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Experimental Investigation on Waste Utilization of Marble Dust in Concrete with Partially Replacement of Cement

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Abstract: ***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 wastes and stone slurry. If the alternative material for cement is a waste,. Based on the experimental results, it was found that the use of marble dust in concrete reduces its environmental impact and is economically beneficial. Marble dust is found to show filler effect by giving the concrete a denser and even structure. It is observed that mechanical and durability properties of concrete enhanced with incorporation of dried marble dust for upto 15% replacement. Finally based on review of literature and experimental results, a set of guidelines has been proposed for the use of marble dust as a partial replacement of cement in concrete.***

Keywords: Marble Powder, Cement, Compressive Strength, Split Tensile Strength, Metamorphosis,

I. INTRODUCTION MARBLE DUST POWDER

Marble powder is the by-product of Marble factories; the sludge or moist powder is usually acquired from the polishing, dressing and trimming of the marble stones and the fine marble powder which is usually still left after dressing polishing and dumped into the landfills, water sheds, streams, blind wells and the periodic streams which is usually after that transported out by the rainfall water to the agricultures lands thus leading to negative effects on the soil and reducing the fertility of soil, creation.



Marble Dust Powder

II. LITERATURE REVIEW

Topcu et al studied the effect of waste marble dust content as filler on properties of self-compacting concrete which can be used in transportation structures like bridges and tunnels. The marble dust was used as additional filler in the mix and was replaced up to 50%. For a constant range of flow value the super plasticizer was varied in the various mixes. In 0% MD mix the amount used was 2.5% of the binder content and in 10 % MD mix it was 2.2 % which showed that the requirement of super plasticizer decreased with increasing marble dust content, as it was only 1.1 % for the 50% mix.

Manuel Sardinha *et al.* utilised four substitution proportions talking to, by bond volume, 0, 5, 10 and twenty p.c of marble sludge. Their examination incontestable that the solidness qualities of cement weaken as bond substance can increment and marble slop substance can increment. For the 5 and 10 p.c change of integrity proportions, these misfortunes were immaterial.

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Arun Kumaret al Experimental investigation on Strength Behaviour of Concrete Produced with Marble Dust Powder, marble natural stone industry generates both solid and stone slurry and according to prior survey solid waste materials generation is even more in marble natural stone industry, in and about 40% of waste materials is formed, that's around 68 million tonnes. So, have an effect on the fertility of the soil. Experimental programme was carried out using 0%, 7.5%, 15%, 22.5%, 30% by wt. partial replacement of cement with marble dust powder for making of cement concrete with 0.40 water cement ratio.

III. OBJECTIVE

The objectives of the present work are listed below

A. To find Physical and Chemical characteristics of Waste Marble Powder.
B. To investigate and compare compressive, split tensile and flexural strength of partially replaced specimens with control mix.
C. To found the optimum percentage of marble dust powder substitute in concrete that provides the strength of the concrete (structure) maximum

The objective of this study is to search alternatives material, which can fully or partially

IV. MATERIALS AND METHODOLOGY

A. List of Materials use in this Experiment
1) Cement
2) Fine Aggregate
3) Course Aggregate
4) Marble powder
5) Water

B. Methodology
The following laboratory tests were performed on aggregates as per relevant IScode and mix design of M25 and M30 grade of concrete. The laboratory test programmed is
summarized below.

1) Physical properties of coarse aggregates (20mm and 10mm size)
- Sieve analysis
- Specific gravity
- Water absorption

2) Physical properties of cement
- Fineness
- Specific gravity

3) Physical properties of fine aggregates
- Sieve analysis
- Specific gravity
- Water absorption

4) Mix design (M 30 grade) as per IS 10262:2009.
5) Mix design (M 25 grade) as per IS 10262:2009
6) Preparation of specimens
- Concrete Cube of size 150x150x150
- Concrete Cylindrical columns of Dia 150mm and length 300 mm.
- Concrete beams 0f size 150x150x700 mm.

