USED OF MARBALE WASTE POWER FOR REPLACEMENT OF CEMENT

DR.M.Husain[1], ChavanF.I[2] Kalyani Navale[3]
1Professor, Department of civil engineering, SSBT College of Engineering, Bambori, North Maharashtra University, India.
2Asst. Professor Department of civil engineering, SSBT College of Engineering, Bambori, North Maharashtra University, India.
3PG Research Scholar, Department of civil engineering, SSBT College of Engineering, Bambori, North Maharashtra University, India

Abstract—. This project describes the feasibility of using the marble sludge dust in concrete production as partial replacement of cement. In INDIA, the marble and granite stone processing is one of the most thriving industry[6] the effects if varying marble dust contents on the physical and mechanical properties of fresh and hardened concrete have been investigated. Slump and air content of fresh concrete and absorption and compressive strength of hardened concrete were also investigated. Test results show that this industrial bi product is capable of improving hardened concrete performance up to 10%, Enhancing fresh concrete behavior and can be used in architectural concrete mixtures containing white cement. The compressive strength of concrete was measured for 7 and 28 days. In order to evaluate the effects of marble dust on mechanical behavior, many different mortar mixes were tested.

Keywords—water, marble, granite, concrete, strength, environment

I INTRODUCTION

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. 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. This is relevant because the stone industry presents an annual output of 68 million tones of processed products Therefore the scientific and industrial community must commit towards more sustainable practices. There are several reuse and recycling solutions for this industrial by-product, both at an experimental phase and in practical applications. These industrial wastes are dumped in the nearby land and the natural fertility of the soil is spoiled. Concrete is a widely used vital material in the construction world. Producing

cement in huge amount in factories directly influences the green house gases emission. Reductions in getting good quality limestone directly affect the production of good quality cement. The construction cost is also gets escalated and also leaving the waste materials to the environment directly can cause environmental problem. Hence the reuse of waste material has been emphasized. The advancement of concrete technology can reduce the consumption of natural resources and energy sources and lessen the burden of pollutants on environment. The result is that the mass which is 40% of total marble quarried has reached as high as millions of tons. This huge unattended mass of marble waste consisting of very fine particles is today one of the environmental problems around the world. One of the logical means for reduction of the waste marble masses calls for utilizing them in building industry itself. Some attempts have been made to find and assess the possibilities of using waste marble powder in mortars and concretes and results about strength and workability were compared with control samples of conventional cements and mortar/concrete. In building industry, Marble has been commonly used for various purposes like flooring, cladding etc., as a building material since the ancient times. The industry's disposal of the marble dust material, consisting of very fine powder, today constitutes one of the environmental problems around the world. In India, marble dust is settled by sedimentation and then dumped away which results in environmental pollution, in addition to forming dust in summer and threatening both agriculture and public health and also the marble processing is one of the most thriving industry the effects. Therefore the scientific and industrial community must commit towards more sustainable practices. Marble dust is not only the economical material but also improves the properties of the concrete so by varying marble dust contents on the physical and mechanical properties of fresh and hardened concrete have been investigated .All these problems can be minimized by partial substitution of industrial waste such as marble dust in cement and also marble stone industry generates both solid waste and stone slurry.

II OBJECTIVE OF STUDY

1. To study the influence of partial replacement of cement with marble powder.
2. To compare it with the compressive and tensile strength of ordinary M20 concrete.
3. To find the percentage of marble powder replaced in concrete that makes strength of the concrete maximum**.**
4.Nowadays marble powder has become a pollutant. So, by partially replacing cement with marble powder, we are proposing a method that can be of great use in reducing pollution to a great extent.

III METHODOLOGY

Marble

We are using Waste Marble Powder (WMP) which partially replaces cement in step of 5% (0%, 5%, 10%, 15%, 20%) in concrete. This partial replacement of cement with WMP improves the properties of concrete in various ways. We are casting the cubes and cylinders to check compressive strength and tensile strength of concrete.

3.1 TYPES OF MATERIAL USED

1.1Natural Aggregate

Gravels are obtained by crushing natural basalt stone obtain from quarries nearby Jalgaon. They are hard, strong, tough, clear and free from veins, alkali, vegetable matter and other deleterious substances. Aggregates are free from such material, and confirming as per IS 383-1970.

