iJRASET
International Journal For Research in Applied Science and Engineering Technology

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 12 **Issue:** V **Month of publication:** May 2024

DOI: https://doi.org/10.22214/ijraset.2024.62486

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International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.538
Volume 12 Issue V May 2024- Available at www.ijraset.com

A Research Report Comprising on Behaviour of Sea Sand and Normal Sand

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Abstract: ***Consumption of concrete has grown rapidly over a year, and it is also becoming one of the basic construction materials. Since, it is a composite mixture of the constituents containing cement, fine aggregate, coarse aggregate and water. For manufacturing the concrete the fine aggregate are required more quantity. In general, river sand and RIVDER SAND is used as fine aggregate in construction industry. Due to this increase in use of river sand and RIVDER SAND the requirement has been increasing massively day by day in building sector. The government also have given some limitation on mining of river sand from the river beds. The treatment needed to remove the salt content in sea sand and sea water is difficult on time of treatment and cost. So, the untreated sea sand is used in this test. The work on this study evaluates the different comparisons of mechanical properties of complete RIVDER SAND , complete sea sand (SS) and 50% of RIVDER SAND with 50% of sea sand (MSSS). Main intention to consider the sea sand based concrete is to preserve the environmental resource in economical and sustainable development in construction and concrete sector. The experimental test results of sea sand based concrete shows adverse increase in strength compared to RIVDER SAND based concrete specimens.***
Keywords*: River sand, sea sand, Strength, Physical properties*

I. INTRODUCTION

Today the construction sector results direct to boom of economic growth. Due to this rapid development of construction sector the competitions for the resource extraction rights of fine aggregate and coarse aggregate supplies from riverbeds fierce to competition in society. This result in unlawful mining of resources available in river beds for river sand causes and crushed stone mining in hills for stones and River sand processing with environmental problems on society. The grouping of different construction materials like cement, coarse aggregate, fine aggregate and water makes up a concrete. The strength of concrete which plays an major role in concrete quality. To reduce the scarcity of river sand, this thesis aims to use sea sand as a fine aggregate in concrete manufacturing process. Many researchers say that using sea sand as a replacement for river sand would reduce the bonding between cement and sand because of enormous amount of silt content present in the sea sand. To avoid this problem and to attain well graded grain size, this project aims to partially add Sea sand instead of river sand. So hereby we take 50 % of Sea sand and 50% of river sand. Many engineers are afraid that the chloride present in sea sand might generate corrosion in Reinforced Cement Concrete (RCC) elements; but though it cannot be completely arrested, it can be controlled to some extend by means of proper treatment of sea sand. In construction industry, in order to avoid corrosion, a few kinds of steels like stainless steel, epoxy coated steel and fiber reinforced polymer steels are used, and certain chemicals like acrylic solutions are used as a coating over the steel bars that hold the development of electro chemical reaction and reduce the level of chloride ion immersion into concrete surface scarcity of river sand.

II. LITERATURE SURVEY

Here are the literature review and expert interviews concentrated on identifying the key benefits and barriers when using Sea sand over river sand.

TanazDhondy et al. (2019) in the title ‘‘The benefits of using sea sand and sea water in concrete: a comprehensive review” discussed about the natural resources utilization in construction industry by eliminating the costs associated in reinforced concrete structures by non-corrosive fibre reinforced polymers as a solution to minimize the repairing works and improvement on mechanical property of concrete .

Ming CUI et al. (2014) in the title ‘‘Experimental Study on Mechanical Properties of Marine Sand and Seawater Concrete” discussed about the use of marine sand by avoiding river and Sea sand in concrete and mixes seawater by eliminating fresh water. And they analysed different mechanicalproperties of concrete by conducting different tests.

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In a recent study by R Manikandan (2017) to form concrete by using sea sand, many experts say that if the sea sand is collected from 10 km away from the shore area, then the amount of chloride become less and the collected sand can be adoptable to develop the standard quality concrete .

Apart from concrete work, the sea sand may also be used for other constructional works like reclamation and filling during the highway project works. As per the American concrete institute and American coastal department, each individual uses 200 kg of sand annually. So next to water and cement, the need for sand is essential, particularly in civil industry. In the construction industry, 1/3 part is occupied by fine aggregate in the total concrete volume, and without it, concrete production is less possible. The amount of moisture content present in sea sand is nearly about 10% of weight of the total sea sand. It affects the mix ratio while developing the concrete mix design.

Hence moisture level must be considered and has to be eliminated from sea sand using water elimination devices like hot air oven. If concrete is considered as an element, then the property of concrete is mainly based upon the constituents present in the concrete. In this project, sea sand is considered as a fine aggregate for concrete formation. So the properties of concrete like shrinkage, creep, unit weight, young's modulus, surface friction, thermal properties, etc. depend on the sea sand properties. Hence it is necessary to focus on material study apart from elemental study.

