Partial Replacement of Cement with Marble Dust Powder in Concrete.

Ashish M. Parkhi[1], Prof. Shashikant A. Deshmukh[2]

[1]*graduated student, department of civil engineering ,PRMIT&R Badnera ,India.*
[2]*Professor,department of civil engineering ,PRMIT&R Badnera ,India.*

Abstract: *Concrete is the most widely used construction material in civil engineering industry because of its high structural strength and stability. 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 waste and stone slurry. The concrete industry is constantly looking for supplementary material with the objective of reducing the solid waste disposal problem. Marble Waste i.e. Marble sawing powder, pieces of irregular size and marble sludge or slurry is a widespread by product of marble processing industries. All these wastes are thrown away in the areas near the factories and cause severe environmental problems. The main objective of this study is to explore the possibility of using marble powder waste as partial replacement of cement in concrete. Since this concrete is prepared with marble powder as a partial replacement of cement in different proportions i.e. 0%, 5%, 10% and 15%. Concrete of different mix is prepared and tested for the period of 7days , 21days and 28days days curing. This compressive strength is compared with the conventional concrete i.e. concrete prepared without marble powder.*

Keywords: **Marble powder , Portland Pozzolana Cement, Sand, Concrete, Compressive strength.**

1. INTRODUCTION

It has been estimated that several million tons of Marble dust Powder (MDP) are produced during quarrying worldwide. Hence utilization of marble powder has become 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 color and appearance it is white if the limestone is composed of calcite (100% CaCO3). 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. Leaving these waste materials to the environment directly can cause environmental problem. 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 slg 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. Therefore, utilization of the MDP in various industrial sectors especially the construction, agriculture, glass and paper industries would help to protect the environment. Waste can be used to produce new products or can be used as admixtures so that natural resources are used more efficiently.

2. Objectives

The main objective is to study the influence of partial replacement of cement with MDP. The compressive strength of M50 grade of concrete are obtained. Similarly, compressive strength was obtained for 5%, 10% & 15% replacement of cement with MDP by weight. The water cement ratio (0.38) kept constant throughout the investigation of this project work.

3.1 Applications of Marble Ingredient

.An additive for thermoplastic and as a hardening agent for rubber industry are as follows.

1. Power coating, paints and ceramic industry.
2. Reinforced polyester glass fiber
3. leather cloth and flooring applications
4. detergent applications
5. glass industry (in manufacturing sheet & optical glasses)

3.2 Disadvantages of marble wastes

1. Marble dust increases the soil alkalinity.
2. The waste is dumped on land the dust is airborne by the wind and makes air pollution in environment.
3. Marble dust affect the soil fertility and reduce them.

4. Specimen used for experiment

To test the compressive strength of concrete, totally twelve standard cube specimens of dimension 15cm x 15cm x 15cm were cast. Three specimens were cast for each mix with replacement of Waste Marble Dust with cement.

5. TESTS PERFORMED

5.1 Sieve Analysis

The sieve analysis is a practice or procedure used to evaluate the particle size distribution of the particulate material. Size distribution is often very important to the way the material performs during use. Sieve analysis is a precise method of all sorts of non-organic or organic particulate matter including sand, crushed rock, clay, granite, feldspar,

coal, soil, a wide range of manufactured powders, cereals and seeds. Probably the most common as it is a simple technique like particle sizing. Fineness modules of given marble dust is 2.505.

5.2 Test for Compressive Strength of Concrete

For the cubic compression test of concrete, a cube of 150 mm × 150 mm × 150 mm size was used. All cubes were tested in the ambient curing process. For the different proportions, cubes were tested using a 1000 KN volume compression tester 7 days, 21 days and 28 days after curing. After placing the test piece in the center of the testing machine, the test was conducted with a uniform stress of 10 kg / cm 2 / min. Loading continued until the readings were reversed from the incremented value. Reversal of the reading indicates that the test piece has failed.The machine stopped, and it turned out that reading at that moment was the ultimate load. The value obtained by isolating the final load by the cross-sectional area of the sample is equal to the final cubic compressive strength.

6. EXPERIMENTAL PROGRAMME

6.1 Mixture Proportioning

The M50 mix proportioning is designed as per guidelines, according to the Indian Standard Recommended Method IS 10262- 2009. The total binder content was 476.71kg/m³, fine aggregate is taken 782.55 kg/m³ , coarse aggregate is taken 1386.67 kg/m³. This research is carried out on mix of M50 grade concrete with replacement of 0%, 5%, 10% & 15% of Cement with Marble dust is carried out to determine the optimum percentage of replacement at which maximum compressibve strength is achieved .

The concrete was left in the mould and allowed to set for 24 hrs before the cubes were demoulded and placed in curing tank until the day of testing.The three specimens of each mix was prepared and left for curing in the curing tank for 7, 21 and 28 days.

