

An Experimental Investigation on Effect of High strength Concrete Using manufacturing Sand

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ABSTRACT: High strength concrete replaced manufactured sand is the more advantage in the Construction industry. The main objective of High strength concrete to develop the compressive strength of concrete by replacing Natural sand into Manufacture sand and using admixture. To examine the workability of manufactured sand and using admixture in concrete. To investigate the performance of this concrete terms of its compressive strength and split tensile strength. This paper puts forward the applications of manufactured sand as an attempt towards sustainable development in India. It will help to find viable solution to the declining availability of natural sand to make eco-balance. Manufactured sand is one among such materials to replace river sand, which can be used as an alternative fine aggregate in mortars and concretes. The use of manufactured sand in concrete is gaining momentum these days. The present experimental investigations have been made on concrete using manufactured sand as fine aggregate and observed the effects of manufactured sand on strength properties of concrete

KEYWORDS: Manufactured sand, Mineral Admixture, workability, Compressive Strength, Flexural Strength,

I. INTRODUCTION

Now-a-days, the Government have put ban on lifting sand from River bed. Important governing factors for HSCs are strength, long term durability, serviceability as determined by crack and deflection control, as well as response to long term environmental effects. Concrete mix design of M60 grade was done according to Indian Standard code Concrete cube; beam and cylindrical specimens were tested for evaluation of compressive and split tensile strength respectively.

The concrete exhibits excellent strength with 100% replacement of natural sand, so it can be used in concrete as viable alternative to natural sand. Concrete mixes with different % percentages of fly ash as cement replacement material were investigated. The dosages of silica fume were different % of the cementitious materials. The compressive strength of concrete obtained at the ages of 7, 28, 56days.

II. EXPERIMENTAL PROGRAMME

2.1 Natural sand vs. manufactured sand

The sand from river due to natural process of attrition tends to possess smoother surface texture and better shape. It also carries moisture that is trapped in between the particles. These characters make concrete workability better. However, silt and clay carried by river sand can be harmful to the concrete. Another issue associated with river sand is that of obtaining required grading with a fineness modulus of 2.4 to 3.1. It has been verified and found, at various locations across south India, that it has become increasingly difficult to get river sand of consistent quality in terms of grading requirements and limited silt / clay content. It is because we do not have any control over the natural process. In case of

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manufactured sand, the process of attrition through VSI and washing makes the crushed stone sand particles good enough to be compared shape and surface texture of natural sand. With well-designed screening system the required grading (Zone II) and fineness modulus (2.4 to 3.1) can also be achieved consistently in the case of manufactured sand. It must be noted that properly processed manufactured sand can improve both compressive strength and flexural strength through better bond compared to river sand.

2.2 Materials

The materials used for the study are Coarse aggregate, Water, and admixture. These materials are discussed in the following sections.

2.2.1 Cement

Portland pozzolana cement of 53 Grade conforming to IS 8112 -1989, and the specific gravity of cement was found to be 3.15. Many tests were conducted to cement some of them are consistency tests, setting tests, etc. The properties of cement are given in table 1.

Table 1: Property of Cement

SI.NO.	PROPERTY	VALUE
1	Specific gravity	3.15
2	Fineness	97.25
3	Initial setting time	45 min
4	Final setting time	385 min
5	Fineness modulus	6%

2.2.2 Fine Aggregate

River-Sand

Good quality natural river sand is readily available in many areas and may be easily obtained and processed. As with the gravels that they often accompany, the sand deposits may not have been laid uniformly, meaning a potential change in quality. Generally fines are classified based on size, i.e.; below 4.75mm is regarded as fine aggregate. The bulk density of river sand was 1860 kg/m³.

Manufactured Sand

Fine aggregate used in this research is M- sand. The aggregates whose size is less than 4.75mm. It was collected from **RPP READY MIX PLANT**, Erode, India. The bulk density of manufactured sand was 1860 kg/m³.

