

TO DETERMINE THE EFFECT ON THE PROPERTIES OF CONCRETE M30 BY PARTIAL REPLACEMENT OF CEMENT WITH MARBLE POWDER

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abstract: *This Dissertation work was carried out to find out the effect of marble powder on the strength properties of concrete grade M30. To achieve this objective, marble powder was replaced with cement in the percentage of 0%, 3.5%, 7%, 10.5%, 14% and 17.5% respectively. To check out the strength characteristics of concrete mix M30, Compressive strength test and Flexural strength test were conducted in the lab at 7days and 28 days curing period of concrete specimens. On the basis of test results it was observed that addition of marble powder by weight of cement enhanced the properties of concrete mix M30. Upto 10.5 % addition of marble powder in a concrete mix M30 by weight of cement increases the compressive as well as flexural strength of concrete. Earlier research also indicate that the effects of marble powder on the properties of cement such as consistency, initial setting time, final setting and soundness remain within the acceptable ranges of different standards. The production of cheaper and more durable concrete using marble powder can solve to some extent the ecological and environmental problems. Therefore a dissertation work is decided to find out the effect of marble powder on the properties of concrete by partial replacement of cement with marble powder in a concrete mix. This paper provides a scope for more research which is required to design economical and durable concrete with this solid waste (marble powder)*

Key word: *Marble powder, Compressive strength, Flexural strength.*

I. INTRODUCTION

The ingredients of Cement Concrete mix is Cement, fine aggregate and Coarse aggregate. Generally, we use sand (natural/crushed) as fine aggregate and cement as binding material in required quantity of different grades of Concrete mix such as M10, M15, M20, M30 etc. to full fill the designed compressive strength. For manufacturing the cement, lot of environmental status deflecting due to originating the carbon dioxide, nitrogen oxide, sulfur dioxide, carbon monoxide gases in the environment. Therefore a lot of air pollution, soil pollution, etc. occurs during manufacturing of cement. To minimize these pollutant effects, we required the alternative of minimum consumption of Cement. In view of this, the study has been carried out by utilizing the marble powder up to the same extent at the place of cement. So that the environmental condition may not be disturbed as well as economy in construction material can achieve. Now a day, Use of Marble stone in different building work &

Engineering work is increasing day by day. There by the waste of marble stone, i.e. pieces/chips create the waste disposal problem. Therefore, to utilize this marble stone piece/chips in the shape of powder seems to be a better alternative of cement, ecological balance as well as economy also. In this Dissertation work marble powder is used to enhance the properties of concrete M30. In the present study marble powder is replaced by weight of cement in the percentage of 0%, 3.5%, 7%, 10.5%, 14% and 17.5%. To find out the effects on the properties of concrete, compressive strength test and flexural strength test of concrete has been conducted in the lab.

Total 36 cubes and 36 beams have been cast for conducting these tests. After casting the concrete cubes and beam, mould were demoulded in 24 hours and placed in water tank for curing for a period of 7days and 28 days. After that the cubes and beams were tested on a compression testing machine and two point loading machine at 7days and 28 days time period of curing to find out the effect of marble powder on compressive strength and flexural strength of concrete grade M30. The test result shows that up to 10.5 % addition of marble powder by weight of cement in concrete M30 increases the compressive strength as well as flexural strength of concrete and beyond that the compressive strength as well as flexural strength of concrete goes decreases side. The utilization of the solid waste in cement manufacturing company will help in conservation of natural resources like limestone. The use of marble powder as a partial replacement of Cement can reduce the production cost of cement and due to this it may be control the emission of harmful gases into the environment and proved Eco friendly to the environment.

II. MATERIALS AND PROPERTIES OF MATERIALS CEMENT:

Cement is a fine powder which is used as a binding material for making concrete. In this Study work Ordinary Portland Cement of grade 43 manufactured by Bangur Cement Company has been used. It was purchased from the Village – Barwa, (Haryana) from a Building material shop. During this study different Cement related tests were conducted in the laboratory like Fineness, Consistency, Initial and Final setting time, Compressive Strength, Soundness etc. to find out the properties of cement. Different properties of cement on the basis of test results given in table no. 1

TABLE NO.1: PROPERTIES OF CEMENT

S.NO.	Test Conducted on cement	Results	IS Requirement
1	Consistency of cement	34%	---
2	Initial setting Time	39 min.	Minimum 30 minutes As per IS 4031-1968
3	Final setting Time	264 min.	maximum 600 minutes As per IS 4031-1968
4	Fineness	5%	Max. 10% As per IS 269-1976
5	Soundness	1.00 mm	Upto 10.00 mm As per IS :8112-1989
6	Specific Gravity	2.98	3.15 As per IS :8112-1989
7	Compressive Strength (N/mm ²)	26.70	As per IS :8112-1989
	3 days	38.47	>23
	7 days	46.86	>33
	(c) 28 days		>43

