

Feasibility of Cement Concrete by Partially Replacing Cement by Marble dust in Cement Concrete

ANKIT SHARMA¹, ASHUTOSH S. TRIVEDI², MANOJ SHARMA³

¹*P.G scholar, faculty of civil engineering IPS-(CTM), RGPV, (Bhopal), MP, India*

²*Professor, faculty of civil engineering IPS-(CTM), RGPV (Bhopal), MP, India*

³*Assistant Professor, faculty of civil engineering IPS-(CTM), RGPV (Bhopal), MP, India*

Abstract— *It has now become popular to use marble dust in concrete as a partial replacement of cement or partial replacement of sand for improving the properties of concrete and also to reduce the effect of gas evolved from concrete surface in the environment. Huge waste is generated from marble industries in the form of marble powder which has reached millions of tonnes and it has now become severe problem for disposing this marble dust, so idea of this paper is to use this marble dust in concrete as a partial replacement of cement. Use of marble dust in cement concrete not only help in reducing the disposing problem but also help in reducing the effect of gases evolved from concrete surface in the environment and also reduce the cost of concrete . Marble dust is partially replaced in cement in percentage of 0, 5,10,15,20 in this paper and slump cone test, compressive strength test of cement concrete cubes are performed. For Compressive strength of cube mould of 150mm×150 mm is used and compressive strength is checked on 7 days and 28 days. All tests are performed on M15 concrete.*

Keywords— *marble dust, Compressive strength testing machine, Economical, constituents, slump cone apparatus*

I. INTRODUCTION

Marble is obtained from the transformation of a pure limestone and it is a type of metamorphic rock. When original rock such as igneous rock or sedimentary rock subjected to pressure, temperature changes or any other force in the environment then these rocks transform to another rock known as metamorphic rock .colour and appearance of marble indicates the purity of marble. When limestone main constituent is calcite (100%) then colour of marble will be white. Composition of limestone is responsible for the colour of the marble. Marble is a requirement of good decoration work in construction. Marble give good appearance to construction work due to which demand of marble is rising day by day. The main ingredients of marble are calcite and dolomite. The originity of marble changes the composition of marble. Large amount of powder is generated during the dressing process of marble. The waste generated is about 20% of total marble quarried. This generated waste has reached millions of tons. There is a chances of environment problem when this waste is directly leaved in the environment. Concrete technology advancement can reduce the effect of marble dust on the environment and also reduce the harmful effects of gases evolved from the concrete surface in the environment. It also reduces the pollutants burden of environment. Today marble dust is generated in huge amount in marble processing units and has a bad impact on environment and humans. Marble dust particles flies in the air and get deposited at different place. This deposited marble dust is dumped at one place which encircles the agricultural area due to which crop production is affect. Public health is also affected by this marble waste. Therefore, it has now become necessary to utilise this marble dust in various industries especially in construction and paper industries. It will also lead to sustainable development. Previously attempts has been done in construction industry for using this marble powder. Cement was previously replaced partially by this marble powder in cement mortar and compressive strength of cement was tested in compressive strength testing machine.

II. LITERATURE REVIEW

A). Jashandeep singh, Er. R S Bansal: partial replacement of 12% cement by marble dust in cement concrete results grade of cement concrete. Thus 12% is the optimum percentage of replacement of cement by marble dust in cement concrete.

B). Manju Pawar et.al (2014): he founded that with the partial replacement of cement by marble powder up to 12.5% the compressive strength of concrete increases and further addition results decrease in compressive strength. also tensile strength of concrete were founded to increase when marble dust is used up to 12.5% and further replacement results decrease in tensile strength.

C). Noha M. Soliman (2013): the compressive strength, workability and tensile strength increases by using definite amount of marble dust as a replacement of marble dust in cement concrete. It also increases the stiffness and the ultimate strength of RC slabs as compared to normal concrete slab having 0% marble dust.

D). Prof. P.A. Shirule, Ataur Rehman, Rakesh D. Gupta: the compressive strength of concrete specimen was found to be increased up to 27.4% on partial replacement of cement by marble dust 10% in concrete while split tensile strength of cylinders was increase by 11.5% as compared to ordinary concrete.

