorbent clean platform i.e., in a mixing tray with a trowel. Initially fine aggregate is put into the platform following cement and fine aggregate for plain concrete. For concrete with CSA, initially fine aggregate is put into the mixing tray followed by mixture of cement and slag and then coarse aggregates are mixed properly. At last required quantity of water as per water – cement ratio is added and mixed well within 2 minutes.

E.Mould Preparation-

Mould is cleaned properly and greased with mould oil. Concrete is placed in the mould of dimension 150mm x 150mm x 150mm, in 3 layers each layer of height approximately 50mm. After the placement of first layer of concrete it is compacte by a tamping rod of 16mm diameter, 0.6m long and bullet pointes at the lower end. The stroke of the bar is uniformly distributed over the cross section of the mould. Each layer is compacted with 25 strokes and next scoop of concrete is place followed by same manner of compaction and top layer is finished.

F. Curing of Specimen-

The test specimens are stored in place free from vibration, in moist air of at least 90% relative humidity and at a temperature of $27_0 \pm 2_0$ C for 24 hours from the time of addition of water to the dry ingredient. After this period, the specimen are marked and removed from the moulds and immediately submerged in cleaned fresh water and kept there until taken out just prior to test. The water in which the specimen are submerged, are renewed every seven days and maintained at a temperature of $27_0 \pm 2_0$ C. The specimens are not allowed to become dry at any time until they have been tested.

G.Method of Testing -

Specimen are tested at the ages of 7 and 28 days. The specimens to be tested are taken out from water and wiped to remove excess water and grit present on the surface. 3 specimen are tested for each type of mix at specific age. Cubes are placed on the compression testing machine of 200 tons capacity such that the marked face faces the observer and load is applied on the specimen and increased at the rate of 140kg/sq cm/min until the resistance of the specimen to the increasing load breaks down and no freater load can be sustained. Maximum load applied to the specimen was recorded and compressive strength of the concrete is found out using the relation,

Compressive strength = P / B X D

V. 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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REFERENCES

1. Pooja.J.Chavhan et al Int. Journal of Engineering Research and Applications ISSN:2248-9622 vol.4, April 2014.
2. ConcreteTechnology–M.S.Shetty. Design Of Concrete Mixes- N.Krishna Raju.
3. Bahar Demire (2010), "The effect of the using waste marble dust as fine sand on the mechanical properties of the concrete".
4. "International Journal of Civil and Structural Engineering Volume 1, No 4, (2011)." By Baboo Rai, Khan Naushad H , Abhishek Kr , Tabin Rushad S, Duggal S.K, (Influence Of Marble Granules In Concrete Mix).
5. Valeria Corinaldesi, Giacomo Moriconi, and Tarun R. Naik (2005) "Characterization Of Marble Powder for Its Use In Mortar And Concrete"