A recent survey has informed that Cochin port trust(2017) , plans to dredge out 70,000 m 3 of sand slurry daily and 8 Mt of sand annually. Shell content reduces workability and strength, whereas chloride content reduces durability and strength. So these two components must be eliminated from sea sand to attain better quality concrete.

If we construct a structure using steel RCC, then the chloride content in cement must be limited to 0.1% (As per IS 456:2000). If the limit exceeds, then it destroys the alkaline coating present in the steel surface leading to the formation of rust due to increase in the volume of steel reinforcement.

Thus, the reinforcement loses its stability, which automatically makes the entire element to lose its load bearing capacity. Finally the entire system collapses indicated by certain warning. The sea sand containing free chloride ion would be washed away by keeping it under natural rainfall for a period of 1 year.

But this is not suitable for the sea sand in which the chloride ions are physically or chemically bounded with it. In such cases, an additional requirement is needed. It has been established through the process of wet sizing and attrition scrubbing, in which the amount of chloride can be reduced from 500 ppm to 100 ppm.

Ponnani, the area located in Kerala at which the sea sand treatment is going successfully under large working area with lot of human resources, and the treated sea sand is transported to ready mix concrete plants. All these relevant works are done by the directorate of ports.

After obtaining the ready mix concrete plants, the chemical engineers add small quantity of admixtures to remove the effect of minimum amount of chloride ion and check with the standard value, and finally the prepared concrete plants are supplied to nearby contractors. Through this activity, the Kerala government has made 2300 employment opportunities both directly and indirectly. Depending on the past ratio average of cement consumption in the country, the expected requirement of sand at 2025 will be about 600- 650 Mt.

Jianzhuang Xiao, et al. (2017) discussed in his studies about the effect of using sea water and sea sand as raw materials of concrete results including the short term and long term duration strength on concrete workability. Both the sea sand and sea water based concrete shows rich chloridecontent on strength development.

Concrete made with the sea sand and sea water shows an similar compressive strength on short term and long term basis of strength to ordinary concrete .

Sea sand has been recommended and usable for the construction purposes (Newman , 1968; Limeira et al., 2011; Huiguang et al., 2011; Sukumaran et al., 2010; Sai Deepak and Tirupathi Naidu, 2015; Subashini et al., 2016). Earlier literature study revealed that the partial replacements of fine aggregate by sea sand in percentages of 20%, 40%, 60%, 80% and 100% resulted in successive reduction in the characteristic compressive strength of concrete (Kumar et al., 2016).

Further, it was stated that 20% replacement was found to be effective and gained more strength compared to the other percentages. Hence this effective percentage of 20% was chosen andmixed with 80% of river sand (Sai Deepak and Tirupathi Naidu. 2015). This paper reports the experimental study which investigated the influence of 20% replacement of river sand with sea shore sand and mineral extracted sand separately. These results are compared with those of 100%river sand.

III.MATERIALS USED AND ITS PROPERTIES

CEMENT

SEA SAND

RIVER SAND

COARSE AGGREGATE

- Here we have used PPC cement collected from local market.
- Sea sand is collected from chandrabhagha beach near konark.
- River sand is collected from Daya river near Dhauli.
- Coarse aggregate taken from locally available.

Properties of cement.	
Description	Properties of material
Initial Setting Time	31min
Final Setting Time	560 min
Standard Consistency	36.50%
Specific Gravity	3.22
Fineness	3.7%

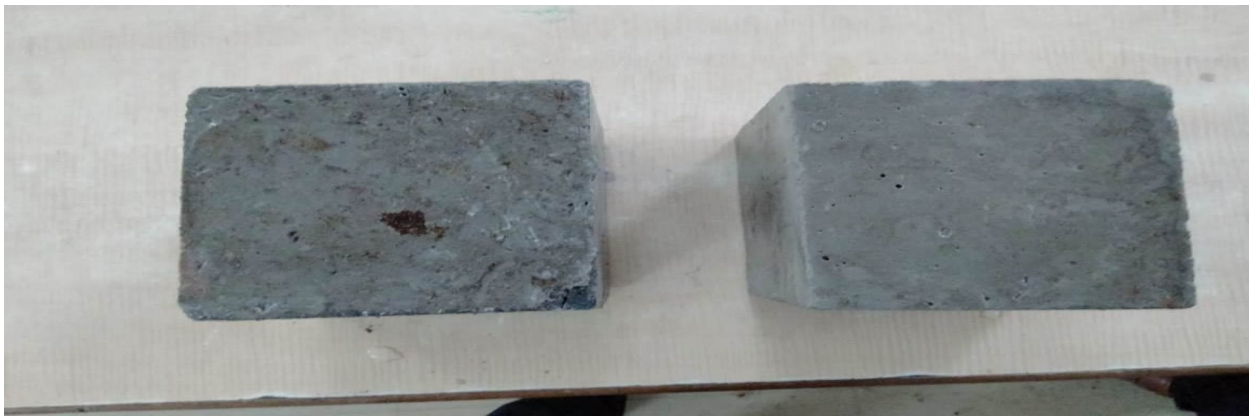
Properties of Fine Aggregate.		
Description	Properties of material	
	River-Sand	Sea Sand
Specific Gravity (Gs)	2.62	2.73
Fineness Modulus	4.1	3.6
Sieve Analysis	Zone I	Zone I