When rock is crushed and sized in a quarry the main aim has generally been to produce coarse aggregates and road construction materials meeting certain specifications. Generally, this process has left over a proportion of excess fines of variable properties, generally finer than 5-mm size. Manufactured sand is used for aggregate material less than 4 mm that is processed from crushed rock or gravel and intended for construction use.

Manufactured sand is a material of high quality, in contradiction to non-refined surplus from coarse aggregate production. The use of manufactured aggregates (crushed hard rock) in concrete has been known since the Roman time. In modern technology, natural aggregates have proved to be significantly economical in use, for which reason extensive use of manufactured aggregates has been concentrated to regions or projects where the availability of natural aggregates has been limited.

2.3 Coarse Aggregate

Coarse aggregate of nominal size of 20mm & 12 mm is chosen and tests to determine the different physical properties as per IS 383-1970. Test results conform to the IS 383 (PART III) recommendations. The bulk density of coarse

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aggregate 1691kg/m³. Coarse aggregate 12 mm and 10 mm was used, which was manufactured from locally available rock.



Fig.1 M-sand & River Sand

2.4 Water

Water is a key ingredient in the manufacture of concrete. Water used in concrete mixes has two functions: the first is to react chemically with the cement, which will finally set and harden, and the second function is to lubricate all other materials and make the concrete workable. Although it is an important ingredient of concrete, it has little to do with the quality of concrete. One of the most common causes of poor-quality concrete is the use of too much mixing water.

2.5 Admixture

2.5.1 Fly ash

Fly ash is a byproduct of the thermal power plants and the quantity of them are increasing. Dust collection system removes the fly ash, as a fine particulate residue, from combustion gases before they are discharged into the atmosphere. The types and relative amounts of incombustible matter in the coal used determine the chemical composition of fly ash. More than 85% of most fly ashes is comprised of chemical compounds and glasses formed from the elements silicon, aluminum, iron, calcium, and magnesium.

2.5.2 Silica Fume

It is a product resulting from reduction of high purity quartz with Coal in an electric arc furnace in the manufacture of silicon or ferrosilicon alloy. Silica fume rises as an oxidized vapour. It cools, condenses and is collected in cloth bags. Silica fume as an admixture in concrete. It is further processed to remove impurities and to control particle size. Since it is an airborne material like fly ash, it has spherical shape. Silica fume has become one of the necessary ingredients for making high strength and high performance concrete

2.5.3 Chemical Admixture

Super-plasticizer is an essential component for high strength concrete. Conplast SP 430 was used. Conplast SP430 is the chloride free, super-plasticizer based on sulphonated naphthalene polymers super plasticizer is a unique workability retaining high performance super-plasticizer with high strength properties. Super-plasticizer admixture at 1.5% by weight of cement was used to obtain the desired workability.

III. MIX DESIGN

The mix design was carried out based on the recommended guidelines in Indian Standards. The basic assumption made in the Indian standard method for mix design is that the compressive strength of workable concrete is by and large

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governed by the water/cement ratio. In this method the water content and proportion of fine aggregate corresponding to a maximum size of aggregate are first determined from the reference values of workability, water-cement ratio, and the grading of fine aggregate. The water content and proportion of fine aggregate are then adjusted for any difference in workability, water/cement ratio and grading of fine aggregate in any particular case. Fig 2 represents slump testing and fig 3& 4 represents slump value in fly ash and slump value in silica fume

Table 2: Workability Test Results

MIX DESIGN	% of mineral admixture replacement	Slump (mm)
M60	0 %	38
M60	5 % of silica fume	35
M60	7.5 % of silica fume	27
M60	10 % of silica fume	24
M60	10 % of Fly Ash	30
M60	20 % of Fly Ash	25
M60	30 % of Fly Ash	21



