International Journal of Innovative Technology and Exploring Engineering (IJITEE)
ISSN: 2278-3075 (Online), Volume-9 Issue-5, March 2020

Utilisation of Seasand as Partial Replacement of Fine Aggregrate to Strengthen the Concrete

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Abstract- Concrete is an important construction material widely used in the construction industry nowadays. It is blended material consisting of cement, fine aggregate, coarse aggregate and water. Generally the use of river sand as fine aggregate in our country is very widespread in industry. This paper mainly focuses on the study of strength properties of concrete in which river sand is replaced with sea sand as fine aggregate. In addition to it, Quarry Dust when added gains strength. Different mix proportions was replaced partially in 5%, 10%, 15% by Sea sand and Quarry dust. The strength of concrete for various mix proportions are carried out and tested for 14, 28, 56 days of curing. From the results obtained, with the replacement of river sand by sea sand along with well graded quarry dust upto to 15% increases the strength of concrete.

Keywords: Concrete, SeaSand, Quarry Dust

I. INTRODUCTION

Fine aggregates or sand is the most important material which passes through 4.75mm IS sieve. It is used as an component of concrete that fills the cavities in coarse aggregate to produce a compact concrete and to reduce the amount of cement. The shape of River sand is more rounded grains hence require less water and cement to attain good workability but it cannot be used in the future and existing resources are over exploited. Scarcity of good quality river sand has made the construction industries to look for suitable replacement: One such alternative is "SEA SAND". Sea sand should not be used in its natural state which will attack the reinforcement, because of salt content is high it will retard setting and hardening of cement and may cause efflorescence it may not have any effect on ultimate strength of concrete. The high demand of river sand is an indication of development especially for the construction industry. Thus, the alternative that is viable to replace the river sand is by using the sea sand. In applying this alternative, the chloride content and the sea sand shape particles are the major problems that should be taken note. High level of chloride content is possibility affecting the strength of the construction structure (Khairul et.al). Quarry dust has been added to sea sand that gives extra strength to the concrete. When concrete combines with Quarry dust acts as an effective fine aggregate permits the greater strength, density and also lower permeability. Quarry Dust are easily available, cost effective and used as an active replacement material instead of river sand.

Revised Manuscript Received on March 30, 2020.

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1.1 OBJECTIVE OF THE STUDY:

The main objective of this study are to know the practical utilization of sea sand along with quarry dust as fine aggregate to determine Strength parameter with different percentage of replacement using sea sand and quarry dust.

II. METHODOLOGY

1.2 Casting Of Specimen:

In the present experimental programme, cube, beams and cylinders were prepared by hand mixing. Coarse and fine aggregates were measured by weight after cleaning the coarse aggregates from organic impurities. Locally available potable water was collected and used. After completion of curing of respective cube, beam and cylinder specimens, the same were removed from the curing tank and transferred into open air to allow the same for drying without any moisture film on the surface. After the completion of drying process, the cube and cylinders were tested in Compressive Testing Machine. The beam specimens were also tested for flexural strength in Universal Testing Machine. The actual dimensions of the specimens were taken into consideration in calculation. After curing, the following tests were carried out out on the different concrete specimens.

2. Testing Of Specimens:

2.1 Compressive Strength:

14, 28, 56 days cube- compressive strength was conducted in accordance with **IS:516-1959** using compression testing machine of capacity 2000 KN. The cubes are tested for compression testing and pressure applied at a rate of $5N/m^2$.The max load at which specimen fails is noted. The failure pattern of the specimen has been found to be in dumbbell shape.

2.2 Split Tensile Strength:

Similarly for testing of split tensile strength of concrete is done as per **IS:5816-1959**. The test is carried out by placing a cylindrical specimen horizontally between the loading surfaces. The load is applied till the failure of the cylinder is along the vertical diameter of the cylinder.

2.3 Flexural Strength:

The testing of flexural strength of concrete is done as per **IS: 516-1959**. Prisms are tested for flexure in universal testing machine of capacity 400 KN. The load is applied axially and without subjecting specimen to any torsional stresses (or) restrains. No packing is used between specimen and roller. The load is increased until the specimen fails and the maximum load applied to the specimen during test is noted. It is expressed in modulus of rupture.