Grade of concrete	Water cement ratio	C.A.	Natural sand		Replacement in percentage	Cement replacement with marble ingredient	Cement
			Churi	Kanan			
M50	0.38	40.11	4.5	18.00	0%	0	13.79
M50	0.38	40.11	4.5	18.00	5%	0.69	13.09
M50	0.38	40.11	4.5	18.00	10%	1.38	12.40
M50	0.38	40.11	4.5	18.00	15%	2.07	11.72

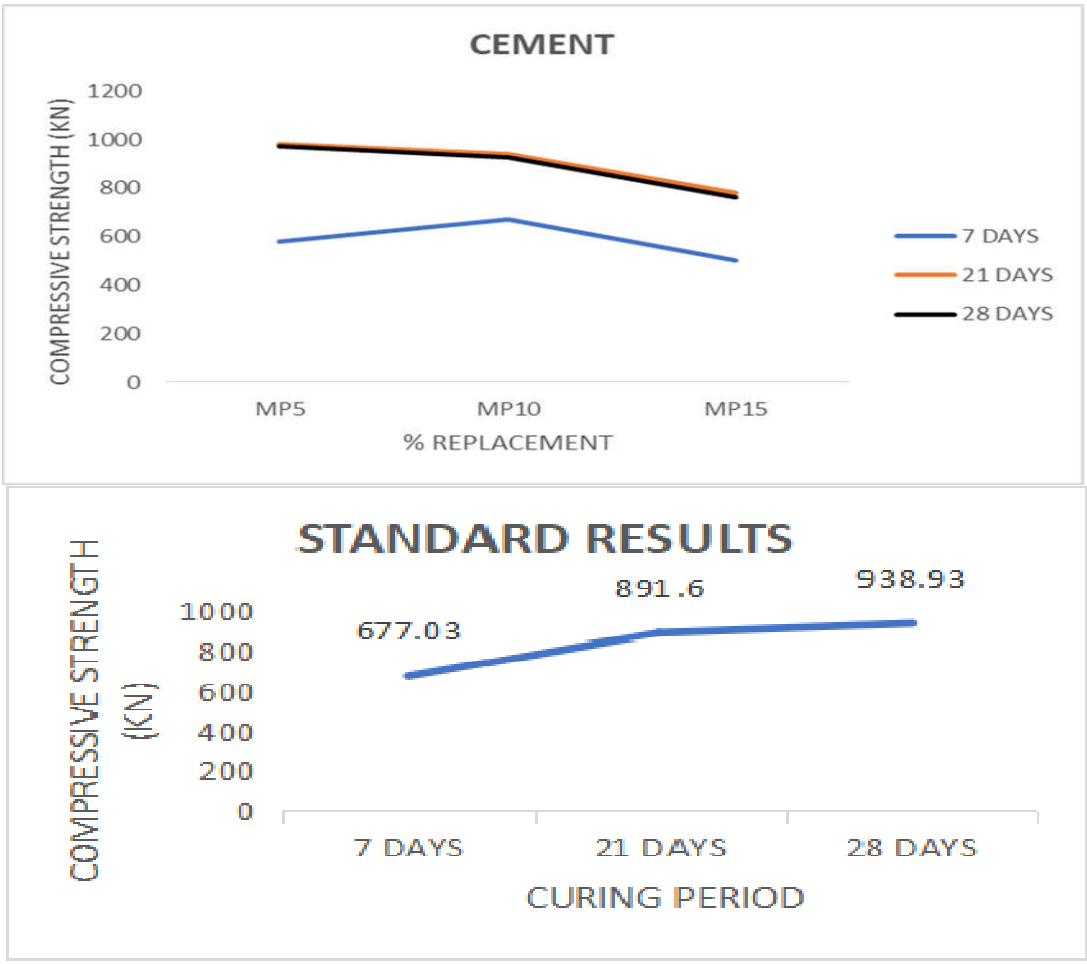

Figure 1. Average compressive strength for replacement of different percentage of waste marble powder.

Figure 2. Average compressive strength of concrete without any replacement

7. Conclusion

Based on the results presented above, the following conclusion can be drawn

- Maximum compressive strenghth is achieved by replacement of 5% cement with MWP in concrete by weight.
- The maximum compressive strenghth obtained after 21 days & 28 days of curing is almost same .
- Maximum compressive strength after 7 days of curing can be seen in sample with 10% replacement of cement with MWP.
- There is no need to compromise in compressive strength at 28 days of curing if replacement of cement with MWP is 5%.

REFERENCES

1. Journal Article

[1] *International Journal of Recent Advances in Engineering & Technology (IJRAET)."Study of Partial Replacement of Cement by Marble Powder"ISSN (Online): 2347 - 2812, Volume-4, Issue -4.*

[2] *Mr. Ranjan Kumar Int. Journal of Engineering Research and Applications ISSN: 2248-9622, Vol. 5, Issue 8, (Part - 4) "Partial Replacement of Cement with Marble Dust Powder".*

[3] *IOSR Journal of Mechanical and Civil Engineering (IOSR-JMCE) e-ISSN: 2278-1684,p-ISSN: 2320-334X, Volume 13, Issue 4 Ver. III."Study on Marble Powder as Partial Replacement of Cement in Normal Compacting Concrete".*

[4] *Corinaldesi V, Moriconi G, Naik TR, (2010), —"Characterization of marble powder for its use in mortar and concrete", Const. Build. Mat., 24, pp 113-117.*

[5] Dr. B. Krishna Rao,IOSR Journal of Mechanical and Civil Engineering (IOSR-JMCE),"Study on Marble Powder as Partial Replacement of Cement in Normal Compacting Concrete".

[6] *Md.Gulfam Pathan,Veena Pathan ,"feasibility and Need of use of waste marble powder in concrete production"IOSR Journal of Mechanical and Civil Engineerin vol 6 pp 23-26 2011.*

[7] *Baboo rai, khan, naushed H, Abhis, Tabin Rushad S,Duggal s.k ,"Influence of Marble Powder/Grannules in conctrete mix" international journal of Civil and Structural Engineering,vol 1,no 4,2011.*

2. Is codes

[1]. IS10262-2009, Indian Standard Concrete Mix Proportioning- suggestions (First Revision).
[2]IS:1199–1959 Methods of sampling and analysis of concrete.