EXPERIMENTAL INVESTIGATION ON PARTIAL REPLACEMENT OF M-SAND AND QUARRY DUST INTO RIVER SAND.

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ABSTRACT

The main purpose of the project is to develop properties of concrete by replacement of m-sand and quarry dust . Now a days scarcity of sand is the biggest problem in civil field. concrete is the most widely used composite construction material . Fine aggregate plays a very important role for imparting better properties to concrete its fresh and hardened state . Generally sand was used as a fine aggregate for concrete material . The concrete is mainly used in the construction of buildings like residential , commercial , institutional etc… At this time we need a replacement of sand so to solve this issues we use the quarry dust as a replacement of sand. Rapid increase in construction activities leads to acute shortage of conventional construction material.

KEYWORDS:

Manufactured sand, Quarry dust, Replacement, compression test.

INTRODUCTION

River sand is a product of natural weathering of rocks over a period of millions of years. It is mined from the **river** beds. **River sand** is becoming a scarce commodity now. **River** (Freshwater) **sand** is farsuperior for construction purposes than any other **sand** used in construction. **Manufactured sand** (**M-Sand**) is a substitute of river **sand** for concrete construction. **Manufactured sand** is produced from hard granite stone by crushing. The crushed**sand** is of cubical shape with grounded edges, washed and graded to as a construction material. The size of **manufactured sand** (**M-Sand**) is less than 4.75mm. Quarry dust is a by-product of the **crushing** process which is a concentrated material to use as aggregates for concreting purpose, especially as fine aggregates. In quarrying activities, the rock has been crushed into various sizes; during the process the dust generated is called quarry dust and it is formed as waste. We replace to add m-sand as a additional ingredient with the used quarry dust. M-sand is 10% better concrete strength than sand. M-sand is highly recommended for concreting . RCC and masonry works construction have been arrived that manufacturing sand from VSI(vertical shaft impactor) is a suitable and it provides adequate strength and durability for the concrete. On experimentation, it was found that the partial replacement of sand with 10% of quarry dust has given the optimum results. Therefore, this study recommends that if partial replacement of sand with quarry dust up to 10% in M20 grade of concrete is done, the effective waste management can contribute towards saving of our environment. The other alternative taken in the study is quarry dust obtained from stone quarries. Crusher dust, which is available abundantly from crusher units at a low cost in many areas, provides a viable alternative for river sand in concrete. Earlier investigations indicate that stone crusher dust has a good potential as fine aggregate in concrete construction. In our present investigation, there by 100% comparison is reasonable it gives the best solution.

OBJECTIVES OF THE PRESENT STUDY

1) To determine the effect of replacement of sand by M- Sand and quarry dust on properties of concrete.

2) To study the suitability of M-sand by replacing natural sand with , 10%, , 20%, and 30%,40%,50% M-sand.

3) To study the suitability of quarry dust by replacing natural sand with, 10%, , 20%, 30%, 40%, 50% quarry dust.

4) To study the combination of m-sand and quarry dust by replacing natural sand with, 10%, , 20%, 30%, 40%, 50% .

5) To study workability of fresh concrete.

6) To study compressive strength and split tensile strength of hardened concrete.

LITERATURE REVIEW

Sivakumar and Prakash(2012) Investigated on the mechanical properties of concrete with quarry dust. According to their experiment they reported that the quarry dust is the effective replacement for river sand. **Ilangovana. R et al. (2010)** Carried out an experiment and reported that the physical and chemical properties of quarry dust and the durability and strength of

concrete having dust as fine aggregates under sulphate and acid action, was a better option than that of conventional concrete. **Shanmugapriya .T and Uma .R. N. (2012)**Made an investigation on optimization of partial replacement of natural sand in high performance concrete with silica fume. It was reported that sand and silica fume increased the flexural and compressive strength.**Devi .M and Kannan. K.(2011)**They investigated on the strength of concrete and corrosion resistance nature in concrete having quarry dust as a fine aggregates. The admixture didn't show any adverse effect on the strength andalso there was an increase of strength at certain percentage. **M. Shukla and A K Sachan (2000)**They studied on the use of dust in concrete mix which is helpful in environment point of view as well as the utilization of stone dust in construction work. They found that the partially replacement of sand will not affect the strength. The workability of concrete reduces with the increase of stone dust and reduction workability may improved by adding suitable admixtures.

