Abhilesh Kant Sharma al. International Journal of Recent Research Aspects ISSN: 2349-7688, Vol. 1, Issue 2, Sept 2014, pp. 182-184

Use of Marble Waste Dust Powder Partially Replacing Cement in Concrete

Abhilesh Kant Sharma[1], Jainender Sharma[2], Vivek Verma[3], Bhupinder Singh[4]

[1,2] Student, M. Tech, Civil engg. Deptt, IGCE, Abhipur, India
[3,4] Associate Professor, Dept. of Civil engg., IGCE, Abhipur, India

***Abstract*— Waste materials can result environmental problem if we leaving it directly to the environment. Hence the reuse of waste material has been needed. New products can be produce from waste or waste material 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. Whereas solid waste results from the rejects at the mine sites or at the processing units, stone slurry is a semi liquid substance consisting of particles originating from the sawing and the polishing processes and water used to cool and lubricate the sawing and polishing machines. Stone slurry generated during processing corresponds to around 40% of the final product from stone industry. The disposal of these waste material acquire large land area and remain scattered all around , spoiling the aesthetic of entire region and natural fertility of the soil is spoiled. There are many reuse and recycling solutions for this industrial by-product, both at an experimental phase and in practical applications. The physical, chemical and mechanical properties of the waste are analyzed.**

***Keywords*— Marble powder, Compressive strength, Tensile strength, Aesthetic.**

I. INTRODUCTION

The advancement of concrete technology can reduce the consumption of natural resources and energy sources and overcome the burden of pollutants on environment. A large amount of marble dust are generated in natural stone processing plants with an important impact on environment and humans. The present study describes the feasibility of using the marble sludge dust in concrete production as partial replacement of cement. In INDIA, the marble processing is one of the most thriving industry the effects of varying marble dust contents on the physical and mechanical properties of fresh and hardened concrete have been investigated. Test results show that this industrial bi product is capable of improving hardened concrete performance up to10%, improving fresh concrete behavior. 30 cubes and 30 cylinders have been casted. The compressive strength and split tensile strength of cubes and cylinders was measured for 7 and 28 days.

II. EXPERIMENTAL PROGRAMME

In order to achieve the objectives of the present study, an experimental program was planned to investigate the effect of marbal dust on the mechanical properties of concrete, when a part of cement is replaced by marbal dust in different percentages i.e. 0%, 5%, 10%, 15% .Portland Pozzolona cement of Ambuja cement conforming to IS 269-1976 and IS 4031-1968 was adopted in this work. The cement used is 53 grade.

Coarse aggregate:

The aggregate used in this project mainly of basalt rock which comes under normal weight category. The aggregates are locally available. 50% of the aggregate used are of 10-12 mm size and remaining 50% are of 20mm size. The coarse aggregate was also tested for various properties like impact value test, crushing value test, elongation and flakiness index test to check their suitability for the experiment.

Sand:

Natural sand which is easily available and low in cost was used in the work . Sand which is used here is taken from Nugal river palampur. Particles of this sand have smooth texture. It has cubical or rounded shape with smooth surface texture . Being cubical , rounded and smooth texture it give good workability. Sieve analysis was done to find out fineness modulus which comes out to be 3.14% which is under limit as per IS 383-1970.

Marble powder: Marble powder was collected from the dressing and processing unit in Rajasthan .It was initially in wet form (i.e. slurry); after that it is dried by exposing in the sun and finally sieved by IS-90 micron sieve before mixing in concrete.

Water: The water used in the concreting work was the potable water as supplied in the structures laboratory of our college. Water used for mixing and curing was clean and free from injurious amounts of oils, acids, alkalies, salts and sugar, organic materials or other substances that may be deleterious to concrete. As per IS: 456-2000 potable water is generally considered satisfactory for mixing and curing of concrete. Accordingly potable tap water was used for the preparation of all concrete specimens.

III. TEST PROCEDURE

Concrete Mix Design: In the present study, M20 grade with nominal mix as per IS 456-2000 was used. The concrete mix proportion (cement: sand:coarse aggregate) is 1:1.5: 3 by volume and a water cement ratio of 0.5.

Testing and Casting Detail: Total number 30 cubes and 30 cylinders were casted. Marble powder were added in concrete in step of 5% (0%, 5%, 10%, 15%, 20%). For each percent of marble powder replacing Cement, 3 cubes

& 3 cylinders were casted for 7 days and 28 days. Final strength of cube & cylinder were & 28 days curing. Test are performed for compressive strength of cube and split tensile strength of cylinder. The crushing loads were noted and average compressive strength and tensile strength for three specimens calculated.