1.2 Sand

Natural sand free from silt, veins, alkali, vegetables matter and other deleterious substances, which is obtain from Girna River Jalgaon and confirming as per IS 383-2007

1.3 Cement

Portland Pozzolana cement (PPC) of 53 grades, date of manufacturing is 3rd week, 1st month of 2015 year confirming to Indian standard code IS 1489-1991.

1.4 Water

Water is used for mixing; curing purpose should be clean, portable, fresh and free from any bacteria and desire matter confirming to IS 3025-1964 is used for mixing.

1.5 Marble

3.2 TESTS ON NATURAL AGGREGATE

1. Sieve Analysis of Coarse Aggregates.
2. Specific Gravity and Water Absorption of Course.
3. Crushing Strength of Aggregate.
4 Aggregate Impact Value.
5. Aggregate Abrasion Value.
6. Flakiness and Elongation Index of Coarse Aggregate.

VI CASTING OF TEST SPECIMEN

Total Quantity of materials required for one set of cube, cylinder and beam for each percent and Water cement ratio.

percentage	Specimen	Cement (Kg)	Sand (Kg)	Aggregate (Kg)	Marble Powder (Kg)
0	3 Cubes, 3 Cylinders & 3 Beams	40	60	120	-
5	3 Cubes , 3 Cylinders & 3 Beams	38	60	120	2
10	3 Cubes , 3 Cylinders &	36	60	120	4

	3 Beams				
15	3 Cubes , 3 Cylinders & 3 Beams	34	60	120	6
20	3 Cubes , 3 Cylinders & 3 Beams	32	60	120	8

4.1Test carried on Aggregate

Test	Fineness Modulus	Specific Gravity	Water Absorption	Flakiness Index	Elongation Index	Crushing Strength	Impact Value
Result	3.73	2.80	1.44%	14.77	14.97	14.30	15.40

4.2 Test carried on Sand

Test	Fineness Modulus	Specific Gravity	Water Absorption
Result	3.59	2.65	2.63%

4.4 Test carried on Cement

Test	Standard Consistency	Initial Setting Time	Final Setting Time Setting Time	Soundness	Fineness	Compressive Strength
Result	33%	50 Minutes	260 Minutes	2 mm	2.33%	53.1 N/mm^2

4.5 Test carried on Cement + Marble with 5% Replacement

Test	Standard Consistency	Initial Setting Time	Final Setting Time Setting Time	Soundness	Compressive Strength
Result	34%	60 Minutes	266 Minutes	1.5 mm	52.6 N/mm^2

4.6 Tescarried on Cement + Marble with 10% Replacement

Test	Standard Consistency	Initial Setting Time	Final Setting Time Setting Time	Soundness	Compressive Strength

Result	36%	75Minutes	275 Minutes	1.3 mm	50.1 N/mm^2

4.7 Test carried on Cement + Marble with 15% Replacement

Test	Standard Consistency	Initial Setting Time	Final Setting Time Setting Time	Soundness	Compressive Strength
Result	38%	80 Minutes	285 Minutes	1.1 mm	49.5 N/mm^2

4.8 Test carried on Cement + Marble with 20% Replacement

Test	Standard Consistency	Initial Setting Time	Final Setting Time Setting Time	Soundness	Compressive Strength
Result	40%	80Minutes	280 Minutes	0.9 mm	48.5 N/mm^2

4.9 Compressive Strength of Concrete Cube Specimen tested after 28 days of Curing for W/C ratio 0.4

% of marble powder	Sr. no.	Date of Casting	Date of testing	Load at failure(kN)	Strength at 28 days (N/mm^2)	Avg. strength(28) (N/mm^2)
0%	1	01.10.2015	29.10.2015	520	23.11	
	2	01.10.2015	29.10.2015	530	23.55	
	3	01.10.2015	29.10.2015	560	24.88	**23.85**
5%	1	02.10.2015	30.10.2015	600	26.68	
	2	02.10.2015	30.10.2015	650	28.89	
	3	02.10.2015	30.10.2015	660	29.33	**28.3**
10%	1	03.10.2015	31.10.2015	670	29.77	
	2	03.10.2015	31.10.2015	660	29.33	
	3	03.10.2015	31.10.2015	640	28.44	**29.18**
15%	1	05.10.2015	02.11.2015	470	20.89	
	2	05.10.2015	02.11.2015	500	22.22	
	3	05.10.2015	02.11.2015	450	20	**21.03**
20%	1	06.10.2015	03.11.2015	430	19.11	