SAND/FINE AGGREGATES:

It is a constitute of Concrete. Natural river sand which is locally available and passed through 4.75 mm Indian Standard sieve has been used in this study. The fine aggregates were purchased from the Village- Choudharywas, District – Hisar (Haryana). To find out the properties of sand different tests have been conducted in laboratory like Fineness modulus test, specific gravity test, etc. It confirms to IS: 383-1970 requirements of Zone –II. The properties of Fine aggregates are given in Table.No.-2

Table.No.-2: PROPERTIES OF FINE AGGREGATES

Specific gravity of fine Aggregates	2.65
Fineness modulus of Fine Aggregates	2.73
Moisture Content	1.73%
Grading	Zone-II as per IS: 383-1970

COARSE AGGREGATES:

The locally available Coarse Aggregate has been used in this study work upto the size of 20mm. The Coarse aggregates were obtained from a local quarry from Village Khanak and Tosham (Haryana). Several tests were conducted with the coarse aggregates to find out the properties like Specific gravity, Fineness modulus test of coarse aggregates etc.

Properties of coarse aggregates are in table no.-3.

Table.No.-3: PROPERTIES OF COARSE AGGREGATES

Specific gravity of Coarse Aggregates	2.73
Fineness modulus of Coarse Aggregates	7.03
Water Absorption	Nil

MARBLE POWDER:

It is a byproduct of marble processing factories. It is obtained by grinding the waste marble stone of irregular shape or chips in a grinding machine. For this study, the marble powder is collected from the Village – Barwa (Haryana) from a Building Material shop. It was used in this investigation as a partial replacement with cement for making of M30 grade concrete. The fineness modulus of marble powder was obtained 3.38 during test.



FIGURE-(A) SAMPLE OF MARBLE POWDER

WATER:

Potable water has been used in present study work for mixing and curing of concrete. Water used for mixing and curing of concrete was clean and free from excess amount of oil, acids, salts, organic substance etc. that may be deleterious to concrete. As per IS: 456-2000 potable water is best for mixing and curing of concrete.

III. EXPERIMENTAL PROGRAM

TESTING OF CONCRETE SPECIMENS:

The following tests have been carried out the properties of concrete grade M30:-

- Compressive Strength Test
- Flexural Strength Test

(i) COMPRESSIVE STRENGTH TEST:

Compressive strength of concrete cube is checked by compression testing machine which is shown in figure – (B). The test was conducted on the cubes as per IS 516-1959 code. The standard size of Cube 150mm×150mm×150mm has been used for the compression test. Total 36 cubes were tested in this work to find out the compressive strength of concrete grade M30. The marble powder has been replaced by weight of cement in the percentage of 0%, 3.5%, 7% 10.5%, 14%, and 17.5% for making a concrete cube and compressive strength of cube checked at 7 days and 28 days of curing.



FIGURE –(B) COMPRESSION TESTING MACHINE

(ii) FLEXURAL STRENGTH TEST:

Flexural strength of concrete beam was tested by two point loading machine which is shown in figure (C). Beam mould size 100mm×100mm×500mm has been used in this study work. Total 36 beam specimens were cast to find out the flexural strength of concrete. The percentage of marble powder replaced by cement was taken as 0%, 3.5%, 7%, 10.5%, 14% and 17.5% for preparation of concrete beam grade M30. The flexural strength of concrete beam was checked at 7 days and 28 days period of curing.



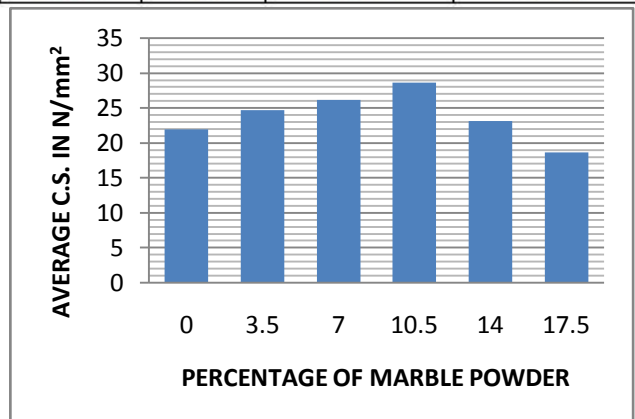
FIGURE-(C) FLEXURAL STRENGTH TEST OF CONCRETE BEAM