7) Testing of cubes for compressive strength.
8) Testing of beams for flexural strength.
9) Testing of cylindrical columns for Split tensile strength.

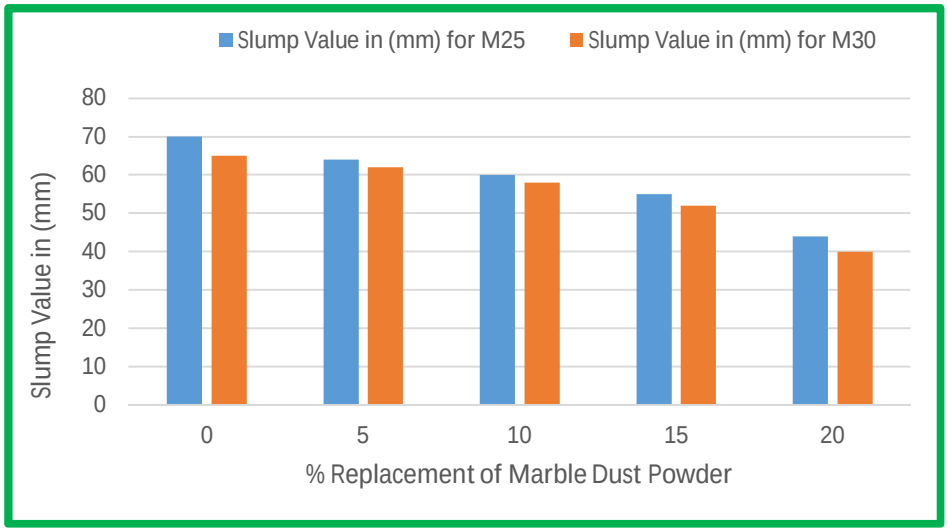
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V. EXPERIMENTAL RESULT

A. Workability

The workability is tested by slump test. When the concrete is freshly mix then it is tested by filling the fresh concrete in the slump cone. The workability is measured by removing the slump cone and measured the subsidence of the concrete this value is called the slump value of the concrete



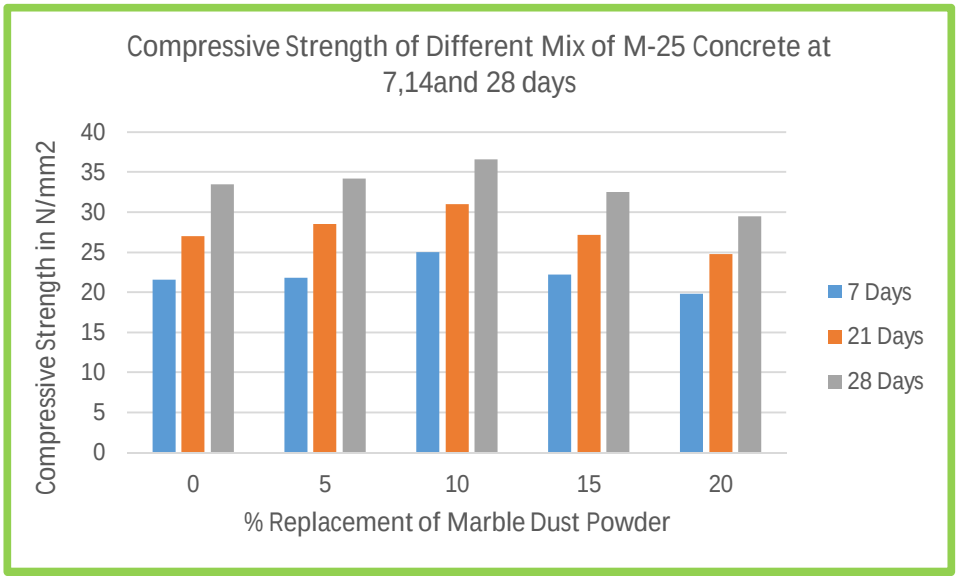
Slumps of M-25& M-30 at Different percentage of MDP

From the Experiment work ,It is also observed that, as the percentage of Marble Dust Powder increases from 0% to 20%, the concrete mix becomes stiffer, and workability results in low slump value. Low slump value may have great impacton the workability of concrete.

