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PROPERTIES OF HARDENED CONCRETE BY USING MARBLE DUST POWDER

Mr.Sharad Shinde[1], Mr.Sudarshan Dhawale[2], Mr.Abhishek Thakur[3] ,Mayur Tanpure[4]

Student, Department of Civil Engineering, Dr. D Y Patil School of Engineering And Technology, Charoli Bk, Pune.[1,2,3]
[2] Professor, Department of Civil Engineering, Dr. D Y Patil School of Engineering And Technology, Charoli Bk, Pune.[4]

Abstract- 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 material use, generate economic benefits and build structure that will strong, durable and sensitive to environment. MDP is by-product obtain during the quarrying process, which contains high calcium oxide content of more than 50%. The partially replacement of MDP with cement in proportion to 5%, 10%, 15%. Concrete mix design is made for grade M40 concrete result have been detect by testing split tensile strength, compressive strength, and flexural strength in 7day and 28day intervals.

Keywords- *Marble dust powder(MDP), Cement, Compressive strength, Flexural strength, Split tensile strength*

I INTRODUCTION

In India, marble dust is settled by sedimentation and then dumped away which results environmental pollution, in addition to forming dust in summer and threatening both agriculture and public health. Therefore, utilization of the marble dust in various industrial sectors especially the construction industry would help to protect the environment. 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 protect from waste deposits. There are several reuse and recycling solutions for this industrial by-product, both at an experimental phase and in practical applications. In today's development phase, concrete is a very important contribution to the world. From the ancient times to the present day many amazing constructions are being done with the help of this concrete. Buildings, historic buildings, roads, bridges, highways, dams and others are being built in the form of constructions with the help of this concrete. Concrete is made up of many main components; cement is the main component in these components. Due to the growing needs due to development, cement is also being consumed very fast in concrete. Due to the high consumption of cement consumption, there is a very harmful effect on the environment. The main reason for the harmful effects of the environment is gas emitted from cement like CO2 and others. In order to overcome these problems caused by the construction, some researchers have replaced cement with partial amounts of pozzolana to reduce the consumption of cement and improve the manufacturing sector's economy, due to which the environment A fair prospect of improvement has been demonstrated In this research work, cement has been substituted in partially form of marble dust powder. Marble dust has been replaced with cement in proportion to 5%,10% and 15%.Concrete mix design is made for grade M40 concrete results have been detected by testing split tensile strength and compressive strength and flexural strength in 7days and 28days intervals

II.OBJECTIVE

i. To study the influence of partial replacement of cement to concrete with marble dust powder, and to determine the compressive strength and tensile strength of ordinary M40 concrete.

ii. Similarly compressive strength, Split tensile strength & flexural strength obtained for 5%, 10%, 15%, & 20% replacement of cement with MDP by weight.
iii. To compare the results of normal concrete and partial replacement of cement by marble dust powder.

III .LITERATURE RIVIEW

A.Shukla(2019) i) Marble dust has been replaced with cement in proportion to 0%, 5%, 7.5%, 10%, 12.5%, 15% and 20%.Concrete mix design is made for two grades M 25 and M 30, then both grades of concrete have been observed. In this paper, concrete results have been detected by testing split tensile strength and compressive strength in 7 days, 28 days & 56 days intervals.
ii) In both grades of concrete M25 and M30, the result of high strength is obtained when adding marble dust powder to 10% ratio with cement.

A.Mahajan(2018) i) The maximum compressive strength of mix had been obtained by replacing cement with MDP by 10% of its weight and after adding the fibers' the maximum compressive strength of mix was obtained by replacing cement with MDP by 15% of its weight and 1% of steel fibers by volume fraction of concrete, hence this mix has been found out to be the optimum variation.
ii) The maximum Split tensile Strength of mix was obtained by replacing cement with MDP by 10% of its weight and after adding the fibers the maximum split tensile strength of mix was obtained by replacing cement with MDP by 15% of its weight and 1% of steel fibers by volume fraction of concrete, hence this mix has been found out to be the optimum variation.