E). Prof. Veena G. Pathan, Prof. Md. Gulfam Pathan: Properties of cement such as consistency, setting time, insoluble residue and soundness improves up to studied feasibility of 10% replacement of cement by marble powder in OPC. There is also an impressive increase in the tensile strength of concrete on partial replacement of cement by marble powder in cement concrete.

F). V.M. Sounthararajan et.al (2013): he founded increase in the compressive strength of 46.80 MPa at 7 days for 10% replacement of cement by marble dust in concrete. Also some mechanical properties were founded improved as compared to controlled concrete.

G). Vaidevi C (2013): partial replacement of cement by marble dust saves 1 bag of cement as 10% replacement of cement by marble dust in concrete gives the same compressive strength of concrete specimen as that of 0% marble dust concrete. Result was obtained for every 10 bags of cement.

III. MATERIALS USED IN THE PRESENT STUDY

3.1 Cement

Ordinary Portland Cement (OPC) of grade 43 is used in this study

TABLE 3.1: CEMENT TESTING

S.NO.	PROPERTY	RESULT
1.	Consistency	36%
2.	Initial setting time	32 minutes
3.	Final setting time	380 minutes
4.	Fineness	2%
5.	Soundness	3 mm expansion

3.2 Aggregates

The main ingredient of concrete is aggregates. It not only reduce shrinkage but also effect economy of concrete and give body to concrete. The coarse aggregate passing through a 20 mm and retained on 10 mm sieve having fineness modulus 3.49. Good quality Ganga River sand is used as a fine aggregate conforming to Zone- II of IS: 383 – 1970 have a fineness modulus of 4.77.

3.3 Water

Boring water is used for preparing concrete mix. Water cement ratio is kept as per the workability requirement. Potable water free from organic substance is used for mixing as well as curing of concrete.

3.4 Marble Powder

Local available Marble powder used as Partial replacement of cement in concrete.

Table 3.2 Chemical constituents of MDP

[Sources: Lab Testing Sucofindo 2013]

Chemical compound	% in MDP	% in OPC
CAO	55.09	31-57
SiO ₂	0.48	22-29
MgO	0.40	1.5-2.2
Fe ₂ O ₃	0.12	1.5-3.2
Al ₂ O ₃	0.17	5.2-8.8
Na ₂ O	0.20	-
K ₂ O	0.06	-
SO ₃	0.06	-
Loss on ignition	43.48	-
Total amount	100%	-

IV. RESULTS AND DISCUSSIONS

4.1 MIX PROPORTIONING

TABLE 4.1: MIX PROPORTIONING

PARAMETERS	PERCENTAGE REPLACEMENT OF CEMENT BY MARBLE DUST				
	0%	5%	10%	15%	20%
Cement kg/cu.m	310.712 kg	295.18 kg	279.64 kg	264.105 kg	248.569 kg
Marble Dust Powder kg/cu.m	-	15.532 kg	31.07 kg	46.607 kg	62.142 kg
Fine Aggregates kg/cu.m	621.43 kg	621.43 kg	621.43 kg	621.43 kg	621.43 kg
Coarse aggregates kg/cu.m	1242.85kg	1242.85 kg	1242.85 kg	1242.85 kg	1242.85 kg
W/C Ratio	0.48	0.55	0.58	0.64	0.70
Water kg/cu.m	149.15 kg	170.90 kg	180.213kg	198.856 kg	217.498 kg