B. Compressive Strength Test

Compressive strength test finds out the high amount of compressive load a material can bear below facture limit. The Compressive Strength compared to control specimen with various percentages of MDP.

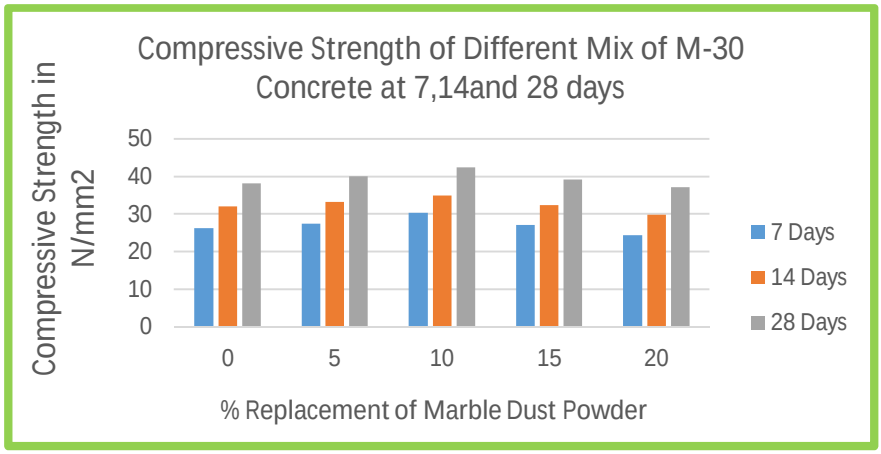
1) Compressive Strength of Different Mix of M-25 Concrete



Compressive Strength of Different Mix of M-25 Concrete at 7,14and 28 days at different Percentage of MDP

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2) Compressive Strength of Different Mix of M-30 Concrete



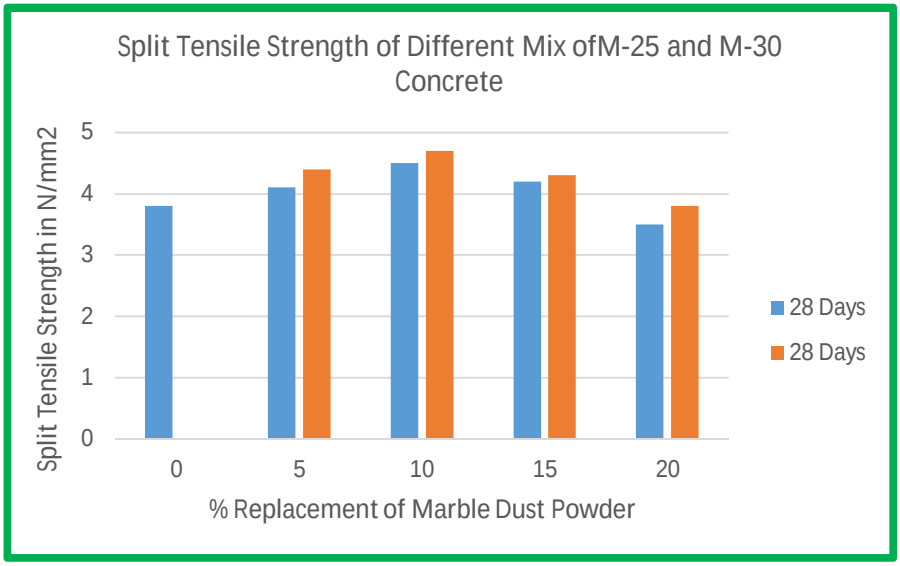
Compressive Strength of Different Mix of M-30 Concrete at 7,14and 28 days at different Percentage of MDP

