Comparative Study on Effect of Chloride and Water on Marble Dust Concrete

Mr. Abhilash B. Gaikwad[†], Mr. Abhishek J. Patil Thorat[†], Mr. Bajirao V. Mane[†], Miss. Komal R. Nikam[†],(BE Civil), Mr. R. P. Patil[‡]
† (ME Civil – Structures), Nanasaheb Mahadik College of Engineering, Peth, (MH)
Tal. Walwa, Dist. Sangli (415407)
Email ID – abhilashgaikwad8515@gmail.com
Email ID – ranjitpatil8571@gmail.com

Abstract— In recent years the waste material to the environment directly can cause the environment problems. Hence the reuse of the waste material has been used. This waste is produced from manufacturing and polishing process like sawing and shaping. This research aims to study the effect of using marble powder as partially replaced of cement on the compressive strength of concrete. In this paper, we have used M30 grade concrete. The concrete cubes are casted for partially replacement of cement by marble dust with 0%,5%,10%,15% & 20%. The 0% replacement is considered controlled percentage replacement. Then the specimens having size of (150mm x 150mm x 150mm) are tested after 28 & 60 days for water and chloride water curing. We have kept 5% Nacl consistency. The result graph shows that variations in compressive strength for cement replaced by marble dust for 28 & 60 days curing in water and chloride water curing. The 5% & 10% replacement is desirable percentage of replacement of cement by marble dust.

Index Terms— Marble dust, Cement replacement and compressive strength of concrete, Chloride attack.

1 INTRODUCTION

Marble industries are grown widely in recent few years. These extract marble dust which is harmful polluting waste due to its highly alkaline property. So main objects is waste management and use of marble dust in making low cost concrete. Marble has been commonly used as a building material seen the ancient times. The industries disposal of the marble powder material, consisting of very fine powder, today constitutes one of the environmental problems around the world. Marble dust is waste pollute which damage environment due to manufacturing and processing techniques because of its lower cost versatility. This waste is used for making marble dust concrete. Marble dust can be used as filler in concrete is helps to reduced total void content in concrete. For the study of marble dust concrete, we used M_{30} grade concrete, so as to find out effect of general category concrete as it is widely used in practice. The concrete cubes of (150mm x 150mm x 150mm) are cast for partial replacement of marble dust with 0%,5%,10%,15% & 20%. Mainly 0% specimen known as "controlled specimen", then these cubes were cured into water and 5% Nacl water curing for 28 and 60 days. The graph obtained studied with respect to controlled specimen. These shows variations into compressive strength for partial replacement of cement by marble dust for water and 5% Nacl water curing, results shows that 5% and 10% replacement is desirable percentage of replacement of cement by marble dust. Compressive strength goes on increasing with variations in percentage of marble dust up to 10% replacement.

2 OBJECTIVE:

The objective of the research paper is to study the behavior of marble dust concrete for water and 5% Nacl water curing. Also we are interested to study the comparison of compressive strength of marble dust concrete for 0%, 5%, 10%, 15% & 20%. Replacement of cement by marble dust for both water and chloride water curing. The concrete specimens are then allowed for 28 and 60 days for both water curing and 5% Nacl water curing. Then test will give us the nature of profile compressive strength variations and this variations can be effectively represented by means of graph.

3 ADMIXTURE:

MARBLE DUST:

In this study the collection of marble dust from Shiroli MIDC, Kolhapur. The specific gravity of marble dust is 2.842gmm/cc. the fineness by sieving 24.4%, specific surface area (cm^2/gm) 11.4 X 10^3. Marble is a metamorphic rock resulting from the transformation of a pure limestone. The purity of marble is responsible for its colour and appearance. It is white if the limestone is composed solely of calcite(100% $CaCo_3$). Marble is used for construction and decoration. Marble is durable, has a noble appearance, and is consequently in great demand. This huge unattended mass of marble waste consisting of very fine particles is today one of the environmental problems around the world.

