Experimental Study on Partial Replacement of Cement With Marble Powder

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Abstract- *To consider the conduct of cement, having incomplete supplanting of concrete with squander marble powder M20 review for which the marble powder is supplanted by a test think about was done and the impact on compressive quality and split rigidity attributes (0%, 5%, 10%, 15%, 20%) was examined. The aftereffect of this present examination shows that the supplanting of concrete with squander marble powder accomplishes most extreme compressive and rigidity. The ideal rate for supplanting of marble powder with concrete and it is right around 12%cement for the two 3D squares and chambers and it additionally limit the expenses for development with utilization of marble powder which is uninhibitedly or efficiently accessible all the more significantly.*

Keywords- Marble powder, slump, compressive strength and split tensile strength.

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 tone's 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. The physical, chemical and mechanical properties of the waste are analyzed.

The advancement of concrete technology can reduce the consumption of natural resources and energy sources and lessen the burden of pollutants on environment. Presently large amounts of marble dust are generated in natural stone processing plants with an important impact on environment and humans. 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 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.

II. LITERATUREREVIEW

Jamsheed*etal.*,(Feb2017) studied on "Partial Replacement of Cement with Marble Powder" and concluded that Waste can be used to produce new products or can be used as ad mixtures 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. Due to marble dust, it proved to be very effective in assuring very good cohesiveness of mortar and concrete. From the above study, it is concluded that the marble dust can be used as are placement material for cement; and 10% replacement of marble dust gives an excellent result in strength aspect and quality aspect and it is better than the control concrete. The results showed that the substitution of 10% of the cement content by marble stone dust induced higher compressive strength, higher splitting tensile strength [24-28],and improvement of properties related to durability

Mohd. Afaque Khan *et al.,* (Mar 2016)studied on "Compressive Strength Of Concrete Using Marble Dust As Partial Replacement Of Cement" and concluded that With the inclusion of marble powder, the compressive strength of concrete gradually increases up to a certain limit but then gradually decreases. Increase in curing days will increase the strength of marble dust concrete when compared from14 days to 28 days. To minimize the costs of construction with usage of marble powder, which is freely or cheaply available ? It is essential to find out the specific are as where this mix can be used. To realm of saving the environmental pollution by cement production; being our main objective as civil engineers. Kirti Vardhan *etal.,* (Nov 2015) studied on "Mechanical properties and microstructural analysis of cement mortar incorporating marble powder as partial replacement of cement" and concluded that results of the study indicate that up to10% of marble powder can be used as replacement of cement with no compromise on the technical characteristics of the result ant mixture. In fact, up to 10% replacement of cement with marble powder helps in improving the workability of the mixture, with the compressive strength of the mixture remaining unaltered. The large variation in chemical composition of marble powder as compared to that of the cement does not affect the expansion and setting characteristics of cement.

Reminder Singh *et al.,* (Nov 2015) studied on "Strength evaluation of concrete using Marble Powder and Waste Crushed Tile Aggregates" and concluded innovations in concrete increases the Sustainability in concrete production and they studied about the feasibility of the substitution of waste marble powder for cement and waste tile aggregates for coarse aggregates to achieve economy and environment saving. There is an increase in the Compressive strength of the concrete produced from waste marble powder as partial replacement of cement up to 10% and crushed tile aggregate as partial replacement of natural coarse aggregate up to 30%. As the partial replacement level of waste marble powder with cement in concrete increases, work ability decreases.

Ranjan Kumar *et al.,* (Aug 2015) studied on "Partial Replacement of Cement with Marble Dust Powder" and concluded that the waste generated from the industries cause environmental problems. Hence the reuse of this waste material can be emphasized. Marble Dust Powder (MDP) is a developing composite material that will allow the concrete industry to optimize materiel use, generate economic benefits and build structures that will strong, durable and sensitive to environment. Compressive strength, split tensile strength & flexural strength of the concrete mixtures has been obtained at 7 and 28 days. The results of the laboratory work showed that replacement of cement with MDP increase, up to 10% for compressive strength, & up to 15% for split tensile strength & flexural strength of concrete.

III. EXPERIMENTAL PROGRAMME

Concrete Mix Design(M20)

Design Stipulations

- Characteristic comp. strength required In the field at 28 days 25Mpa
- Level of quality control Good

Test Data for Materials

- Specific Gravity Of Cement 2.63
- Comp.StrengthOfCementat7days Satisfies

Preparation and Curing Of Specimen 72 Standard cubic specimens of size 150 mm and 72 standard cylindrical moulds for size 150 x 300mm (four for each percentage of marble powder) were cast. Concrete cube were cast for compressive and split tensile strength of concrete was undertaken at 7, 14 Days & 28 days of age.All specimens were removed 24 hrs.

