

REPLACEMENT OF CEMENT WITH MARBLE POWDER

¹M.Naveen Kumar, PG Scholar, Dept Of Structural Engineering, Geethanjali College of Engineering and Technology,

²M.Mujahid Ahmed, Assistant Professor, Dept of Civil Engineering, Geethanjali College of Engineering and Technology.

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%, 25% & 30%) 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 and split tensile strength after 7 & 28 days of proper curing. The results of the laboratory work showed that replacement of cement with Marble dust powder increases up to 10% for both compressive strength and split tensile strength of concrete.

Keywords: Marble Powder, Cement, Compressive Strength, Split Tensile Strength.

1. INTRODUCTION

Marble has been commonly used as a building material since the ancient times. The industry's disposal of the marble powder material, consisting of very fine powder, today constitutes one of the environmental problems around the world. Marble 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 [1]. 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, aggregate (coarse and fine aggregate) and water. Aggregate can not only limit the strength of concrete but also affect the durability and performance of concrete. The advancement of concrete technology can reduce the consumption of natural resources and energy sources which in turn further decreases the burden of pollutants on the environment. One of the logical means for reduction of the waste marble masses is by utilizing them in building construction. 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 cementitious material in the production of concrete will also induce a relief on waste disposal issues. Now-a-days the demand for cement 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.

2. RELATED WORK

It has been estimated that several million tons of MDP are produced during quarrying worldwide. Hence utilization of marble powder has become an important alternative materials towards the efficient utilization in concrete for improved harden properties of concrete. Marble is a metamorphic rock resulting from the transformation of a pure limestone. The purity of the marble is responsible for its colour and appearance it is white if the limestone is composed solely of calcite (100% CaCO_3). Marble is used for construction and decoration; marble is durable, has a noble appearance, and is consequently in great demand. Chemically, marbles are crystalline rocks composed predominantly of calcite, dolomite or serpentine minerals. The other mineral constituents vary from origin to origin. The main impurities in raw limestone (for cement) which can affect the properties of finished cement are magnesia, phosphate, leads, zinc, alkalis and sulfides. A large quantity of MDP is generated during the cutting process. Moreover, there is a limit on the availability of natural aggregate and minerals used for making cement, and it is necessary to reduce energy consumption and emission of carbon dioxide resulting from construction processes, solution to this problem are sought through usage of MDP as partial replacement of Portland slag cement. In India, MDP is settled by sedimentation and then dumped away which results an environmental pollution, in addition to forming dust in summer and threatening both agriculture and public health.

3. LITERATURE SURVEY

A. Manju Pawar et.al (2014) A Study has been conducted on Periodic Research, The Significance of Partial replacement of Cement with Waste Marble Powder. They found that the effect of using marble powder as constituents of fines in mortar or concrete by partially reducing quantities of cement has been studied in terms of the relative compressive, tensile as well as flexural strengths. Partial replacement of cement by varying percentage of marble powder reveals that increased waste marble powder (WMP) ratio result in increased strengths of the mortar and concrete .

B. V.M. Sounthararajan et.al (2013) A Study has been conducted on Effect of the Lime Content in MDP for Producing High Strength Concrete. They found that the MDP up to 10% by weight of cement was investigated for hardened concrete properties. Furthermore, the effect of different percentage replacement of MDP on the compressive strength, splitting tensile strength and flexural strength was evaluated. It can be noted that the influence of fine to coarse aggregate ratio and cement-to- total aggregate ratio had a higher influence on the improvement in strength properties. A phenomenal increase in the compressive strength of 46.80 MPa at 7 days for 10% replacement of MDP in cement content was noted and also showed an improved mechanical property compared to controlled concrete.

C. Corinaldesi V et al., (2010) Marble as a building material especially in palaces and monuments has been in use for ages. However the use is limited as stone bricks in wall or arches or as lining slabs in walls, roofs or floors, leaving its wastage at quarry or at the sizing industry generally unattended for use in the building industry itself as filler or plasticizer in mortar or concrete. The result is that the mass which is 40% of total marble quarried has reached as high as millions of tons.

4. IMPLEMENTATION

The most valuable property in concrete is the compression strength because it gives the overall quality of hardened concrete. The hardened concrete tests conducted were the compressive test, split tensile test & flexural test. The mechanical property of hardened concrete depends upon the cementitious material available in the mix. Mechanical behavior of concrete was studied for M25 grade of cubes were casted and cured for 7 and 28 days. Compressive strength of concrete is tested on cube at different percentage of MDP content in concrete.