S.P.Deshmukh(2018) i) The 4 % replacement of cement and 10 % of fine aggregate by marble dust and marble fine aggregate got more Compressive strength compared to 0 % replacement of cement and fine aggregate.
ii) The 4 % replacement of cement and 10 % of fine aggregate by marble dust and marble fine aggregate got more split tensile strength compared to 0 % replacement of cement and fine aggregate.

N.Bhanushali(2018) i) Extreme value against acid attacks was obtained when cement Is replacement with marble dust powder at 3.5%.

ii)5% replacement of cement with marble waste powder led to an increase of about 4% in the compressive strength.

iii) Workability of concrete was reduced due to large surface area of waste marble powder.

K.Dharani(2017) i) It has been observed that the experimental result for the 10% replacement of marble powder & Quarry dust to PPC has increase in strength in comparison with 0% and 10% replacement. Beyond 20% replacement of marble powder, the strength was decreased
ii)Based on the test results of Marble powder & Quarry dust Concrete, it can be concluded that, Marble powder & Quarry dust can increase the overall strength of the concrete when used up to a 10% Cement replacement with w/c ratio of 0.46. Marble powder and Quarry dust are the valuable pozzolanic materials and it can potentially be used as a partial replacement for cement and fine aggregate respectively. This could reduce the environmental problems.

K.Santosh(2017) i) Replacement marble powder up to 5% in the 28 days compressive strength is 28N/mm2.
ii) Conventional concrete in the 28 days compressive strength is 25N/mm2.
iii) The compressive test results on the cement replaced marble powder cubes did
show improvement while adding 5% and in the 28 days strength in comparison to the control cube, but it fall increasing the percentage above 20% 7 days and 28 days cube strength of M20 grade concrete.

B.Krishna Rao(2016) i) It was observed that 0.43%, 11.6% and 5.6% of spilt tensile strength increased at 10% of marble powder compared to normal mixed 7, 28 and 56days respectively.
ii) It was observed that 2.81%, 2.92% and 4.58% of strength increased compared to normal mix with 10% replacement of marble powder at 7, 28 and 56days respectively.
iii) It was noticed that 11.22%, 20% and 14.8% of flexural strength increased at 10% replacement of marble powder compared to normal mix at 7, 28 and 56days respectively.

N.Sharma(2015) i) When cement is replaced with marble powder up to 10% weight a high strength concrete was achieved.
ii) Increasing the amount of marble powder decreases the workability of concrete.
iii) Based on the experiment result it showed that replacement of cement and sand by marble powder up to 10% increases the compressive strength but above 10% content of marble powder decreases the compressive strength.
iv) Compared to the control concrete flexural strength is maximum when replace with fine aggregate up to 10%.

IV .MATERIALS DESCRIPTION PROPERTIES

4.1 Cement

Ordinary Portland cement (OPC)was used during the study. the OPC used of grade53.

4.2 Marble dust powder(MDP)

Sieved by IS-90 micron sieve before mixing in concrete

Fig.1 Marble dust powder

Table-1 Physical properties of MDP

Sr.no	Physical Properties	Result
1	Colour	White
2	Size of particle	Passed out 90micron sieve
3	Specific gravity	2.7

4.3 Course 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.

4.4 Sand

Natural sand which is easily available and low in price was used in the work. It has cubical or rounded shape with smooth surface texture. Being cubical,rounded and smooth texture it give good workability.