	2	06.10.2015	03.11.2015	450	20	
	3	06.10.2015	03.11.2015	470	20.89	**20**

4.10 Split tensile strength of concrete cylinder specimen tested after 7 days of curing for W/C ratio 0.4

% of marble powder	Sr. no.	Date of Casting	Date of testing	Load at failure(kN)	Strength at 7 days (N/mm^2)	Avg. strength(7) (N/mm^2)
0%	1	01.10.2015	08.10.2015	190	2.68	
	2	01.10.2015	08.10.2015	180	2.54	
	3	01.10.2015	08.10.2015	150	2.12	**2.44**
5%	1	02.10.2015	09.10.2015	200	2.89	
	2	02.10.2015	09.10.2015	190	2.68	
	3	02.10.2015	09.10.2015	180	2.54	**2.70**
10%	1	03.10.2015	10.10.2015	210	2.97	
	2	03.10.2015	10.10.2015	220	3.11	
	3	03.10.2015	10.10.2015	220	3.11	**3.06**
15%	1	05.10.2015	12.10.2015	190	2.68	
	2	05.10.2015	12.10.2015	220	3.11	
	3	05.10.2015	12.10.2015	190	2.68	**2.82**
20%	1	06.10.2015	13.10..2015	130	1.84	
	2	06.10.2015	13.10.2015	140	1.98	
	3	06.10.2015	13.10.2015	150	2.12	**1.98**

4.11 Split tensile strength of concrete cylinder specimen tested after 28 days of curing for W/C ratio0.4

% of marble powder	Sr. no.	Date of Casting	Date of testing	Load at failure(kN)	Strength at 28 days (N/mm^2)	Avg. strength(28) (N/mm^2)
0%	1	01.10.2015	29.10.2015	290	4.10	
	2	01.10.2015	29.10.2015	240	3.39	
	3	01.10.2015	29.10.2015	260	3.67	**3.72**
5%	1	02.10.2015	30.10.2015	260	3.67	
	2	02.10.2015	30.10.2015	250	3.53	
	3	02.10.2015	30.10.2015	270	3.81	**3.67**
10%	1	03.10.2015	31.10.2015	260	3.67	
	2	03.10.2015	31.10.2015	260	3.61	
	3	03.10.2015	31.10.2015	290	4.10	**3.81**
15%	1	05.10.2015	02.11.2015	290	4.10	
	2	05.10.2015	02.11.2015	250	3.53	

	3	05.10.2015	02.11.2015	240	3.39	**3.67**
20%	1	06.10.2015	03.11.2015	250	3.53	
	2	06.10.2015	03.11.2015	230	3.25	
	3	06.10.2015	03.11.2015	210	2.97	**3.25**

Filling of concrete in cubical & cylindrical mould.

Testing of Concrete Cube Specimen

Testing Of Concrete Cylinder Specimen

Testing Of Concrete Beam Specimen

VII CONCLUSION

1.The test conducted on materials like Aggregate, Sand, Cement and marble powder having the entire test within permissible limit as per IS code.
2.As the water cement ratio is increases the compaction factor is also increases. We take water cement ratio 0.6 the compaction factor is 94.49 N/mm^2
3.The Compressive strength of Cubes are increased with addition of waste marble powder upto 10% replace by weight of cement and further any addition of waste marble powder the compressive strength decreases.
4.The Split Tensile strength of Cylinders are increased with addition of waste marble powder upto 10% replace by weight of cement and further any addition of waste marble powder the Split Tensile strength decreases.
5.Water cement ratio is decrease compressive strength is increases. We take water cement ratio 0.4 average compressive strength of cube is 29.18 N/mm2 with 10% replacement of marble powder with cement**.** Average compressive strength of cylinder is 3.81 N/mm2 with 10% replacement of marble powder
6.The maximum Value of flexural strength is & 71.34 N/mm^2 with 10 % replacement of Marble Powder at 28 days curing.
7.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 cylinders and beams
8.Thus we originate out the optimum percentage for substitution of marble powder with cement and it is almost 10 % cement for cubes, cylinder, beam.
9.The compressive strength of cubes were increased with accumulation of waste marble powder up to 10 % replace by weight of cement and many more any addition of waste marble powder the compressive strength decreases.
10.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.
11.We have also stepped into a realm of saving the environmental pollution by cement production; being our main objective as Civil Engineers.