CHEMICAL PROPERTIES OF MARBLE DUST:

Material	Marble Dust
LOI	40.63
SiO_2	4.99
Al_2O_3	1.09%
Fe_2O_3	1.09%
CaO	32.23%
MgO	18.94
SO_3	0.02
K_2O	0.91
Na_2O	0.63

3 NECISSITY OF USE OF MARBLE DUST:

In marble industry generation of waste into large quantity. Also stone dust generated during manufacturing and processing techniques, corresponds to around 20% of the final product from marble industry. There are several reused and recycling solutions for this industrial by product both in experimental and practical applications.

4 APPLICATION OF MARBLE DUST:

An additive for thermoplastic and as a hardening agent for rubber industry are as follows:

1. Power coating, paints and ceramic industry
2. Reinforced polyester glass fiber
3. Leather cloth and flooring applications
4. Detergent applications
5. Glass industry (in manufacturing sheet and optical glasses)

5 ADVANTAGES OF MARBLE DUST

1. Marble Dust can be used as filler in concrete and paving materials and helps to reduce total void content in concrete.
2. Marble Dust can be used as an admixture in concrete, so that strength of the concrete can be increased.
3. We can reduced the environmental pollution by utilizing this marble dust.
4. Marble dust is mixed with concrete, cement or synthetic resins to make counters, building stones, and many other objects.
5. Marble dust used as a component for manufacture of white cement.
6. The crystallized particles present in the dust from the marble gives an iridescent feel to the objects.
7. Marble dust is chipper as compared to cement.
8. Marble have low cost as compared to cement.
9. Binding property of marble slurry is very good.

6 DISADVANTAGES OF THE MARBLE DUST

1. Only 20% of the final product is obtained from stone industry.
2. Marble dust is not available in all the place.
3. Marble dust increases the soil alkalinity.
4. The waste is dumped on land the dust is airborne by the wind and makes air pollution in environment.
5. Marble dust affect the soil fertility and reduce them.

7 UTILIZATION OF MARBLE DUST

Utilization of the marble dust in various industrial sectors especially.

1 Construction
2 Glass
3 Paper industry

8 MIX PROPORTION:

In this research paper, the M_{30} mix proportioning is designed as per guidelines according to the Indian standard recommended method IS: 10262:2009. We used 33 grade of OPC cement. Also zone II is selected from IS: 383 (1970). The coarse aggregate is selected which is able to passing through 20mm and retained on 10mm IS sieve. After the designing from IS :10262:2009 we got the final mix proportion as follows:

Cement	Fine Aggregate	Coarse Aggregate	Water to Cement Ratio
1	1.38	2.43	0.36

The mix proportion for M_{30} grades of concrete with varying percentage of marble dust is presented by following table.

MIX PROPORTION FOR CONCRETE MIX:

0% Replacement

Cement + Marble Dust (Kg)	Fine Aggregate (Kg)	Coarse Aggregate (Kg)	Water to Cement Ratio (Lit).
4.9557+00.00	6.8556	12.082	1.8113
1	1.38	2.43	0.36

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5% Replacement

Cement + Marble Dust (Kg)	Fine Aggregate (Kg)	Coarse Aggregate (Kg)	Water to Cement Ratio (Lit).
4.9557+0.2477	6.8556	12.082	1.8113
1	1.38	2.43	0.36

10% Replacement

Cement + Marble Dust (Kg)	Fine Aggregate (Kg)	Coarse Aggregate (Kg)	Water to Cement Ratio (Lit).
4.9557+0.4955	6.8556	12.082	1.8113
1	1.38	2.43	0.36

15% Replacement

Cement + Marble Dust (Kg)	Fine Aggregate (Kg)	Coarse Aggregate (Kg)	Water to Cement Ratio (Lit).
4.9557+0.7433	6.8556	12.082	1.8113
1	1.38	2.43	0.36

20% Replacement

Cement + Marble Dust (Kg)	Fine Aggregate (Kg)	Coarse Aggregate (Kg)	Water to Cement Ratio (Lit).
4.9557+0.9911	6.8556	12.082	1.8113
1	1.38	2.43	0.36

RESULTS AND DISCUSSION:

The tests are carried out for percentage replacement of cement by marble dust after curing has been done for water curing and 5% Nacl water curing. The compressive strength goes on increasing up to 5% & 10% replacement and subsequently decreasing by increasing the percentage of marble dust. The results shows that 5% replacement gives better compressive strength for water curing after 28 and 60 days respectively. Also the 10% replacement gives better compressive strength for 5% Nacl water curing after 28 and 60 days respectively. The graphical variations also shows that the compressive strength.

a) Test Result for Water Curing:

Table No.1 Compressive strength for water curing

Sr. No.	% Replacement of cement by MD	Average compressive strength for water curing (N/mm^2)	
		28 Days	60 Days
1	0%	35.28	32.54
2	5%	38.29	33.52
3	10%	36.36	33.15
4	15%	28.17	37.12
5	20%	29.52	31.54

Graph No.1 compressive strength for water curing

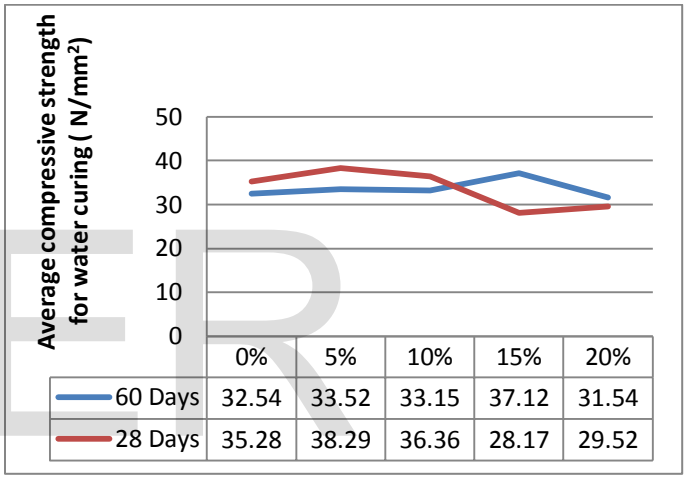

Table No.2 Compressive strength for 5% Nacl water curing

Sr. No.	% Replacement of cement by MD	Average compressive strength for 5% Nacl water curing (N/mm^2)	
		28 Days	60 Days
1	0%	36.02	32.51
2	5%	36.81	32.53
3	10%	38.38	39.83
4	15%	28.82	32.41
5	20%	32.95	31.92

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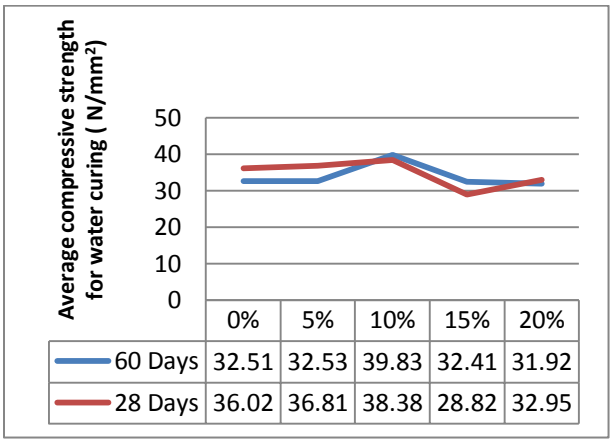
Graph No.2 compressive strength for 5% Nacl water curing



CONCLUSION:

From the experimental study it is concluded that, for 5% and 10% replacement of cement by MD, it is clearly seen that compressive strength increases as compare to 15% and 20% replacement in the water curing for 28 and 60 days respectively. For chloride water curing, the 5% and 10% replacement of cement by MD, it is seen that compressive strength goes on increasing, but for 15% and 20% replacement of cement by MD compressing strength goes on decreasing for 28 and 60 days respectively. In water curing 5% and 10% replacement of cement by MD, compressive strength is 10.5% greater than that of 15% and 20% replacement. Also in chloride water curing 5% and 10% replacement of cement by MD, compressive strength is 5% greater than that of 15% and 20% replacement.

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