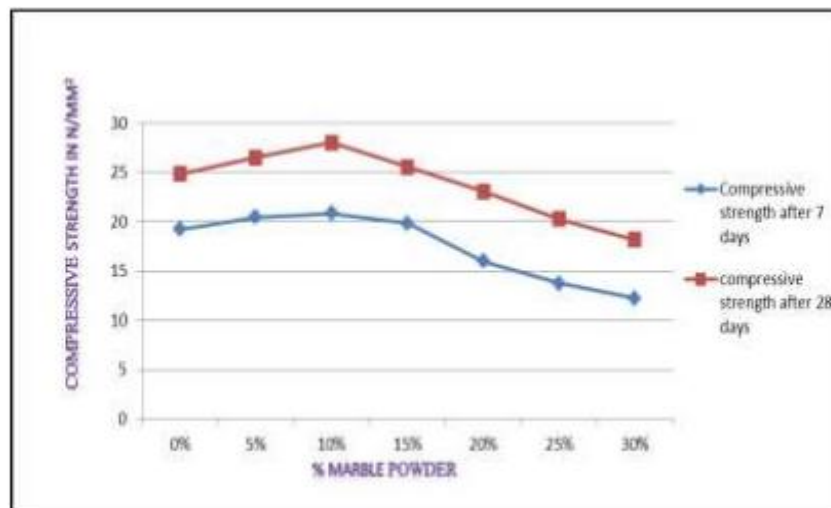


Fig.1.Power difference

The strength of concrete has been tested on cube at 7 days curing and 28 days. And the results obtained. With replacement of MDP in %age, in concrete 7 days test has been conducted to check the gain in initial strength of concrete Split tensile strength is done as per IS 5816- 1999. The test is conducted on Compression testing machine of capacity 2000 KN as shown in Fig. 4.3, and the results obtained are reported in Table 4.4 & shown in graph 4.3. The cylinder is placed horizontally between the loading surfaces of compression testing machine and the load is applied till failure of the cylinder. Packing material such as plywood is used to avoid any sudden loading. During the test the platens of the testing machine should not be allowed to rotate in a plane perpendicular to the axis of cylinder.

5. ANALYSIS

The cylinder is placed horizontally between the loading surfaces of compression testing machine and the load is applied till failure of the cylinder. Packing material such as plywood is used to avoid any sudden loading. During the test the platens of the testing machine should not be allowed to rotate in a plane perpendicular to the axis of cylinder. The bearing surfaces of the supporting and loading rollers are wiped clean before loading. The prisms are placed in the machine in such a manner that the load is applied to the upper most surface along the two lines spaced 13.30 cm apart. The axis of the specimen is aligned with the axis of the loading device. The load is applied at a rate of 180 kg/min without shock on the specimen.

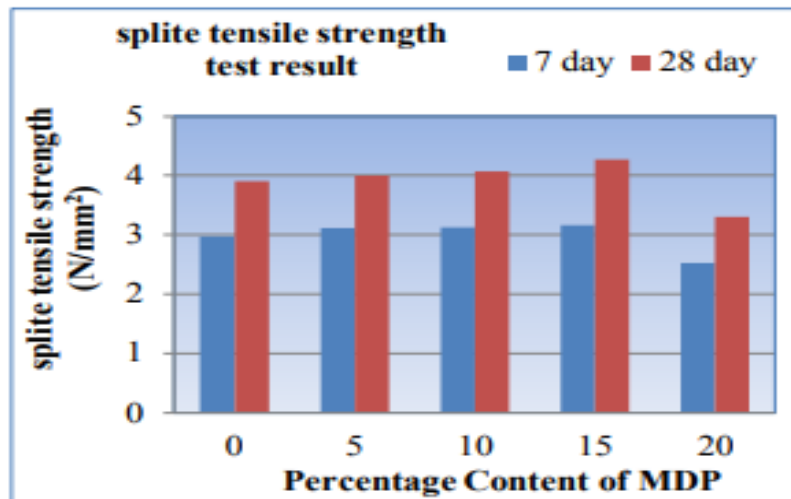


Fig.2.Split Strength

The aim of this research is to develop high strength concrete with the utilization of a waste product MDP. MDP possesses good pozzolanic activity and is a good material for the production of concrete. Also now a day's one of the great applications of MDP is in various structural fields as in reinforced cement concrete, which is gaining popularity because of its positive effect on various properties of concrete. In this project our main objective is to study the influence of partial replacement of cement with MDP. The compressive strength, tensile strength & flexural strength of ordinary M25 grade of concrete are obtained. Similarly compressive strength, tensile strength & flexural strength were obtained for 5%, 10%, 15%, & 20% replacement of cement with MDP by weight. The water cement ratio (0.43) kept constant throughout the investigation of this project work.

CONCLUSION

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. 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. 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.

REFERENCES

- [1]Manju Pawar et.al (2014) Feasibility and need of use of waste marble powder in concrete production. ISSN No. 2349-943435.PP 1-6.
- [2] V.M.Sounthararajan and A. Sivakumar (2013) Effect of the lime content in marble powder for producing high strength concrete .ISSN 1819-6608.PP 260-264.
- [3] Corinaldesi V, Moriconi G, Naik TR, (2010), —Characterization of marble powder for its use in mortar and concretel, Const. Build. Mat., 24, pp 113-117.

- [4] Vaidevi C (2013) Study on marble dust as partial replacement of cement in concrete .ISSN 2319 – 7757.PP14-16.
- [5] Candra Aditya, Abdul Halim Chauliah, Fatma Putri, Waste Marble Utilization from Residue Marble Industry as a Substitution of Cement and Sand within Concrete Roof tile Production International Journal of Engineering Research Volume No.3, Issue No.8, pp.: 501- 506 ISSN: 2319-6890) (online), 2347-5013(print) 01 Aug2014
- [6] Prof. Veena G. Pathan¹, Prof. Md. Gulfam Pathan² Feasibility and Need of use of Waste Marble Powder in Concrete Production IOSR Journal of Mechanical and Civil Engineering (IOSR-JMCE) e-ISSN: 2278-1684, p-ISSN: 2320-334X PP 23-26.