III. RESULTS AND DISCUSSION

Table 1.1, 1.2, and 1.3 presents the compressive, split tensile and flexural strength of concrete with
partial replacement of sea sand at 14days, 28days, and 56 days, respectively.
From the below table it is observed that the compressive strength analysis of concrete shows maximum in replacement by 15% of sea sand and quarry dust in M15 grade as 26.54 N/mm^2, M20 grade as 28 N/mm^2 and M25 grade as 30.09 N/mm^2 in which comparatively M25 grade yields higher compressive strength in 56 days of curing.

Table 1.1 Compressive Strength of Concrete -Sea Sand & Quarry Dust

Grade of Concrete	Percentage (%)	Compressive Strength (Mpa)		
		14 Days	28 Days	56 Days
M15	0	20.46	22.34	24.55
	5	17.33	18.4	19.47
	10	15.55	16.8	18.05
	15	22.66	24.6	26.54
M20	0	20.78	24.50	28.36
	5	23.5	25.5	27.54
	10	22.2	24.8	27.4
	15	21.6	24.8	28
M25	0	21.77	26.22	30.67
	5	25.77	27.5	29.23
	10	20.44	22.4	24.4
	15	23.11	26.6	30.09

Table 1.2 Split-Tensile Strength of Concrete - Sea Sand & Quarry Dust

Grade of Concrete	Percentage (%)	Split Tensile Strength (Mpa)		
		14 Days	28 Days	56 Days
M15	0	1.839	2.02	2.201
	5	1.414	1.55	1.686
	10	1.27	1.55	1.83
	15	2.12	2.54	2.96
M20	0	1.697	1.829	1.981
	5	1.55	1.83	1.963
	10	1.69	2.26	2.83
	15	1.97	2.12	2.97
M25	0	2.34	2.819	3.298
	5	1.62	1.97	2.32
	10	1.76	2.12	2.48
	15	1.97	2.4	2.83

The split tensile strength analysis of concrete were found maximum by replacement of 15% sea sand and quarry dust in M15 grade as 2.96 N/mm^2, M20 grade as 2.97N/mm^2, and M25 grade as 2.83 N/mm^2 in which comparatively M20 grade yields higher split tensile strength of concrete by 15% replacement.

Table 1.3 Flexural Strength of Concrete -Sea Sand & Quarry Dust

Grade of Concrete	Percentage (%)	Flexural Strength (Mpa)		
		14 Days	28 Days	56 Days
M15	0	2.04	2.34	2.74
	5	1.43	1.73	2.13
	10	1.58	1.88	2.28
	15	5.4	5.76	6.1
M20	0	2.29	2.59	2.99
	5	2.17	2.47	2.87
	10	4.45	4.75	5.15
	15	1.38	1.68	2.08
M25	0	1.54	1.88	2.24
	5	1.77	2.07	2.47
	10	2.04	2.34	2.74
	15	2.72	3.02	3.42

The flexural strength analysis shows maximum by 15% replacement of sea sand and quarry dust in M15 and M25 grades as 6.1 N/mm^2 and 3.42 N/mm^2 in 56 days of curing and by replacement of 10% sea sand and quarry dust in M20 grade as 5.15 N/mm^2.
Fig 1.1, 1.2, 1.3 shows the compressive strength of different grade of concrete by using Sea Sand

