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AN EXPERIMENTAL STUDY ON EFFECT OF REPLACING NATURAL SAND BY ARTIFICIAL SAND ON PROPERTIES OF CONCRETE

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Abstract:- *Now a day the construction industry in the India is facing one of the major problems that is natural fine aggregate. And court awarded that totally band on excavation of fine aggregate from river because they affect on environment and changing the river direction Cement, sand and aggregate are basic needs for any construction industry. Sand is a prime material used for preparation of mortar and concrete and which plays a major role in mix design. Now a day's erosion of rivers and considering environmental issues, there is a scarcity of river sand. The non-availability or shortage of river sand will affect the construction industry; hence there is a need to find the new alternative material to replace the river sand, such that excess river erosion and harm to environment is prevented. Many researchers are finding different materials to replace sand and one of the major materials is artificial sand (wash/foundry/crush sand). Using M-20 grade proportion of this wash sand along with sand the required concrete mix can be obtained. Replacement of natural sand with wash sand by 100% and also finding the compressive Strength of that concrete cube This Project presents a review of the different alternatives to natural sand in preparation of concrete. The project emphasize on the physical and mechanical properties and strength aspect on concrete*

Key Words *- River sand, Wash sand, Crushed sand, foundry sand, mix design compressive strength of concrete.*

INTRODUCTION

Concrete is the most widely used in man-made construction in the world. It is obtained by mixing of cement, water & aggregates in required proportions. The main components of concrete are cement coarse aggregate, fine aggregate, water and admixtures. Sand is one of main constituents of concrete making about 35% of volume of concrete used in construction industry. We cannot imagine civil engineering structures without concrete. Concrete is backbone of infrastructural development. Maximum content of concrete is made of aggregate. The workability, bleeding, segregation and durability are the characteristics of aggregate which influence the concrete.

There are two types of fine aggregate, natural sand and artificial sand. Availability of good quality of natural sand is decreasing and also it is costly and hence there is need to find the substitute for natural sand. Natural sand is mainly obtained from river beds and always contains high percentages of inorganic materials, chlorides, sulphate silt and clay that adversely affecting the strength & durability of concrete & reinforcing steel there by reducing the life of structure.

Digging sand, from river bed, in huge quantity it is hazardous to environment. The deep pits dug in the river bed, affects the ground water level. Erosion of nearby land is also due to excessive sand lifting. In order to fulfill the requirement of fine aggregates, some alternative material must be found. Crushed sand as replaced materials to natural sand has become beneficial and is common in the world. Crushed sand is manufactured by crushing larger stones of quarry.

The chemical & physical properties such as color, size & shape, surface texture of particles depend upon types of stone & its source. Use of crushed sand has become a good substitute for natural sand and it has become essential keeping in view of technical, commercial & environmental requirements. Proper quality control is obtained while using crushed sand.

Cement concrete is the most widely used building material in the world because of its high strength and mould-ability. As there is increase in infrastructure development, demand for the production of concrete has increased. The global consumption of natural sand is very high, due to the extensive use in concrete and mortar. In general, the demand of natural sand is quite high in developing countries to satisfy the rapid infrastructure growth. In this situation the developing country like India is facing shortage in good quality of natural sand. Particularly in India, natural sand deposits are being depleted and causing serious threat to environment as well as the society. Properties of aggregate affect the durability and performance of concrete, so fine aggregate is an essential component of concrete and cement mortar. The most commonly used fine aggregate is natural river or pit sand .Natural or river sand are weathered and worn out particles of rocks and are of various grades or sizes depending upon the extent of wearing.

Now-a-days good sand is not readily available, it is transported from a long distance. The artificial sand produced by proper machines can be a better substitute to river sand. The sand must be of proper gradation (it should have particles from 150 microns to 4.75mm).When fine particles are in proper proportion, the sand will have fewer voids. The cement quantity required will be less. Such sand will be more economical. Demand for manufactured fine aggregates for making concrete is increasing day by day as

river sand cannot meet the rising demand of construction sector. Because of its limited supply, the cost of natural river sand has sky rocketed and its consistent supply cannot be guaranteed. River sand in many parts of the country is not graded properly and has excessive silt and organic impurities and these can be detrimental to durability of steel in concrete whereas Artificial sand has no silt or organic impurities.

1.1 Wash Sand

Wash sand is mixture of 5 to 6 sample of sand in which each sample is taken in same proportion by volume in which Natural Sand. Foundry sand, Crush Sand, waste of tiles , Sea Sand, and sand coming from founda ghat which is used for Iron industries. After mixing this sand samples then its wash by high water pressure for 2 to 3 hours. And after washing sand open to sale in market.

1.2 Foundry Sand

Concrete is the most extensively used construction material in the world, second to water. Increasing rate of urbanization and industrialization has lead to over exploitation of natural resources such as river sand and gravels, which is giving rise to sustainability issues. It has now become imperative to look for alternatives of constituent materials of concrete. Waste foundry sand, a by-product of ferrous and non ferrous metal casting industries is one such promising material which can be used as an alternative to natural sand in concrete. In last few decades, several studies have been conducted to investigate the effect of addition of waste foundry sand as partial and complete replacement of regular sand in concrete. It has been found suitable to be used as partial replacement of sand in structural grade concrete. A number of properties have been reviewed in the current paper, the results observed from the various studies depict that replacement of foundry sand to a certain extent enhance the durability as well as strength properties of the concrete but simultaneously decreases the slump value with the increase of replacement level of waste foundry sand.

1.3 Artificial Sand as Fine Aggregate

Aggregates are the most important constituent in concrete. They give body to concrete, reduce shrinkage and effects economy. Both coarse aggregates and fine aggregates constitutes 70%-80% of concrete matrix. In order to reduce depletion of natural aggregate due to construction, artificially manufactured aggregate can be used as an alternative.

