Strength Investigation on Hardened Concrete by Partial Replacement of Sand with Marble Powder and Quarry Dust

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Abstract – Construction industry is one of the major users of the natural resources. Continuous use of natural resources had led to high escalation in their unit costs. Sand is one such material which continuous use has started posing serious problems with respect to its availability, cost and environmental impact. At the same time, increased concern is being expressed with respect to disposal of industrial wastes. Disposal of industrial wastes like fly ash, marble powder and quarry dust is becoming a serious threat to the environment. In this work marble powder was replaced for 25%, 35%, 45%, 55% and 65% and quarry dust was replaced for 75%,65%55%,45% with sand.. Hardened concrete test such as compression strength test, split tensile strength and flexural strength were performed for M25 Grade of concrete the results were found to be good.

Index Terms – Concrete, Marble Powder, Quarry Dust.

1. INTRODUCTION

Currently the world is poised for a major initiative in infrastructure development in construction of buildings and other structures where concrete plays a vital role in this initiative of development. Conventional building materials such as cement, aggregate, steel and timber are increasingly becoming expensive and scarce. River sand, which is one of the constituents used in the production of conventional concrete, has become very expensive and also becoming scarce due to depletion of river bed. This goes a long way in environmental protection and ecological balance. In recent time to eradicate environmental problems lot of waste materials were partially replaced in concrete. The main objective of this work is to find the compression strength, tensile strength and flexural strength of concrete by replacing sand with quarry dust and marble powder for different combination, to find the workability of concrete and to find the optimum performance.\

2. MATERIALS

Ordinary Portland cement

Ordinary Portland cement with specific gravity 3.15 was used. Initial setting time of cement was 30min and final setting time was found to 10hrs.

Marble Powder

Marble Powder collected from local marble cutting shop. Marble powder was sieved in 2.36mm. Specific gravity was found to be 2.85

Sand

River Sand used in this work confirming to IS 383:1970. Specific gravity was found to be 2.66. Fineness modulus was found to be 2.9.

Quarry Dust

Quarry dust obtained from local crusher was used. Specific gravity was found to be 2.74. Quarry dust passing through 4.75mm and retained in 2.36 mm was used.

Coarse Aggregate

Coarse aggregate with size 16mm was used. Specific gravity was found to be 2.89.

Water

Water used for curing and mixing, the water used is free from deleterious material confirming to IS 456:2000

MIX PROPORTION:

M25 Grade of concrete with ratio 1:1:2 was used; water cement ratio was kept at 0.45.Mix design was done as per IS 10262:2009. Slump value was found to be 60mm.

Table 1 PERCENTAGE OF REPLACEMENT OF QUARRY DUST AND MARBLE POWDER

Percentage of replacement of marble powder	Percentage of replacement of Quarry dust
0% replacement	0% replacement
25% replacement	75% replacement
35% replacement	65% replacement
45% replacement	55% replacement
55% replacement	45% replacement

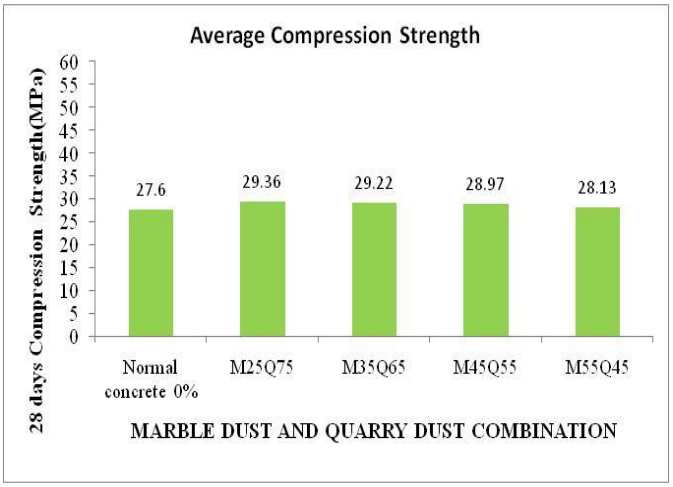

Fig 1: 28 Days compression strength test

3. RESULT AND DISCUSSION

Compression Test on Concrete Cube

The test is done to determine the compressive strength of concrete specimens as per IS: 516 - 1959.Tests should be done at recognized ages of the test specimen, curing was done for 28days. The ages should be calculated from the time of the addition of water to the drying of ingredients.

