Partial Replacement of Sand by Quarry Dust in Construction of Box Culvert

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Abstract – *The concept which is highlighted in this study is the replacement of sand by Quarry dust. This study could help in boosting the less consumption of sand and hence preserving the natural fine aggregate. Use of Quarry dust as fine aggregate in concrete may also leads to the solution of land filling issue by quarry dust and natural sand scarcity. As we all know that availability of sand at low cost is not possible nowadays but using a certain percentage of Quarry dust as fine aggregate that's why we needed an alternative material in replacement of sand and Quarry dust satisfies all the requirements of fine aggregate at low cost. It is found that with 40% replacement of Sand by quarry dust gives the maximum strength and then the strength decreases from 50%.*

1. INTRODUCTION

This experimental study shall deal with the Compressive strength and Slump Value of the concrete and the other properties of the materials used for concrete. With the tests mentioned above it will be found if the Quarry dust is suitable as a fine aggregate in partial replacement of sand or not. The test will be done in two sets, First set of test will be for M20 concrete on 20%, 30%, 40%, and 50% replacement of sand. Second set will be done for M25 concrete for the same % replacement.

2. PROBLEM IDENTIFICATION

In construction, concrete plays an important role and it has been utilizing in a large amount for so many years. Due to depletion of river bed the price of sand is increasing day by day with the increase of demand of sand. Hence, we needed a better alternative material as a replacement of sand.

3. MATERIAL USED FOR CONCRETE

3.1 Cement: -

For this experiment the IPC-43 cement will be used.

Specific gravity: 3.05
Initial setting time: 30 min.
Final setting time: 220 min
Fineness: 8 % residue on IS 90 micron sieve

3.2 Sand: -

For this Experiment sand of size 0.075 mm to 2.36 mm will be used.
Specific gravity: 2.53
Fineness modulus: 3.08
Density: 1.63gm/cc
Void ratio: 0.55

3.3 Quarry Dust: -

For this experiment the Quarry dust of particle size from 0.75 to 5 mm will be used.
Specific gravity: 2.57
Fineness modulus: 2.41
Density: 1.85gm/cc
Void ratio: 0.42

Fig. 1:- Quarry Dust

3.4 Coarse Aggregates: -

For this experiment 2.36mm – 20mm size aggregates will be used.
Maximum size: 20 mm
Specific gravity: 2.98
Fineness modulus: 6.36
Density: 1.58gm/cc

4. METHODOLOGY

For M20 and M25 grade of concrete sand will be replaced by quarry dust with 20%, 30%, 40% and 50%. Concrete will be mixed in proportion given with w/c ratio 0.6 for M20 and 0.5 for M25.

Slump test is done for each % replacement of sand.
For the purpose of 7 days and 28 days of compression test 6-6 concrete cubes will be prepared in the mould of 150x150x150 mm for each % replacement for both M20 and M25 Grade Concrete.

After 7 days of curing testing will be done for each and every cube. The process will be repeat after 28 days of curing, then the result will be obtained for each concrete cube.

Expected Result based on previous papers -

Table 1:- Slump value.

Sand: Quarry dust	Slump value (mm)	
	M20 with w/c ratio 0.6	M25 with w/c ratio 0.5
80:20	13	11
70:30	11	10
60:40	9	9
50:50	9	8

4. TEST ON CONCRETE

Slump Test

To check the ease of placement of concrete, slump test is done. For a normal cement concrete it is found to have higher workability with higher slump value. For concrete made with quarry has found to have less workability, but the problem can be resolved by plasticizers.

For slump test the slump cone with 300 mm height, 200 mm bottom opening and 100 mm top opening will be used for Slump value.

Fig.2: - Slump Test

5. TEST ON CONCRETE CUBES

Compression Test

The compressive strength of concrete may define as the total load applied over a particular area. The compressive strength of concrete shows the load resistance over the applied load.

Fig.2: - Compression testing Machine

Expected Result as per previous research -

Table 2:- Compressive strength of concrete (in MPa)

Sand: Quarry dust	M20		M25	
	7 days	28 days	7 days	28 days
80:20	20.49	23.94	23.24	31.66
70:30	21.43	26.00	24.85	32.34
60:40	22.06	27.07	24.26	33.10
50:50	21.11	25.67	23.65	31.75

7. CONCLUSION

The main objective of this Experimental study is to find out the suitability of quarry dust as fine aggregate in concrete mixture. The whole study is based on the research for finding an alternative material for natural fine aggregate.

Since, the excavation of river bed is leading too much of experimental damage, and dumping of quarry dust also having a big issue due to environmental pollution, the quarry dust might be useful as an alternative fine aggregate.

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