Properties of Coarse Aggregate.	
Description	Properties
Specific gravity	2.78
Fineness	7.20%
Water Absorption	0.93%

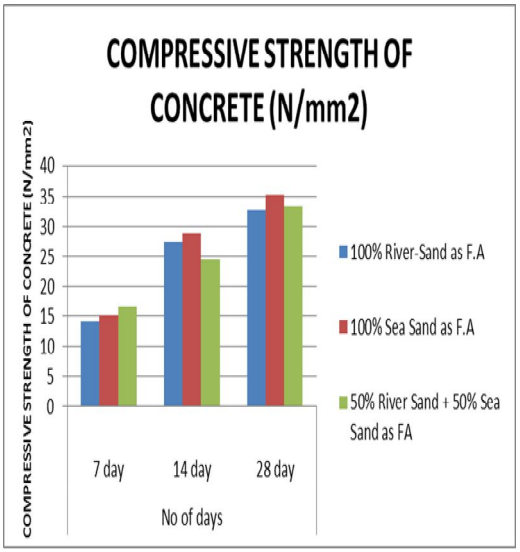
IV. TESTS CONDUCTED

1) *Workability Test:* Workability test is being performed with taking conventional concrete and partially replacing the river sand with sea sand. In both the things we have got 75mm slump of concrete.


2) *Compressive Strength Test:* Average compressive strength of normally cured concrete specimens test results at the ages of 7th, 14th and 28th days of fine aggregate replacement of 100% river sand, 100% sea sand and 50% of river sand + 50% of sea sand based concrete.

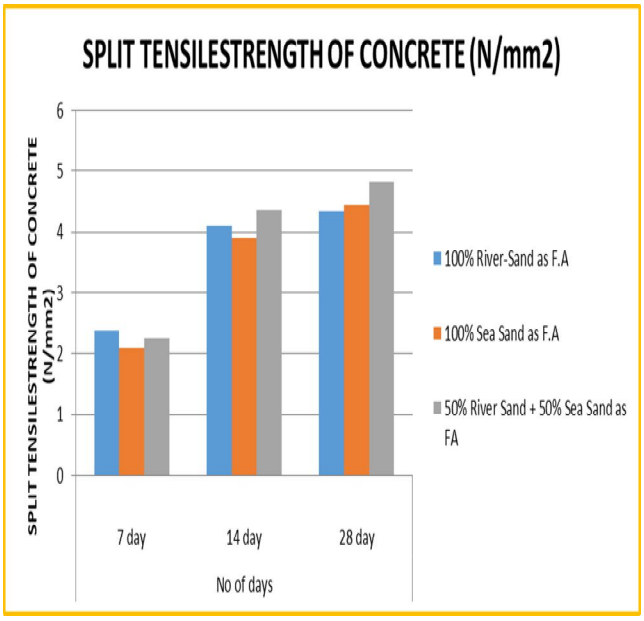



COMPRESSIVE STRENGTH OF CONCRETE				
Sl. No	Description	Average Compressive Strength (N/mm2)		
		7 day	14 day	28 day
1	100% River-Sand as F.A	14.22	27.46	32.7
2	100% Sea Sand as F.A	15.15	28.88	35.36
3	50% River Sand + 50% Sea Sand as FA	16.44	24.44	33.32



3) Split Tensile Strength: Average split tensile strength test results of normal water cured specimens at the age of 7th day, 14th day and 28th day of 100% River sand, 100% sea sand and 50% of river sand + 50% of sea sand based concrete

SPLIT TENSILESTRENGTH OF CONCRETE (N/mm2)				
Sl. No	Description	No of days		
		7 day	14 day	28 day
1	100% River-Sand as F.A	2.385	4.1	4.34
2	100% Sea Sand as F.A	2.1	3.9	4.46
3	50% River Sand + 50% Sea Sand as FA	2.25	4.35	4.82



V. RESULT AND DISCUSSION

1) The compressive strength percentage increases on Fully Sea sand based (100% Sea sand as F.A) and 50% River sand + 50% Sea sand respectively for 28 days is 8.10% & 1.52% compared to Fully River sand based concrete (100% River sand).