Compression test is the most common test conducted on hardened concrete, partly because is an easy test to perform, and partly becomes most of the desirable characteristic properties of concrete are qualitatively related to is compressive strength. The compression test is carried out on specimens cubical or cylindrical in shape. The cube specimen should be in the size 150 × 150 × 150 mm. marble powder was replaced for 25%, 35%, 45%, 55% and 65% and quarry dust was replaced for 75%,65%55%,45% with sand curing was done for 28days and results are shown in fig 1.

SPLIT TENSILE STRENGTH TEST RESULT

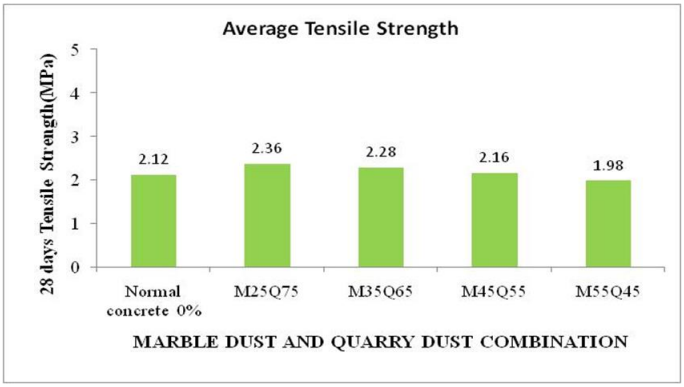

Fig 2: 28 Days split tensile strength test

Cylindrical specimen of 150mm diameter and 300mm in length are cast as per IS 516:1959.. Marble powder was replaced for 25%, 35%, 45%, 55% and 65% and quarry dust was replaced for 75%,65%55%,45% with sand curing was done for 28days and results are shown in fig 2

FLEXURAL STRENGTH TEST RESULT

The prisms of size 100x100x500mm are cast are used for to test the Flexure Strength of the Concrete as per the specifications of IS 516:1959. Marble powder was replaced for 25%, 35%, 45%, 55% and 65% and quarry dust was replaced for 75%, 65%55%, 45% with sand curing was done for 28days and results are shown in fig 2.

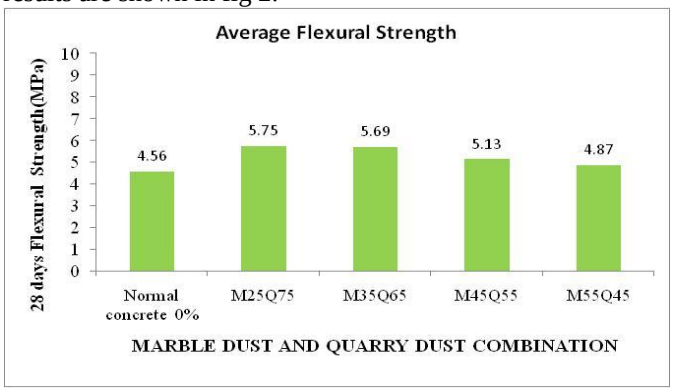

Fig 3: 28 Days Flexural strength test

4. CONCLUSIONS

From the above work the following results were concluded. Marble powder replacement for 25%, 35%, 45%, 55% and 65% and quarry dust was replaced for 75%, 65%55%, 45% with sand was found to increasing in strength when compared to ordinary normal concrete. Marble and quarry dust can be used as an alternative material for fine aggregate. Marble dust 25% and quarry dust 75% replacement for sand has shown best performance in compression, tensile and flexural strength. Using of marble dust and quarry dust is environment friendly. As particle size of marble and quarry dust is very compact absorption of more water can be achieved.

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