IV. RESULT ANDDISCUSSIONS

A. Mix Proportions

A mix M25 grade was designed as per Indian Standard method and the same was used to prepare the test samples.

Table Partial replacement of cement by marble waste powder(cubical moulds)

TRAILS	I	II	III	IV
Concrete mix	0%	PCC+5% Marble Powder	PCC+10% Marble powder	PCC+ 15%
Cement (Kg)	9.85	9.35	8.86	8.37
Fine aggregate (Kg)	14.4	14.4	14.4	14. 4
Coarse aggregate (Kg)	25.61	25.61	25.61	25.61
Marble Powder (Kg)	-	0.49	0.98	1.47
Water-Cement ratio	0.45	0.45	0.45	0.45

B. Compressive Strength

Compressive strength of concrete is tested on cube at different percentage of marble powder content in concrete. The strength of concrete has been tested oncubeat7days,14dayscuringand28days.7days test has been conducted to check the gain in initial strength of concrete, 14 days test has been conducted to check the gain in median strength of concrete and 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. The strength of concrete is very much dependant up on the hydration reaction .The type and amount of cement used in concrete determines the hydration reaction. In this experiment, in all cases, i.e. for 0 to 20 % replacement of cement by marble waste powder the test results[43-46], as shown in Table and show that the seventh, fourteenth and twenty eighth days compressive and split tensile strengths of specimens with marble waste powder are less than that of the corresponding control specimens. The reduction of the strength increased with increasing percentage of marble waste powder. decreases in strength mainly occur due to replacement of Portland cement with powder.

Partial replacement of cement by marble waste powder (Cylinder moulds)

materials	I	II	III	IV
Concrete mix	0%	PCC+5 % Marble Powde r	PCC+10 % Marble powder	PCC+1 5% Marble Powder
Cement (Kg)	13.92	13.20	12.52	11.8 2
Fine aggregat e (Kg)	20.28	20.28	20.28	20.2 8
Coarse aggregat e (Kg)	36.19	36.19	36.19	36.1 9
Marble Powder (Kg)	-	0.69	1.39	2.08
Water - Cementr atio	0.45	0.45	0.45	0.45

C. Split tensile strength

Split Tensile strength of concrete is tested on cylinders at different percentage of marble powder Content in concrete. The strength of concrete has beentestedoncylinderat7dayscuring,14daysand 28 days. 7days test has been conducted to check the gain in initial strength of concrete.28daystestgives 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.

From the figures, it can be seen that marble powder improves the compressive and split tensile strengths of concrete. As the percentage replacement of cement with marble powder increases, the compressive and split tensile strengths increase, reach a maximum value and then decrease.

MARBLE POWDER

UNMOULDINGOFCUBES

CASTINGOFCYLINDERS

SLUMP TEST

COMPRESSIVE STRENGTH TEST

SPLIT TENSILE STRENGTH

V. DISCUSSION

Withtheinclusionofmarblepowderthestrengthofconcretegraduallyincreasesuptoacertainlimit but it gradually decreases in replacement of marble powder in 15%. with the inclusion of marble powder up to 10%.The initial strength gain in concrete is high.

Table Compressive strength of concrete cubes at 7 and 28 days

Trials	Percentage of marble powder	Curing period indays	Mean compressive strength of Cube specimensin N/mm^2
I	0%	7	15.75
II	5%		16.34
III	10%		16.78
IV	15%		14.82
I	0%	28	22.42
II	5%		23.78
III	10%		24.16
IV	15%		20.48

Table split tensile strength of concrete cubes at 7 and 28 days

Trials	Percentage of marble powder	Curing period indays	Mean split tensilestrength of cylinders specimens in N/mm^2
I	0%	7	2.50
II	5%		2.04
III	10%		2.77
IV	15%		1.962
I	0%	28	2.98
II	5%		3.21
III	10%		3.48
IV	15%		2.18

VI. CONCLUSION

- In this experimental study the cube and cylinders were casted with different percentages of OPC + marble powder (0% , 5% , 10%,15%)
- Up to 10% replacement of cement with marble powder there is a increase in all mechanical properties.
- The replacement of 10% of cement with marble powder attains maximum compressive and tensile strength.
- The optimum percentage for replacement of marble powder with cement and it is almost 10%cementforbothcubesandcylinders.
- To minimize the costs for construction with usage of marble powder which is cheaply available.

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