IV. TEST RESULTS

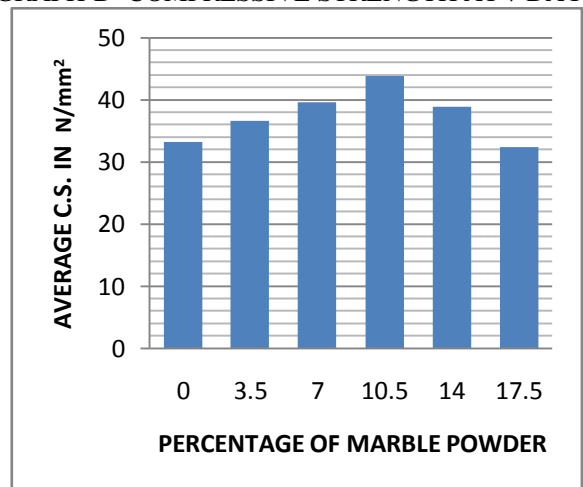
Test results of compressive strength of concrete cubes and Flexural strength of concrete beam at 7 days and 28 days is shown in the form of tables (4 and 5) and graphs (D, E, F and G).

Table – 4: COMPRESSIVE STRENGTH TEST OF CONCRETE CUBE

Mix	%age of Marble Powder	Compressive Strength At 7 Days in N/mm ²	Compressive Strength At 28 Days in N/mm ²
MX0	0	21.92	33.18
MX1	3.5	24.66	36.59
MX2	7	26.15	39.63
MX3	10.5	28.59	43.78
MX4	14	23.11	38.87
MX5	17.5	18.59	32.37



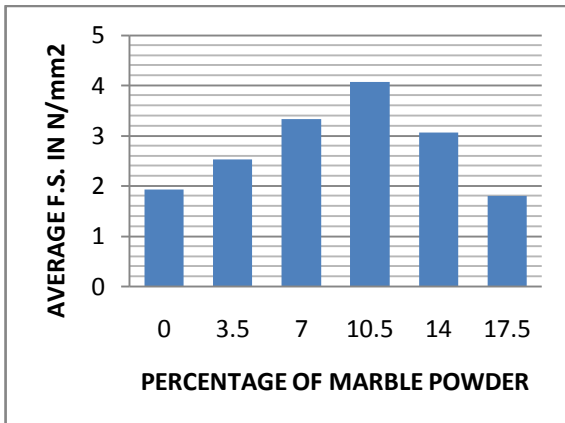
GRAPH-D COMPRESSIVE STRENGTH AT 7 DAYS



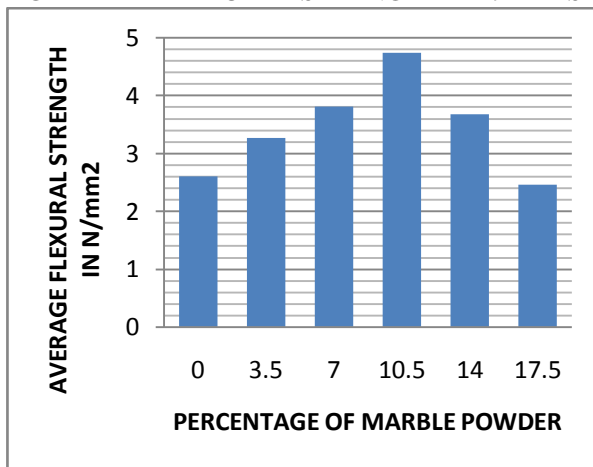
GRAPH-E- COMPRESSIVE STRENGTH AT 28 DAYS

TABLE-5: FLEXURAL STRENGTH TEST RESULTS OF CONCRETE BEAM

Mix	%age of Marble Powder	Flexural Strength At 7 Days in N/mm ²	Flexural Strength At 28 Days in N/mm ²
MX0	0	1.93	2.60
MX1	3.5	2.53	3.26
MX2	7	3.33	3.80
MX3	10.5	4.07	4.73
MX4	14	3.06	3.67
MX5	17.5	1.80	2.46



GRAPH-F- FLEXURAL STRENGTH AT 7 DAYS



GRAPH-G- FLEXURAL STRENGTH AT 28 DAYS

V. CONCLUSIONS

On the basis of results of compressive and flexural tests of concrete, the following conclusions can be made

- The properties of Concrete grade M30 get improved due to addition of marble powder in cement.
- The test result shows that it is feasible to replace the cement by marble powder for improving the strength characteristics of concrete.
- The test result shows that upto 10.5 % additions of marble powder by weight of cement increases the compressive strength of concrete cube and beyond that the compressive strength of concrete goes decreases side.
- Flexural strength of concrete gets improved upto 10.5 % mixing of marble powder in cement by weight, after that more percentage of marble powders decreases the flexural strength of concrete.
- The use of marble powder at the place of cement in desired quantity will reduce the construction cost. Because it is easily available and cheaper than cement.
- The use of marble powder will be prove Eco friendly, because it can be control the emission of harmful gases in cement industry by controlling the cement production.

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