VIII REFERENCES

1.Akbulut H, Gürer C (2007). Use of aggregates produced from marble quarry waste in asphalt pavements. Build. Environ., 42(5): 1921-1930.

2.Alyamac KE, Ince R (2009). A preliminary concrete mix design for SCC with marble powders. Const. Build. Mat., 23(3): 1201-1210.

3.Ali Ergun (2011), “Effects of the usage of diatomite and waste marble powder apartial replacement of cement on the mechanical properties of concrete”, Constructionand Building Materials, 25(2), pp 806812.

4.Aruntas HY, Gürü M, Dayı M, Tekin I (2010). Utilization of waste marble dust as an additive in cement production. Mater. Design., 31(8): 4039-404
5.Animesh Mishra, AbhishekPandey, PrateekMaheshwari, AbhishekChouhan, S. Suresh*, Shaktinath Das, Green Cement For Sustainable Concrete Using Marble Dust, Department of Chemical Engineering, Maulana Azad National Institute of Technology, (MANIT) BhopalMadhya Pradesh India, Research CODEN(USA): IJCRGG ISSN 0974-4290 Vol.5, No.2, pp616-622, April-June2013.

6.Abhilesh Kant Sharma, Jainendar Sharma, VivekVerma, Bhupindra Singh (2014), Use of Marble Waste Dust Powder Partially Replacing Cement in Concrete, International Jpurnal of recent research Issue 2.

7.BaharDemirel, (2010), "The effect of the using waste marble dust as fine sand on themechanical properties of the concrete", International Journal of the Physical Sciences,5(9), pp 13721380.

8.BaharDemirel, The Effect of the using Waste Marble Dust as Fine Sand on the Mechanical Properties of the Concrete ISSN 1992 – 1950 ©2010, International Journal of the Physical Sciences Vol. 5(9), pp. 1372-1380, 18 August, 2010.

9.BabooRai, Khan Naushad H , Abhishek Kr, TabinRushad S, Duggal S.K, The effect of using marble powder and granules as constituents of fines in mortar or concrete INTERNATIONAL JOURNAL OF CIVIL AND STRUCTURAL ENGINEERING Volume 1, No 4, 2011

10.CE & CR August 2010 by M. ShahulHameed, Research Scholar and M. Vijayalaxmi, Faculty, Sethu Institute of Technology, Kariapatti, Tamil Nadu And Dr. A. S. S. Sekar, Assistant Professor, AlagappaChetiyar College Of Engg. & Technology, Kariakudi, Tamil Nadu.

11.Corinaldesi V, Moriconi G, Naik TR, (2010), "Characterization of marble powder forits use in mortar and concrete", Const. Build. Mat., 24, pp 113117.

12.Dr. Anurag Mishra, Mr. Rajesh Gupta, "Utilization of Marble Slurry in Construction Materials". Workshop on gainful utilization of Marble Slurry and other stone waste.

13.Er: Raj.p.singhkushwah, Prof (Dr.) Ishwar Chand Sharma, Prof (Dr.) PBL Chaurasia(2015) Utilization of "Marble Slurry" In Cement Concrete Replacing Fine Aggregate.American Journal of Engineering Research (AJER) e- ISSN : 2320-0847 p-ISSN : 2320-0936Volume-04, Issue-1, pp-55-58

14.Hassan A. Mohamadien, The effect of marble powder and silica fume as partial replacement for cement on mortar INTERNATIONAL JOURNAL OF CIVIL AND STRUCTURAL ENGINEERING, Volume 3, No 2, 2012.

15.International Journal of Civil and Structural Engineering Volume 1, No 4, 2011.