

“Experimental Investigation in Concrete by Partial Replacement of Sand with Marble Dust”

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Abstract - Concrete is the most extensively used and adaptable building material which is generally used to resist compressive forces. Since the use of Sand and production of Sand creates much more environmental issues and is costlier also. The Sand is produced in a natural way. Mining of sand in Narmada River due to natural calamities there is a danger. In the coming time so we have to be ready to deal with this problem. So we are looking from marble dust. Marble Dust is a developing composite material that will allow the concrete industry to optimize material use, generate economic benefits and build structures that will be strong, durable and sensitive to the environment. The marble dust was replaced with Sand at 0%, 5%, 10%, 15% and 20% by weight of sand in M20(1:1.5:3) grade concrete. Concrete mixes were experimentally tested and compared in terms of compressive strength of the conventional cement concrete at 7 days and 28 days for 150mmX150mmX150mm Sized cubes.

Key Words: Cement, Concrete, Marble Dust, Partial Replacement, Durability, Compressive Strength, Flexural Strength, Split Tensile Strength.

1. INTRODUCTION

The use of marble dust or waste has been used since ancient times as a Building Material. The industries dispose of marble powder material, material of marble powder consisting of very fine powder. Which is the cause of environmental problems in around the world? Marble big blocks are cut into smaller blocks in order to give them the desired smooth shape. During the cutting process about 25% the original marble mass is lost in the form of dust. Now a day's marble waste is one of the causes of environmental problems around the world. Therefore, maximum 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, coarse aggregate, fine aggregate (Sand) and water. Aggregate can not only limit the strength of concrete but also affect the durability and performance of concrete. Waste Marble powder can be used to improve the mechanical and physical properties of the conventional concrete. The possibility of utilizing waste marble powder as Cementations material in the production of concrete will also induce a relief on waste disposal issues. Now a days the demand for Sand is quite high in developing

countries owing to rapid infrastructural growth which results in supply scarcity and increase in the cost of material. If the waste material is used in the production of the concrete the construction cost decreases.

1.1 NECESSITY OF STUDY

1. For requirement of substitute for Sand.
2. To overcome the material shortage of concrete.
3. To lessen the expense by making utilization of locally accessible & waste materials.
4. To check different properties of concrete with adding various percentages of Marble Dust.

1.2 OBJECTIVE

1. Comparative study of the behavior of the concrete with & without Marble Dust.
2. To determine the compressive strength, split tensile strength & Bond strength of the Marble Dust used in concrete.
3. To study the behavior of concrete using Marble Dust in strength enhancement.
4. To find the optimum percentage of Marble Dust obtaining the maximum strength of concrete.
5. To prove the Marble Dust can be use as an economical civil engineering material.
6. To study the fresh and hardened properties of concrete.
7. To study the influence of percentage replacement of Sand by marble waste powder on the physical properties of Concrete.
8. To study the effects of percentage replacement of Sand by marble waste powder on different properties of concrete.
9. To achieve desired strength of M-20 (1:1.5:3) grade of concrete.

2. LITERATURE REVIEW

Deepanshu Patel{1} :

Investigation was done that there are several wastes being released from the industries which leads to many environmental and health problems and so it becomes necessary to find an appropriate solution to the emission of these wastes. Marble powder is an inert material which is procured as an industrial by-product during sawing, grinding, and polishing of marble is a cause to various environmental problems. These wastes can be used as the constituents of concrete by partially replacing the cement which makes it economical and also conserves our natural resources. The main objective of this research is to examine whether there is any possibility of utilizing marble powder in concrete production. This study includes different types of concrete mixes of M25 by replacing the cement with marble powder in various proportions (0%, 5%, 10% & 15%) by weight to determine the optimum percentage of replacement.

The testing for Compressive strength of these Concrete mixes is done at 7 and 28 days and the results are then compared with the Control Concrete. The results obtained after the research shows that marble powder can be used as a replacement for cement. From compressive strength tests it is concluded that the best proportion of marble powder is 10% with 28 days of curing. Use of marble powder in concrete does not affect the setting time of concrete.

Vijaya Kumar YM et al. {2}:

Leaving the waste materials to the environment directly can cause environmental problem. Hence the reuse of waste material has been emphasized. Partial replacement of cement by varying percentage of marble dust Powder reveals that increased waste marble dust powder ratio result in increased workability and compressive strengths of the concrete Marble Dust Powder is settled by sedimentation and then dumped away, which results in environmental contamination, in addition to forming dust in summer and threatening both agriculture and public wellness.. In this research work, Marble Dust Powder has replaced the (OPC & PPC) cement accordingly in the reach of 0%, 5%, 10%, 15% 20%, & 25% by weight of M-20 grade concrete. Concrete mixtures were developed, tested and compared in terms of compressive 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.