4.5 Water

Drinkable water is used

V EXPERIMENTAL PROGRAMME

a) Compressive strength test

Compressive strength of the cube find out on the compression testing Machine (CTM) with capacity of 2000KN at loading rate 5.25KN per second. The size of the cube is 150mmx150mmx150mm cast from concrete of each mix sample after 7,28 days of curing. The compressive strength calculated by dividing the maximum compressive load to the cross-sectional area of the cube specimen.

$$Fcu=P/A$$

Where, fcu=Compressive strength

P=maximum crushing load resisted of cube before failure

A= Cross-sectional area of cube

b) Split Tensile strength test

The split tensile strength of cylindrical concrete specimens of size 150mmx300mm is also determine in compressive testing machine (CTM) with capacity of 2000KN at a loading rate of 5.25KN per second is used to determining the peak load after 7 and 28 days. The split tensile strength of cylindrical specimen calculated by using following equation:

$$Fct=2P/\prod Ld$$

Where, Fct = Split Tensile strength of Specimen

P= Maximum crushing Load resisted cylindrical specimen before failure

L=height of specimen

D= diameter cylindrical specimen

c) Flexural strength test

According to IS:9399-1979 code, The size of the beam is100mm x 100mm x 500mm, the specimen tested after 7 and 28 days on Universal testing machine (UTM).The flexural strength calculated by following equation:

$$Fcf=PL/bd2$$

Where, Fcf=Flexural strength of concrete specimen

P=Failure load at which beam specimen is failed

L= length of beam specimen

b= width of beam specimen

d= depth of beam specimen

VI RESULT AND DISCUSSION

1) Compressive strength:

The main reason for the power of concrete is hydration reaction. Due to this hydration reaction, the ability to bond tightness inside the concrete is formed. Due to this reaction, the age of concrete increases . In this experimental work, M40 grade of concrete have been used. In order to know the result of Compressive Strength, concrete is first made in grade of mix designs. Concrete has been molded into the cube in the test of compresses, then they have been soaked in water for 7 days, 28 days interval, and after this interval, they have been evaporated from the water and dried in the atmosphere. After drying these cube, testing with the help of "CTM" machine has given results,

Table 2: Result of compressive strength

Trial Mix.	% of MDP	Average Compressive strength (7days)N/mm^2	Trial Mix.	Average Compressive strength (28days)N/mm^2
M1	0	36.18	M5	39
M2	5	37.81	M6	39.50
M3	10	40.86	M7	43.5
M4	15	37.77	M8	38.54

2) Splite Tensile Strength:

Testing of tensile strength is on the cylinder . In this test, the cylinders formed after mixing different ratios of marble dust with cement. The results of the concrete tensile strength test have been known in the interval of 7 days and 28 days. The results of Split Tensile Strength of grade M40

Table3: Result of split tensile strength

Trial Mix.	% of MDP	Average Split Tensile strength (7days)N/mm^2	Trial Mix.	Average Split Tensile strength (28days)N/mm^2
M1	0	4.992	M5	8.304
M2	5	5.106	M6	8.800
M3	10	6	M7	9.350
M4	15	5	M8	8.700

3) Flexural Strength:

Testing of flexural strength is on beam. The beam formed after mixing different ratio of marble dust with cement. The result of the concrete flexural strength test have been knows in the interval of 7days and 28days. The result of flexural strength of grade M40 beam of concrete.

Table 4: Result of flexural strength

Trial Mix.	% of MDP	Average flexural strength (7days)N/mm^2	Trial Mix.	Average flexural strength (28days)N/mm^2
M1	0	4.84	M5	8.68
M2	5	5.96	M6	8.92
M3	10	6.64	M7	9.92
M4	15	6	M8	9

VII.CONCLUSION

i) Marble dust powder has the ability to provide the option of cement and it helps in maintaining the economic balance along with the environment.

ii) As per the study, replacement of marble powder up to 10% is good for construction purpose for buildings.

iii) The maximum compressive strength of mix had been obtained by replacing cement with MDP by 10% of its weight

iv) The workability increased with increase of marble powder.

v) For compressive strength, spilt tensile strength and flexural strength 10% replacement with marble powder is found to be a best alternative for replacement as increase in percentage of strength is high compared to other variations in the mix.

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