IV. RESULT AND DISCUSSION

Cubes:

Compressive strength of concrete is tested on cube at different percentage of marble pow\der content in concrete. The strength of concrete has been tested on cube at 7 days curing and 28 days. 7 days test has been conducted to check the gain in initial strength of concrete. 28 days test gives the data of final strength of concrete at 28 days curing. Compression testing machine is used for testing the compressive strength test on concrete. At the time of testing the cube is taken out of water and dried and then tested keeping the smooth faces in upper and lower part.

Table 1

PERCENTAGE (MARBAL)	Average strength (N/mm^2)	
	7(days)	28(days)
0	18.37	23.42
5	18.56	26.95
10	20.82	28.44
15	18.10	20.30
20	14.96	19.24

CYLINDER:

Split Tensile strength of concrete is tested on cylinders at different percentage of marble powder content in concrete. The strength of concrete has been tested on cylinder at 7 days curing and 28 days. 7 days test has been conducted to check the gain in initial strength of concrete. 28 days test gives the data of final strength of concrete at 28 days curing. Compression testing machine is used for testing the Split Tensile strength test on concrete along with two wooden boards. At the time of testing the cylinder taken out of water and dried and then tested.

Table 2

PERCENTAGE (MARBAL)	Average strength (N/mm^2)	
	7(days)	28(days)
0	2.12	3.31
5	2.22	3.50
10	2.92	3.75
15	2.64	3.49
20	1.80	3.11

V. DISCUSSION

DISCUSSION (Cube):

a) With the addition of Marble powder the strength of concrete gradually increases upto a certain limit but the gradually decreases.
b) With the addition of Marble powder upto 10% the initial strength gain in concrete is high.
c) At 10% there is 13% increase in initial compressive strength for 7 days d) At 10% there is 20% increase in initial compressive strength for 28 days.
e) The initial strength starts gradually decreases from 15%.

DISCUSSION (Cylinder):

a) With the addition of marble powder the strength of concrete gradually increases up to a certain limit but the gradually decreases.
b) With the additions of marble powder upto 10% the initial strength gain in concrete is high.
c) At 10% there is 37 % increase in initial Split Tensile strength for 7 days
d) At 10% there is 13 % increase in initial Split Tensile strength for 28 days.
e)The initial strength gradually decreases from 15%.

VI. CONCLUSIONS

- The Compressive strength of Cubes are increased with addition of waste marble powder up to 10% replace by weight of cement and further any addition of waste marble powder the compressive strength decreases.
- Thus we found out the optimum percentage for replacement of marble powder with cement and it is almost 10% of the total cement for both cubes and cylinders.
- We have put forth a simple step to minimize the costs for construction with usage of marble powder which is freely or cheaply available; more importantly.
- We have also stepped into a realm of saving the environmental pollution by cement production; being our main objective as Civil Engineers.
- The Split Tensile strength of Cylinders are increased with addition of waste marble powder up to 10% replace by weight of cement and further any addition of waste marble powder the Split Tensile strength decreases.

REFRENCES:

[1]. Dr. Anurag Mishra, Mr. Rajesh Gupta, "Utilization of Marble Slurry in Construction Materials". Workshop on gainful utilization of Marble Slurry and other stone waste.
[2]. International Journal of Civil and Structural Engineering Volume 1, No 4, 2011.
[3]. Concrete Technology – M.S. Shetty
[4]. Concrete Technology:- M. L. Gambhir
[5]. Partial Replacement Of Cement With Marbal
[6]. Dust Powder. Prof. P.A. Shirulea, Ataur Rahmanb , Rakesh D. Gupta.

[7]. IS: 516- 1959: Methods of tests for flexural strength of concrete. Bureau of Indian Standards, New Delhi, 1999.
[8]. Mehta P.K ,"Pozzolanic and cementious by products as mineral admixtures for concrete''ACI SP,1983.
[9]. Tsing Ma Bridge, Hong Kong began in 1992 as per ACI 234R-06 .Guide for the use of silica fume in concrete.
[10]. 311 South Wacker Drive, Chicago built between 1988 and 1990 as per ACI 234R-06 . .Guide for the use of silica fume in concrete.
[11]. Kuala Lumpur City Centre, Malaysia (Thornton et al.1997) as per ACI 234R-06 . .Guide for the use of silica fume in concrete.
[12]. Kinzua Dam Stilling Basin, United States (Luther and Halczak 1995) as per ACI 234R-06 . .Guide for the use of silica fume in concrete.
[13]. Stolma Bridge, Norway in 1998 as per ACI 234R-06. Guide for the use of silica fume in concrete
[14]. Highway bridges, United States in 1996 as per ACI 234R-06. Guide for the use of silica fume in concrete
[15]. Parking structures, United States as per ACI 234R-06. Guide for the use of silica fume in concrete
[16]. The investigation by cohen and Olek (1989) using ASTSM C 666, Procedure A.