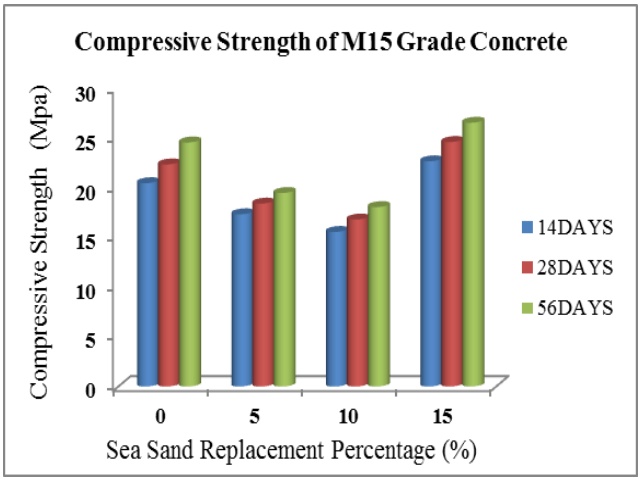

Fig1.1. M 15 Grade with Sea sand

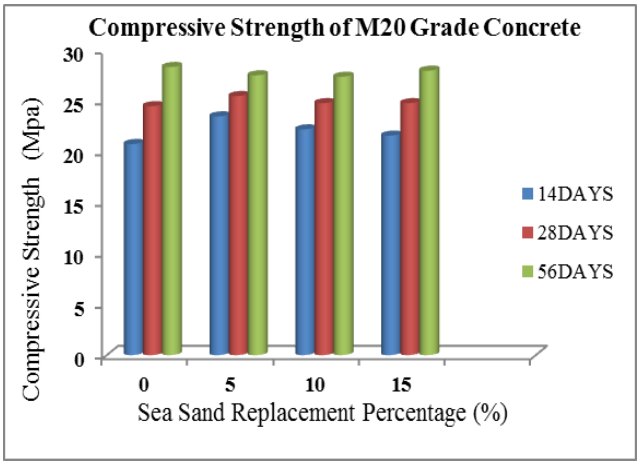

Fig1.2. M20 Grade with Sea sand

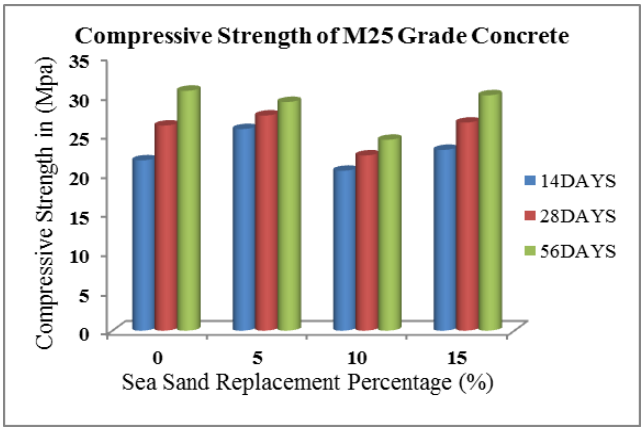

Fig 1.3 M25 Grade with Sea sand

Fig 1.4, 1.5, 1.6 shows the Split-Tensile strength of different grade of concrete by using Sea Sand

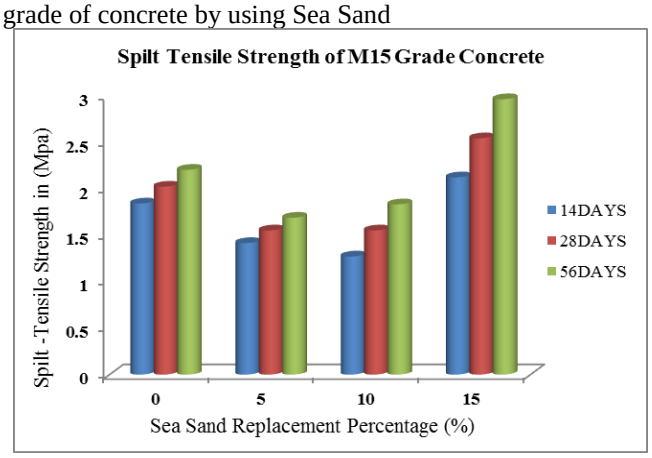

Fig 1.4 M15 Grade with Sea sand

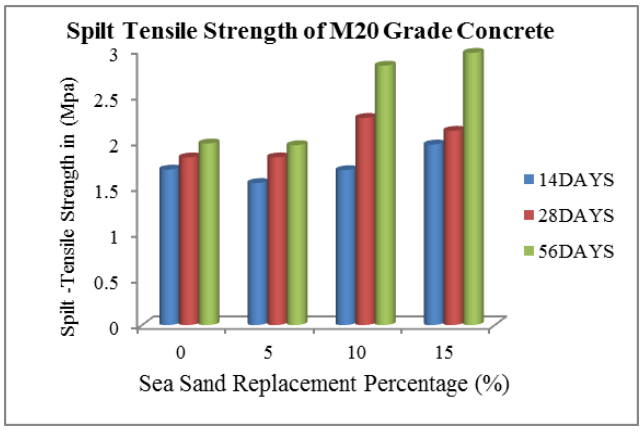

Fig 1.5 M20 Grade with Sea sand

3.3

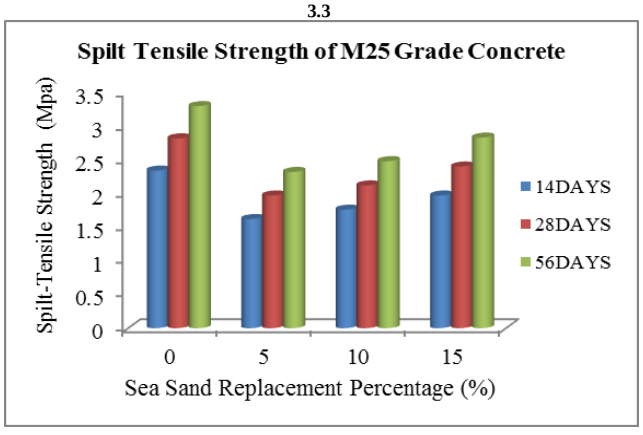

Fig 1.6 M25 Grade with Sea sand

Fig 1.7, 1.8, 1.9 shows the Split-Tensile strength of different grade of concrete by using Sea Sand