Ramya Raju et al. {3}:

This paper presents the study of concrete mix design using marble powder. The disposal of marble powder from the marble industry is one of the environmental problems

today. The places where marble is used for various purposes, the use of marble powder can be included for construction purpose Marble powder is produced from processing plant during the sawing and polishing of marble blocks and about 20 – 25% of the processed marble is turned into powder form. Disposal of the marble powder material from the marble industry is one of the environmental problems worldwide today. The replacement is done partially in various proportions and its effect on properties of concrete is studied. The optimum percentage for replacement of marble powder to attain the maximum strength is 50% replacement where as in tensile strength the optimum strength is achieved by 10% replacement by cement. As the percentage replacement of marble powder increases the workability reduces. The use of marble powder reduces the cost of construction as it used in mixing with concrete for building of floors and other structures and it also reduces the proportion of water cement ratio. Based on the study the following conclusions are drawn:

- The compressive strength is increases at 0.4 w/c ratio, but decreases the tensile strength.
- The partial replacement of cement by marble powder is used up to M25 grade concrete.
- The strength decreases beyond the use of M 25 grade, but shall be improved on the addition of super plasticizer.
- As per the comparative study on use of super plasticizer the strength is increased by 2% for M30 in 28 days, whereas by using only marble powder the strength increases by 9% for M25 with 0.4 w/c ratio in both the cases.
- Use of super plasticizer with marble powder as a partial replacement of cement in higher grades shall be useful for high rise structure to reduce the economy.

Devesh Meena {4} :

The main objective of this research is to investigate the possibility of utilizing waste marble dust (MD) in cement and concrete production. In present study experimental investigation conducted on optimum marble dust replacement with sand. After cutting and sawing marbles, in large amount of marble slurry produce. This marble slurry disposed to open land area, it make land pollution and harmful to land. In road construction it can use as substitute of fine aggregate, it has good binding property and gives enough strength to concrete and due to this it is suitable to bear heavy load on rigid pavement. In present study compressive strength of concrete at 28 days was checked, and this concrete is prepared by mixing cement, aggregates, water and sand. In further study sand is replaced by marble dust, and then concrete was prepared. The replacement ratios which have been studied were 0.0%, 10%, 20%, 30%,

40%, and 50% by weight. Water – cement ratio kept 0.55. Concrete made with marble dust as sand replacement achieved better performance compared to normal concrete. Experiment such as specific gravity test of sand and marble dust by pycnometer method, moisture content of marble dust and sand by oven drying method, specific gravity test of cement by Le-Chatelier flask method, normal consistency of cement, and initial setting time of cement, were performed to determine the physical property of concrete. On fresh concrete slump test was performed to check workability of concrete and after then compressive strength was checked. Thus marble dust is appropriate substitute of fine aggregates in concrete mix for construction. In present study experimental investigation conducted on optimum marble dust replacement with sand. After cutting and sawing marbles, in large amount of marble slurry produce. This marble slurry disposed to open land area, it make land pollution and harmful to land. In road construction it can use as substitute of fine aggregate, it good binding property and give enough strength to concrete.

1. Specific gravity of sand 2.58 and marble dust's 3.06, thus specific gravity of marble dust is more than sand.
2. Sand has more water content then marble dust. So for preparing concrete mix marble dust require more water to add.
3. Initial setting time of cement was found 45-50 minute.
4. In slump test workability of marble dust-concrete was determined, as amount of marble dust increased slump value also decreased as compare to normal cement concrete. For desired slump value for workability add more water added.
5. In compressive strength test on harden concrete cube, it was found as amount of marble dust increased compressive strength decrease but it has enough compressive strength as require for construction. Up to 50% fine aggregate can replaced with sand.

Mr. Ranjan Kumar, Shyam Kishor Kumar {5}:

In this research work, the waste MDP passing through 90 microns, has used for investigating of hardened concrete properties. Furthermore, the effect of different percentage replacement of MDP on the compressive strength, splitting tensile strength (Indirect tensile

strength) & flexural strength has been observed. In this experimental study, the effect of MDP in concrete on strength is presented. Five concrete mixtures containing 0%, 5%, 10%, and 20% MDP as cement replacement by weight basis has been prepared. Water/cement ratio (0.43) was kept constant, in all the concrete mixes. Compressive strength, split tensile strength & flexural strength of the concrete mixtures has been obtained at 7 and 28 days. The results of the laboratory work showed that replacement of cement with MDP increase, up to 10% for compressive strength, & up to 15% for split tensile strength & flexural strength of concrete. The usage of MDP in concrete improved its quality in terms of strength. The following conclusions were based on the study on the test result.

- a. The Compressive strength of Concrete increases up to 10% replacement of cement by MDP and further increasing of percentage of MDP leads to decrease in compressive strength of concrete.
- b. The Split tensile strength of concrete increases up to 15% replacement of cement by MDP & further increasing of percentage of MDP leads to decrease in Split tensile strength of concrete.
- c. The Flexural strength increases up to 15% replacement of cement by MDP and further increases in the percentage of MDP leads to decrease in flexural strength.
- d. It is concluded that the MDP can be used as a replacement material of cement, and 10% replacement of cement with MDP gives an excellent result in strength, as compared to the normal concrete.
- e. Use of these waste material leads to sustainable development in construction industry.
- f. To save the environment, MDP may be used as better partial substitute as a replacement of cement in concrete.

3. METHODOLOGY

As Sand is halfway supplanted by Marble Dust, so in first phase of work 5 batches of various proportions of binders are arranged and cubes and cylinder are casted. Results acquired were examined and extent that gave ideal qualities is taken for the following stage.

Testing of materials:- Concrete (M-20)

1. Slump Test for concrete
2. Compressive Strength Test
3. Split Tensile Test
4. Bond Test of Concrete Test Procedure (IS-227-1967)

4. EXPECTED OUTCOMES

1. Decrease in Slump Value
2. Increase Compressive Strength of concrete
3. Increase Split Tensile Strength of Concrete
4. Increase Bond Strength of Concrete

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