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Use of Sea Sand in Concrete

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ABSTRACT: Increasing demand of construction materials has made a deficiency in the supply of construction materials. There are growing environment concerns regarding excavation of sand from river beds. Traditional rivers have been the main source of supply. Later use of manufactured sand also is becoming popular.This project highlights the properties of sea sand, whether it is possible to practically use sea sand in construction and examination about application in concrete or other structures in order to solve the problem of material scarcity and also environmental degradation in some way.However the title of our project is use of sea sand in concrete we first wanted to test the available sea sand with cement cubes. Some tests were taken on the sand before use like salt content and chloride content available in the sample.Hence we then decided to first cast the cement cubes using sea sand and test them after 7 days and 28 days. So the goal of our project for now is to find out whether we could replace sea sand instead of standard sand in this experiment.Based on the test analysis and results we were able to decide whether we could perform the concrete cube test with the available sea sand sample

Keywords:- seasand, cement concrete, river sand, manufactured sand

I. INTRODUCTION

Around 71% of Earth's surface is covered with water and the oceans hold up to 96.5% of earth's water. India has a coastline of 5422.6-7516.6 km. So, the use of sea sand and sea-water as raw material of construction caught our interest. The construction sector is looking for alternative material such as sea sand due to decaying in other resource today. If they cleaned properly, the use of sea sand in the construction could be one of the best alternative.

The sample of sea sand that is used for our project was bought from Girgaon Chowpatty beach in Mumbai, Maharashtra.Thisprojecthighlightstheproperties ofsea sand,whetheritispossibleto practically use sea sand in construction and examination about application inconcrete or other structures in order to solve the problem of material scarcity and alsoenvironmentaldegradationinsomeway

II. AIM AND OBJECTIVE

The aim of this experimental program is to compare the properties ofnormal cement mortar with sea sand mortar. The basic testsarecarriedoutonmaterialsasrequired.

The main objectives

- Toexaminethepracticalutilizationofseasand.
- To check whether the sea sand is fine and smooth as compared to river sand and if it can be used as replacement for river sand.
- To determine the compressive strength of cement and concrete cubes with distinct possibilities.
- To compare the properties of normal cement mortar with sea sand mortar. The basic tests are carried out on materials.

III. PROBLEM STATEMENT

The main reasons why it is not acceptable for concrete making is the presence of seashells and the chloride content.As regards chloride content, there are various views and the standards also differ considerably on the extent of chlorides content. It is however certain that chloride affects the durability of concrete structures by attacking the reinforcements and corroding them.

Chloride and salt content not only corrodes the reinforcements in concrete but also causes efflorescence due to oozing out of salts from the concrete. Hence, chloride content needs to be controlled within limits.

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Sea sand tends to very fine and rounded. In sea water, chloride is present which will cause corrosion of steel and iron which ultimately leads to reducing carrying capacity of steel and iron, so that the structure built using this may not be sustainable.Sea sand does not have high compressive strength, high tensile strength etc so it cannot be used in construction activities. In addition to this, the salt in sea sand tends to absorb moisture from atmosphere, bringing dampness.

IV. METHODOLOGY

Tests performed

4.1 Sieve analysis

According to Indian standard code IS 460-1962 (revised), the sievenumber is the mesh width expressed in mm for large sizes and in microns for small sizes. The set of IS sieves for fine sieve analysis consist of 4.75mm, 2.36mm, 1.18mm, 600µ, 300 µ, 150 µ, 90µ sieves.

First the sea sand of 2 kg was taken for test. Here we sieved the sample by manual shaking.

The percentage of soil retained on each sieve is calculated on the basis of the total mass of the soil sample taken (2 kg) using the following formula:

Fineness modulus = Sum of cum. % of aggregate retained / 100

$$FM = \frac{\text{total CM \%}}{100} = \frac{282.2}{100}$$

FM = 2.82 %

Sieve size	Retained wt (gm)	Cumulative wt (gm)	% cumulative
4.75mm	0		
2.36mm	2	2	
1.18mm	26	28	1.4
600µ	290	318	15.9
300µ	1026	1344	67.2
150µ	624	1968	98.4
90µ	18	1986	99.3
Pan	14	2000	
		Total CM %= 282.2	

4.2 Specific gravity test:

To find sp. Gravity and density pycnometer test was taken.