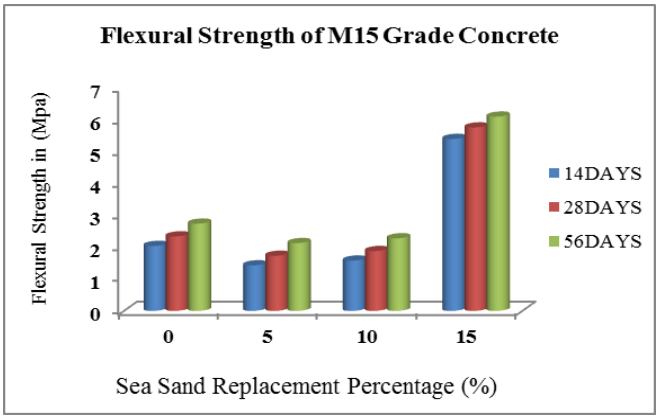

Fig 1.7 M15 Grade with Sea sand

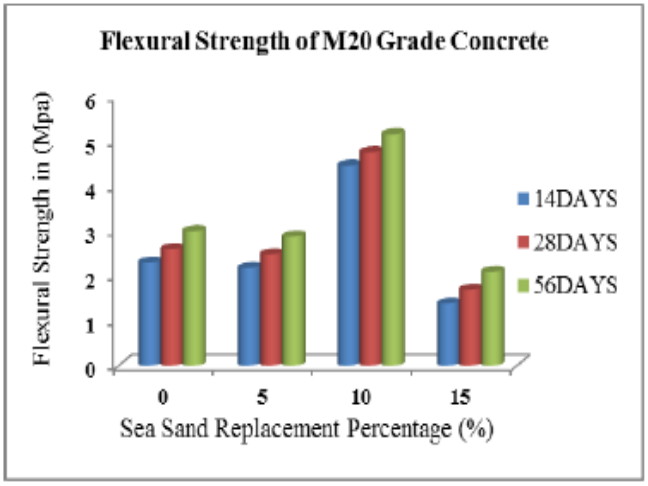

Fig 1.8 M20 Grade with Sea sand

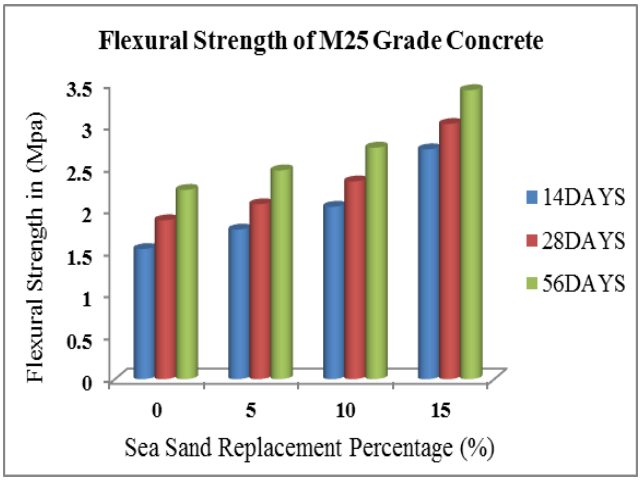

Fig 1.9 M25 Grade with Sea sand

IV. CONCLUSION

The data shows that the Sea Sand can be replaced in place of Fine Aggregates and addition of quarry dust increases the strength which enables it to provide better resistance and improves the strength of concrete. Thus the Sea sand is being replaced for fine aggregate with different mix ratio on varying proportions of 5%,10% and 15% in M15, M20 and M25.

Hence it states that the replacement of Sea sand and Quarry dust upto 15 % as fine aggregate increases strength than that of concrete mix with river sand. This reduces the utilization of river sand in construction and also prevents erosion and flooding. It is recommended that 15% of Sea sand and Quarry dust can be used as an effective replacement of sand in order to obtain the greater strength with good properties.

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