2) The split tensile strength percentage decreases on Fully River sand based (100% River sand @ F.A) and 50% River sand + 50% Sea sand respectively at 28 days is 13.33% & 9.47% compared to Fully Sea sand based concrete (100% Sea sand).

VI. CONCLUSION

From the above all mechanical property test results the utilization of sea sand shows adverse increase in behavior of the sea sand in concrete is recommended as an alternative fine aggregate for River sand in modern construction industry for both concrete production and construction purposes.

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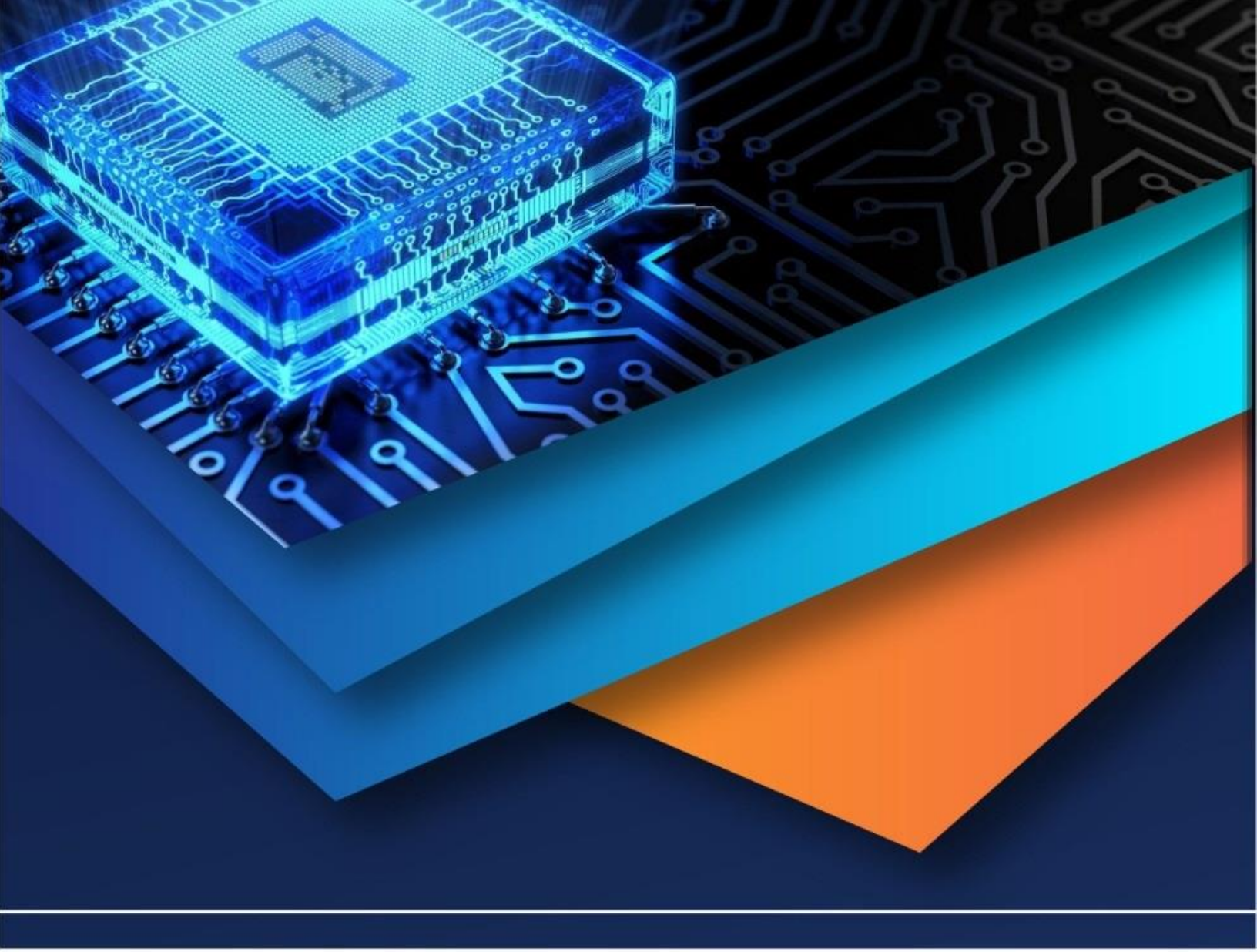

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