Artificial sand is popularly known by several names such as Crushed sand, Rock sand, Green sand, Robo sand, Pozzolan sand etc. IS 383-1970 (Reaffirmed 2007) recognizes manufacture sand as 'Crushed Stone Sand' under Clause 2. Crushed stone sand is produced by crushing boulders.

Table 1: Properties of Coarse Aggregates

Fineness modulus	Water absorption	Specific gravity	Impact value	Crushing value
2.56	2%	2.44	10%	20.75%

Compressive strength for M20 (7 Days)

In this point the comparison of compressive strength of various sets of sand were made by the results obtained after the 7 days curing of cubes in fresh water.

For Cubes 7 days results (MPA)

Sr. No.	Natural	Wash	Foundry	Crush
1	14.47	12.65	11.00	11.15
2	15.99	12.05	10.80	11.65
3	14.20	11.85	10.65	11.30

Sr. No.	Sample Of Sand	Compressive Strength Of Concrete	Natural Sand	% Of Compressive Strength
1	Wash	12.18		-2.7
2	Foundry	10.81	14.88	-4.07
3	Crush	11.36		-3.52

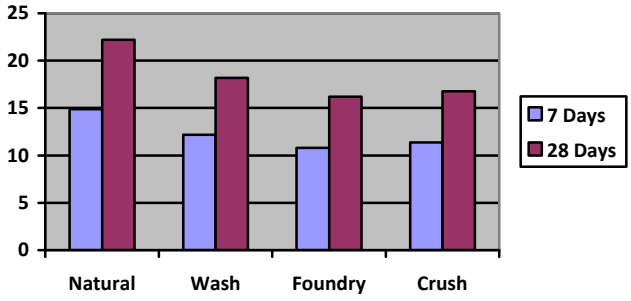
Compressive strength for M20 (28 Days)

In this point the comparison of compressive strength of various sets of sand were made by the results obtained after the 28 days curing of cubes in fresh water.

For Cubes 28 days results (MPA)

Sr. No.	Natural	Wash	Foundry	Crush
1	21.59	18.86	16.43	16.65
2	23.86	17.94	16.08	17.25
3	21.20	17.71	16.11	16.46

Sr. No.	Sample Of Sand	Compressive Strength Of Concrete	Natural Sand	% Of Compressive Strength
1	Wash	18.17		-4.04
2	Foundry	16.20	22.21	-6.01
3	Crush	16.78		-5.43



GRAPH NO.1

Split Tensile test for M20 (7 Days)

In this point the comparison of Split Tensile test of various sets of sand were made by the results obtained after the 7 days curing of cubes in fresh water.

For Cylinder 7 days results (MPA)

Sr. No.	Natural	Wash	Foundry	Crush
1	1.27	0.94	0.63	0.78
2	1.30	1.03	0.67	0.76
3	1.28	0.92	0.62	0.83

Sr. No.	Sample Of Sand	Compressive Strength Of Concrete	Natural Sand	% Of Compressive Strength
1	Wash	0.96		-0.32
2	Foundry	0.64	1.28	-0.64
3	Crush	0.79		-0.49

Split Tensile test for M20 (28 Days)

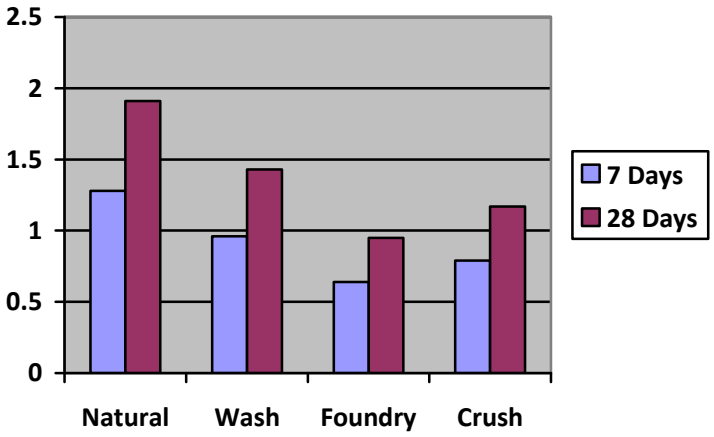
In this point the comparison of Split Tensile test of various sets of sand were made by the results obtained after the 28 days curing of cubes in fresh water.

Split Tensile test for 28 days results (MPA)

Sr. No.	Natural	Wash	Foundry	Crush
1	1.89	1.40	0.94	1.16

2	1.94	1.53	1.0	1.13
3	1.91	1.37	0.92	1.23

Sr. No.	Sample Of Sand	Compressive Strength Of Concrete	Natural Sand	% Of Compressive Strength
1	Wash	1.43		-0.48
2	Foundry	0.95	1.91	-0.96
3	Crush	1.17		-0.74



GRAPH NO.2

Fig -1: Compressive strength test on column

Fig -2 :Split tensile strength test on column

3. CONCLUSIONS

1. The 7 and 28 days compressive strength of concrete by using wash, foundry & crush sand is less than 2.7 %, 4.07 % & 3.25% and 4.04% , 6.01%, & 5.43 % respectively than that of natural sand.

2. The 7 and 28 days split tensile strength of concrete wash, foundry & crush sand is less than 0.32%, 0.64% & 0.49% and 0.48%, 0.96%, & 0.74% respectively than that of natural sand .

3. The compressive strength of concrete by using wash sand is 1.32% and 0.93% more than compressive strength of concrete by using foundry and crush sand for 7 days.

4. The split tensile strength of concrete by using wash sand is 0.32% and 0.17% more than compressive strength of concrete by using foundry and crush sand respectively for 7 days.

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