The sp. Gravity found by the formula $\frac{(W_2-W_1)}{(W_4-W_1)-(W_3-W_2)}$

Where, W_1= empty weight of specific gravity bottle = 634gm

W_2= weight of bottle filled with sand = 1034 gm

W_3= weight of bottle + sand+ water = 1908 gm

W_4= weight of bottle filled with water only = 1658 gm

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$$= \frac{(W_2-W_1)}{(W_4-W_1)-(W_3-W_2)} = \frac{(1034-634)}{(1658-634)-(1908-1034)}$$

$$= \frac{2.67}{}$$

4.3 Calcium test(removal of sea shells)

First of all 10gm of sea sand was taken in a beaker and 55ml of HCL was added in it. A reaction taking place initially with lot of bubbles and gases which slowed down eventually.After 24hrs when the residue was dried it was observed that all the calcium i.e shell particles have dissolved completely.

The wt. of the residue was taken which measured 4.5gm

4.4 Removal of sea salt from sand by washing

Further the salt content is found out. For this 1kg sample of sand was taken and passed from sieve 1.18. The sand was washed with water for 2-3 times and then sun dried for 24hrs .After 24hrs weight of the sand was 994gm i.e 0.6% salt content was present in available sand sample. After this the whole sand was washedthoroughly and sundried for future use.

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4.5 Mix design:

The ratio for making cement cubes was taken 1:3 with the water proportion 0.5.

For 600gm of sea sand and 1800gm of cement was measured initially.

A mortar was prepared 0.5 proportion of water. Cubes with 7.07 * 7.07 *7.07 cm having 5000 sq mm surface area were casted and then kept for curing for 7 days and 28 days

The table given below shows the results after the test:

Sr. no.	Wt. (gm)	7 days strength in N/mm^2	28 days strength in N/mm^2
1	750	10	-
2	734	12	-
3	752	10	-
4	744	-	17.12
5	752	-	17.96
6	734	-	16.12

Hence the average strength of cubes casted at 7 days period is

$\frac{10+12+10}{3}$ = 10.67 N/mm^2

Also the average strength of cubes after 28 days is

$\frac{17.12+16.12+17.96}{3}$ = 17.06 N/mm^2

V. RESULT

- Based on the test analysis and results we were able to decide whether we could perform the concrete cube test with the available sea sand sample
- The sea sand samples collected from Girgaon Chowpatty , beach in Mumbai, Maharashtra consist entirely of 5.5 % of chloride content as an impurity and salt content was 0.6 %..

The average grain sizes of the sea sand ranged from 90 μm to 1.18 μm (medium sand to coarse sand)

VI. CONCLUSION

From the compression test of cement cubes (grade 43 cement was used) the strength of cubes after 7 days and 28 days were 10.67 and 17.6 respectively which was very low as compared to

cubes made of standard sand. According to researches done before we assumed that the low compressive strength of cubes was due to presence of sea shells in the sand as we did not remove shells particles during the experiment.
Hence as for now this sea sand cannot be used directly with presence of shells for any major work.

VII. FUTURE SCOPE OF WORK

- As it is sea sand it consists of salt content the durability parameters should be tested for future work.
- The sand used during casting of concrete blocks is such that only salt content is removed by washing the sand.Further more investigation is needed and removal of shell content is necessary by washing with HCL solution and then drying it which is a little bit of tedious process.
- This will show us if there is any significant difference between compressive strength before and after removal of shell (chloride content).
- Also we have limited our project up to compressive test of cement cube of which the strength is very low but, further we need to fine the compressive strength of concrete by using the same sand.
- Again we can also find compressive strength by partially replacing the same sea sand over river sand and find out what proportion will work out for us in various construction activities.