EXPERIMENT INVESTIGATION

An experimental investigation is a type of evaluation that seeks to determine whether a program or intervention had the intended causal effect on program participants. while experimental are considered to have the most internal validity they are not always the most appropriate. As mentioned above experimental studies are the best used to addressed wheather a program or intervention had the intended causal effect on program participant further it is necessary that the program or the invention can be measured quantitatively in some fashion and the step by step procedure for the manufacturing and testing of self curing is given as follows

MATERIAL INVESTIGATION

MIX DESIGNING

Concrete mix design is the process of finding right proportions of cement , sand and aggregates for concrete to achieve target strength in structures. The concrete mix design involves various steps, calculation and laboratory testing to fine right mix proportion. This process is usually adopted for structure which required higher grades of concrete such as M20 and above and large construction projects where quantity of concrete consumption is huge.

MATERIAL USED:

Ordinary Portland cement (43 grade) was used for the study. Natural river sand has been used for the study in making the control specimens. Quarry dust for the study has been collected from the nearby stone quarry at Milekkal near Kovaipudur. Earlier investigation (Sahu et al. 2003). Indicates that stone crusher dust has a good potential as fine aggregate in concrete construction. Crusher dust not only reduces the cost of construction but also helps to reduce the impact on environment by consuming the material generally considered as a waste product. Crusher dust from quarries, being a waste product will also reduce environmental impact if consumed by construction industry in large qualities. Quarry dust confirming to grading zone II was used for the study.

COMPRESSIVE STRENGTH TEST:

The compressive strength 150mmx150mmx150mm cube specimen were casted and obtained after the curing period of 28 days in accordance with IS:516-1959 specification (21). Clean the mould and apply oil. Fill the concrete in the mould in layers approximately 5cm thick compact each layer with not less than 25stocks per layer using the tamping rod level the top surface and smoothen it with a trowel. The test specimen are stored in moist air for 24 hours and after the period the specimen are marked and removed from the mould and kept submerged in a clean fresh water until taken out prior to test . The specimen are tested by compression testing machine after 28days curing. Load should be applied gradually at the rate of 140kg/cm^2 per minute till the specimen fails. Load at the failure divided by area of specimen gives the compressive strength of concrete.

SPLIT TENSILE STRENGTH TEST

The concrete is very weak in tension due to its brittle nature and is not expected to resist the direct tension. The concrete develop cracks when subjected to tensile force. Thus ,it is necessary to determine the tensile strength of concrete to determine the load at which the concrete member may crack take the wet specimen from water after seven days of curing. wipe out water from the surface of the specimen. Draw diametrical line on the two ends of the specimen to ensure that they are on the same axial place. Note the weight and dimension of the specimen. Set the compression testing machine for the required range. Keep plywood strip on the lower plate and place the specimen

Table 1:Result of sieve analysis of fine aggregate

Dry weight of sample taken= 1000gm

s. no	Sieve size in mm	Weight of sand retained	% weight retained	Cumulative %retained	%finer
1	4.75	0.099	9.90	9.90	90.1
2	2.36	0.165	16.50	26.40	73.6
3	1.18	0.199	19.9	46.30	53.70
4	0.600	0.317	31.70	78.00	22.0
5	0.300	0.053	5.30	83.00	17.0
6	0.150	0.093	9.30	92.60	7.4
7	0.075	0.059	5.90	98.50	1.5
8	retain	0.015	98.50	100.00	0
9	total	1.000	100.00	434.70	265

Table 2: Result of specific gravity of sand.

Description	Trial 1	Trial 2	Trial 3
Weight of empty pycnometer (W1)	617	617	617
Weight of pycnometer +fine aggregate(W2)	1272	1260	1240
Weight of pycnometer+ fineaggregate+water(W3)	1801	1796	1888
Weight of pycnometer+ water(W4)	14	1405	1409
Average			2.53

Table 3: Result of specific gravity of coarse aggregate.

Description	Trial 1	Trial 2	Trial 3
Weight of empty pycnometer (W1)	614	614	614
Weight of pycnometer +fine aggregate(W2)	1421	1304	1296
Weight of pycnometer+ fineaggregate+water(W3)	1907	1832	1762
Weight of pycnometer+ water(W4)	1387	1389	1322
Average			2.81

Table 4:Result of specific gravity of cement.