From the Graph is seen that the compressive strength in M 25 and M30 grade of concrete at 7, 14, and 28 up to 10 % replacement of Marble Dust Powder and After that aove 10 % MDP it decrease compressive strength. From the experiment result it was found that at 28 days the compressive strength for MDP 5% increases in 2.0 8%, when compared to control specimen. The compressive strength for 10%, increases in 9.2 %, and at 15% and 20% it strength decrease -2.9 % and -11.94% respectively. MDP 10% increases in higher strength, when compared to all other mixes. But MDP at 15% and 20% decreases .

C. Split Tensile Strength test

One of the important properties of concrete is "tensile strength" as structural loads make concrete vulnerable to tensile cracking. Tensile strength of concrete is much lower than its compressive strength.

Split Tensile Strength of Different Mix ofM-25 Concrete



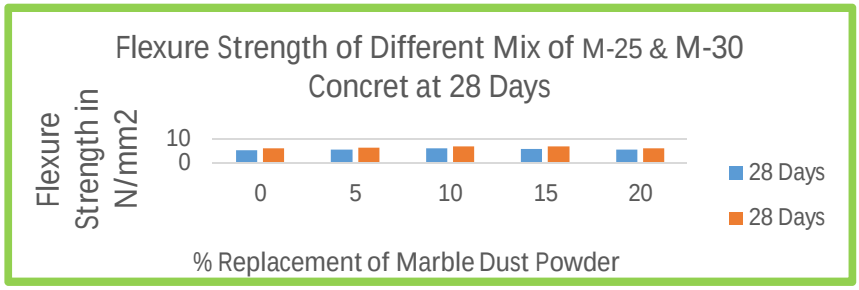
Split Tensile Strength of Different Mix of M-25 & M-30 Concrete at 28 days at different Percentage of MDP

From the above Graph is seen that the Split Tensile strength in M 25 and M30 grade of concrete at 28 days increase up to 10 % replacement of Marble Dust Powder and After that above 10 % MDP it decrease Split Tensile strength. The Split Tensile strength compared to control specimen with various percentages of Metakaolin. When compared to control specimen the Split Tensile strength for M25 grade of concrete at 10% replacement of MDP Flexural strength increases 16.9% of normal concrete and for M30 Split strength increases 11.9 % of normal concrete

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D. Flexure Strength Test

Flexural strength is one measure of the tensile strength of concrete. It is a measure of an unreinforced concrete beam or slab to resist failure in bending.



FlexureTensile Strength of Different Mix of M-25 and M-30 Concrete at 28 days at different Percentage of MDP

From the above Graph is seen that the Flexure strength in M 25 and M30 grade of concrete at 28 days increase up to 10 % replacement of Marble Dust Powder and After that aove 10 % MDP it decrease Flexure strength. The Flexural strength compared to control specimen with various percentages of Metakaolin. When compared to control specimen the Flexural strength for M25 grade of concrete at 10% replacement of MDP Flexural strength increases 15% of normal concrete and for M30 Flexural strength increases 16 % of normal concrete.

VI. CONCLUSION

A. It is also observed that, as the percentage of Marble Dust Powder increases from 0% to 20%, the concrete mix becomes stiffer, and workability results in low slump value. Low slump value may have great impact on the workability of concrete.

B. Result it was found that The Compressive strength of Concrete increases up to 10% replacement of cement by MDP and further increasing of percentage of MDP leads to decrease in compressive strength of concrete, The maximum values of Compressive Strength for M25 is 36.6 N/mm2 and For M30 maximum values of Compressive Strength is 42.5 N/mm2.

C. The maximum values of Split Tensile Strength for M25 is 4.5 N/mm2 for M30 the maximum values of Split Tensile Strength is 4.7 N/mm2

D. The maximum values of flexural Strength for M25 is 6.2 N/mm2 for M30 the maximum values of flexural Strength is 7 N/mm2 .