4.2 SLUMP CONE TEST

TABLE 4.2: SLUMP VALUE

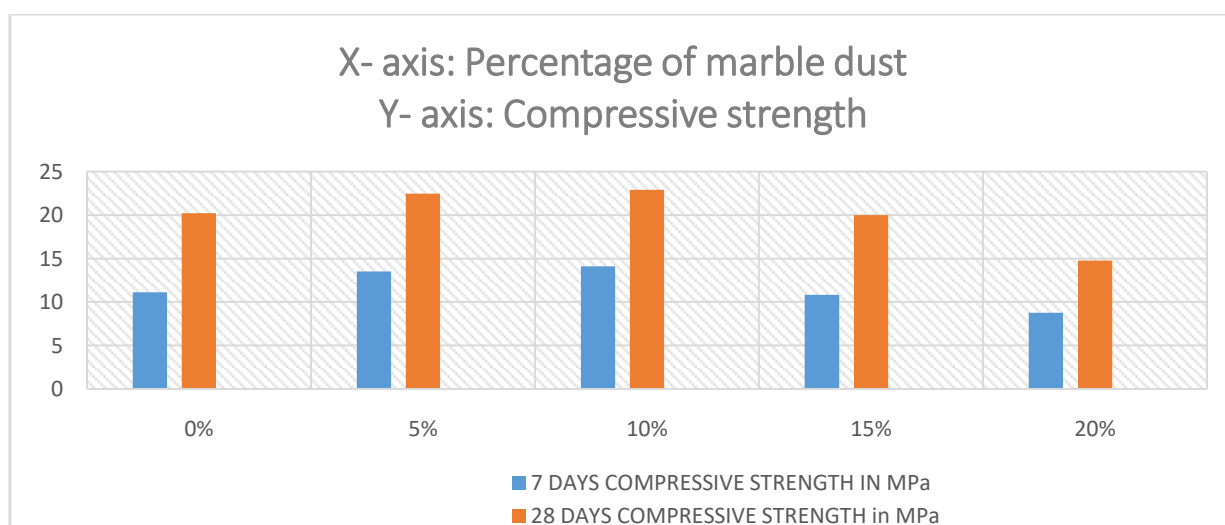
PERCENTAGE REPLACEMENT OF CEMENT BY MARBLE DUST	SLUMP
0%	60 mm
5%	80 mm
10%	90 mm
15%	85 mm
20%	70 mm

4.3 COMPRESSIVE STRENGTH TEST

The compressive strength is performed as per IS: 516-1959. Mold of size 150mm×150mm is used to cast cubes for compressive strength test. The cubes were demolded after 24 hrs and were kept for 7 days and 28 days curing and compressive strength test was performed. The results are represented in Table 4.3. The test results were compared with controlled concrete.

TABLE 4.3: COMPRESSIVE STRENGTH TEST

S.NO	% REPLACEMENT	7 DAYS COMPRESSIVE STRENGTH	28 DAYS COMPRESSIVE STRENGTH
1.	0%	11.1075 MPa	20.1975 MPa
2.	5%	13.4975 MPa	22.4425 MPa
3.	10%	14.1075 MPa	22.8875 MPa
4.	15%	10.8325 MPa	19.99 MPa
5.	20%	8.7775 MPa	14.775 MPa



V. CONCLUSION

1. The compressive strength of concrete specimen increases on partial replacement of cement by marble dust in cement concrete.
2. The maximum percentage of replacement of cement by marble dust in cement concrete is 10%, after this there is decrease in compressive strength of concrete specimen.
3. The problem of disposing marble dust can be shorted by utilizing this in cement concrete.

REFERENCES

- (a) A research paper on “Partial replacement of cement with marble powder by prof. P.A shirule, Aatur Rehman, Rakesh D. Gupta, department of civil engineering, SSBT’s COET, Bambhori, Jalgaon, Maharashtra-425001.
- (b) A book of concrete technology for civil engineering by M.S Shetty.
- (c) A book of concrete technology for civil engineering by M.L Gambhir.
- (d) A research paper on “use of marble dust as a partial replacement of cement by Mrs. Shalaka S. Utkar, department of civil engineering, D.Y Patil College of engineering, Savitribai Phule Pune University.
- (e) SSRG International Journal of Civil Engineering (SSRG-IJCE)-EFES April 2015
- (f) www.iosrjournals.org
- (g) A research article on “Partial replacement of cement with marble powder by Mr. Ranjan Kumar, Shyam kishori kumar, Department of civil engineering, B.I.T Dhanbad, Jharkhand.
- (h) Pooja J. chavhan, “To Study the Behavior of Marble Powder as Supplementary Cementitious Material in concrete” Int. Journal of Engineering Research and applications, ISSN: 2248-9622, Vol. 4, Issue 4 (Version 1), April 2014, pp. 377-381.
- (i) Veena G. Pathan, Md. Gulfam Pathan, “Feasibility and Need of use of Waste Marble Powder in Concrete Production”, IOSR Journal of Mechanical and Civil Engineering (IOSR-JMCE) e-ISSN; 22781684, p-ISSN; 2320-334X PP 23-26.
- (j) Vaidevi C, “Study on marble dust as partial replacement of cement in concrete”, Indian journal of engineering, 2013, 4(9), 14-16.