Description	Trial 1	Trial 2	Trial 3
Weight of empty pycnometer (W1)	0.1280	0.1280	0.1280
Weight of pycnometer +fine aggregate(W2)	0.1810	0.1825	0.1836
Weight of pycnometer+ fineaggregate+water(W3)	0.3540	0.3554	0.3548
Weight of pycnometer+ water(W4)	0.3145	0.3156	0.3167
Average			3.10

Table 5:Result of specific gravity of M-sand

Description	Trial 1	Trial 2	Trial 3
Weight of empty pycnometer (W1)	617	617	617
Weight of pycnometer +fine aggregate(W2)	1373	1311	1364
Weight of pycnometer + fineaggregate+water(W3)	1866	1858	1876
Weight of pycnometer+ water(W4)	1440	1440	1440
Average			2.48

Table 6: Result of specific gravity of quarry dust.

Description	Trial 1	Trial 2	Trial 3
Weight of empty pycnometer (W1)	617	617	617
Weight of pycnometer +fine aggregate(W2)	1376	1294	1291
Weight of pycnometer+ fineaggregate+water(W3)	1890	1834	1821
Weight of pycnometer+ water(W4)	1445	1445	1445
Average			2.56

Fig 1: MATERIALS:

Fig 2: MIXING OF CONCRETE:

Fig 3. CUBE MOULDING:

Fig 4 : CUBE CASTING:

Fig 5: CURING:

Fig 6:COMPRESSION TEST:

Table 7 : Result of compression test for conventional Concrete.

Grade of concrete	w/c ratio	Force (kN)	Compression strength(N/mm^2)
M20 (1:1.5:3)	0.6	474	20.66
		402	17.52
		514	22.41

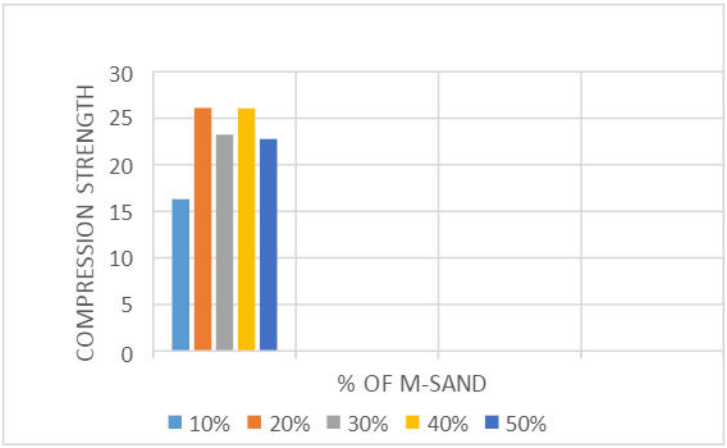
Table 8 :Result of compressive strength test of m sand.

Grade of concrete	Amount of m-sand	Water cement ratio	Force(KN)	Compression strength
	10%	0.6	370	16.13
			330	14.38
			422	18.39
M20 (1:1.5:3)	20%	0.6	550	23.98
			548	23.89
			698	30.43
	30%	0.6	624	27.21
			502	21.89
			474	20.66
	40%	0.6	628	27.38
			512	22.32
			654	28.51
	50%	0.6	564	24.59
			532	23.19
			472	20.57

Result of compression strength of quarry dust for 28 days.

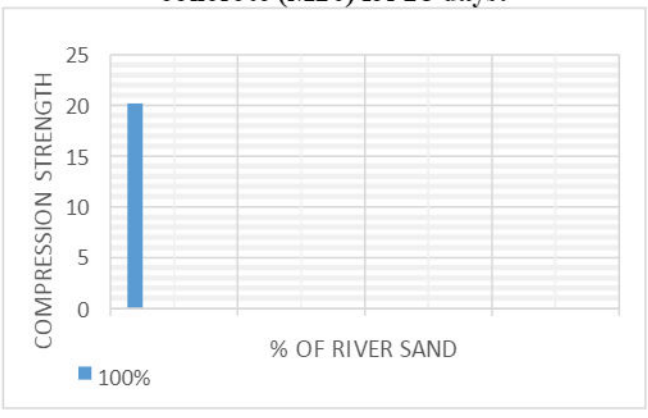
Grade of concrete	Amount of quarry sand	w/c ratio	Force(KN)	Compression strength (N/mm^2)
M20 (1:1.5:3)	10%	0.6	373.12	17.77
			386.23	17.88
			364.65	17.66
	20%	0.6	385.56	19.33
			378.66	18.90
			365.77	18.36
	30%	0.6	399.19	17.14
			401.23	17.83
			412.84	18.35
	40%	0.6	421.12	18.72
			424.01	18.84
			404.1	17.96
	50%	0.6	430.2	19.1
			428.31	19.04
			418.24	18.06

Result of compression strength of M-sand for 28 days.