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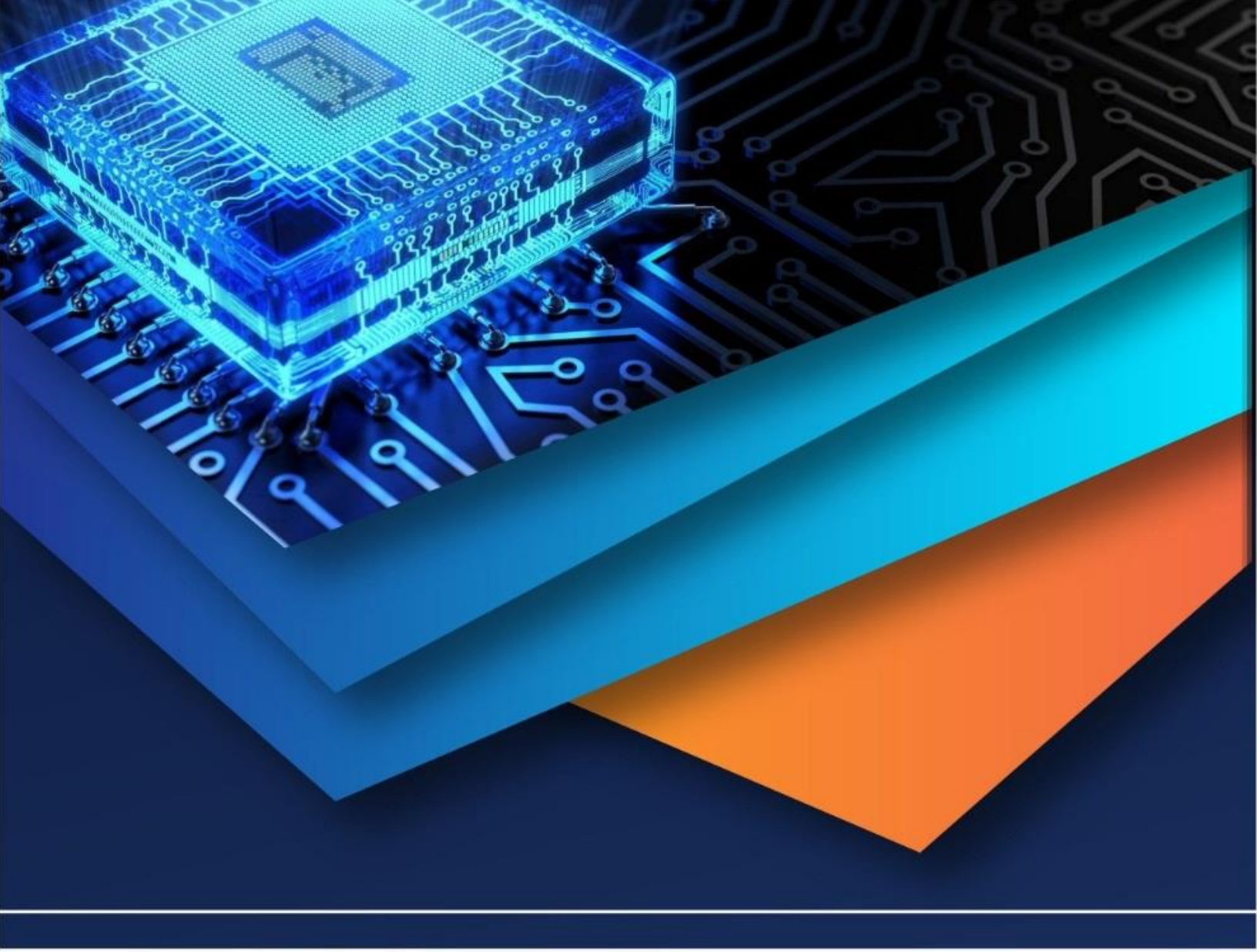
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