GRAPH ANALYSIS FOR CONVENTIONAL CONCRETE,M-SAND ,QUARRY DUST

Result of compression strength conventional concrete (M20) for 28 days.



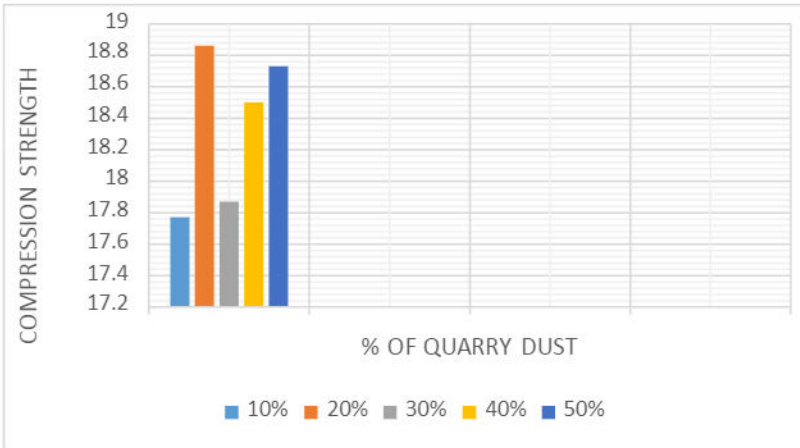
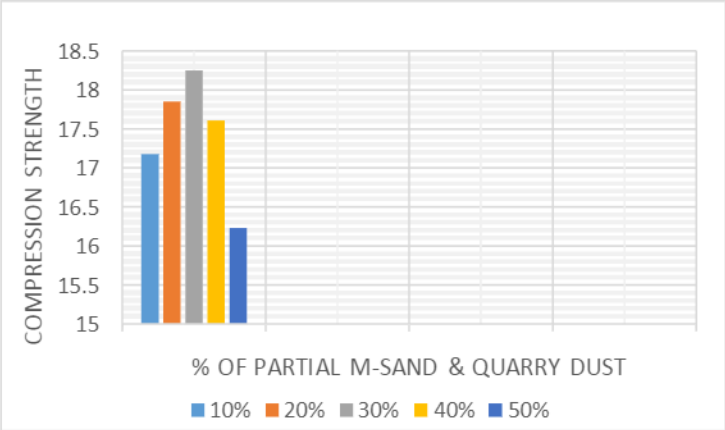


Table 9 :Result of compression strength on combination of M-sand and quarry dust.

Grade of concrete	Amount of M-sand +quarry dust	w/c ratio	Force(KN)	Compression strength (N/mm^2)
M20 (1:1.5:3)	5%+5%	0.6	378	17.26
			385	16.93
			362	17.35
	10%+10%	0.6	396	17.58
			383	18.08
			377	17.89
	15%+15%	0.6	456	18.32
			438	18.53
			497	17.92
	20%+20%	0.6	564	17.44
			548	17.67
			523	17.73
	25%+25%	0.6	321	16.25
			453	16.47
			436	15.98

Result of compression test on partial replacement of M-sand & Quarry dust(M20) for 28 days.



CONCLUSION

From the above study, the following conclusions are drawn:

1. Based on the compressive strength results of cubes, natural river sand is replaced by manufactured sand and quarry sand. The optimum replacement percentage of M-sand and quarry dust is 50% without the usage of any super-plasticizer.

2. Comparing the water cement ratio of 0.6 it is concluded that when the water cement ratio increases, the replacement percentage of manufactured sand and quarry dust strength properties decreases.

3. The various properties of used quarry dust and M-sand such as crushing value, PHvalue, flakiness index,and soundness give the significant effects to strength and durability of concrete.

4. The concrete mix if dust as partial replaced to sand, result a reduction in compression strength.

5. By the comparison of results, the strength of the concrete reduces up to 40% replacement of natural river sand by manufactured sand and quarry dust the strength increases gradually beyond 40%

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