Fig 2 Slump testing

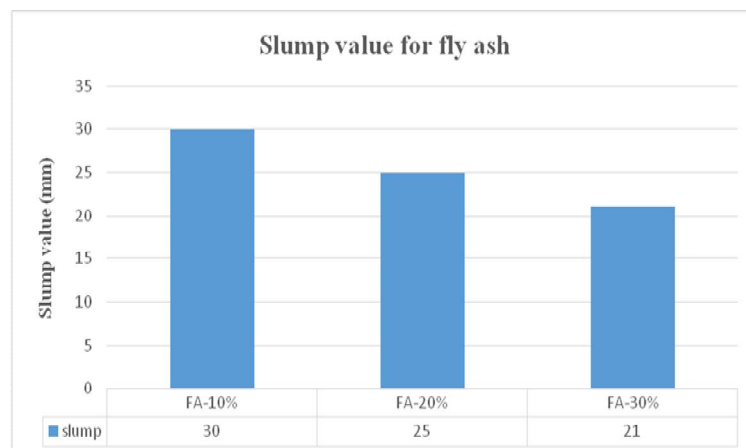


Fig.3 Slump Value in Fly ash

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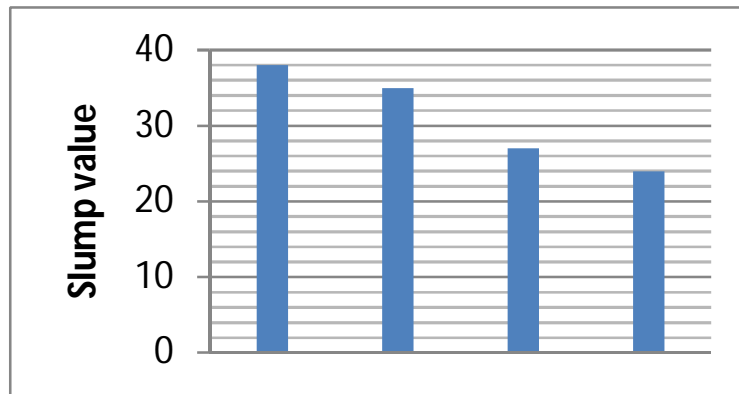


Fig.4 Slump Value in Silica fume

IV. METHODOLOGY

4.1 Cube compressive strength

For cube compression testing of concrete, 150 mm cubes were used. All the cubes are testing at the age of 7days, 28days, 56days of curing using compression testing machine. Fig .5 shows compressive strength test. Loading is continued till the dial gauge needles reverse its direction of motion. The reversal in the direction of motion of the needle indicates that the specimen has fail. The dial gauge reading at that instant is note which is the ultimate load. The ultimate load divided by the cross sectional area of the specimen is equal to the ultimate cube compressive strength.

4.2 Splitting tensile strength

Figure 6 represents to determine the tensile strength of cylindrical specimens. splitting tensile strength tests were carry on cylinder specimens of size 100 mm diameter and 200 mm length at the age of 7, 28, 56 days curing, using compression testing machine. To avoid the direct load on the specimen the cylindrical specimens were kept below the specimens spilt and readings were noted. The splitting tensile strength has been calculated using the following formula:

$$F = 2P/IIld$$

Where, P is the compressive load on the cylinder.

L is the length of cylinder.

D is the diameter.



Fig 6: spilt tensile test

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Table 3: Test Results

Sl.NO	Cube Id	Compressive Strength (N/Mm2)		Split tensile strength(N/mm2)	
		7 days	28 days	7 days	28 days
1	R-Sand	33.33	55.11	2.2	3.18
2	M-Sand	36.88	58.66	2.67	4.45
3	Sf-5%	38.22	63.11	3.15	5.25
	Sf-7.5%	35.55	59.55	2.86	4.77
	Sf-10%	33.77	56.44	2.77	4.61
4	Fa-10%	35.5	59.55	3.24	5.4
	Fa-20%	34.2	56.8	2.90	4.84
	Fa-30%	32	53.77	2.58	4.30

V. CONCLUSION

In the present scenario sustainable developments there is a dire need for utilizing industrial waste and other alternate materials to presence the environment usage of manufactured sand as an alternate material in the place of river sand is gate prevalent widely across the globe. Utilization of m- sand in the high strength concrete in a confident way requires lot of experimental investigations. In the project an attempt has been need to study the strength properties of m60 high strength concrete by adding different proposition of mineral admixture like silica fume and fly ash following are the importance conclusion arrived based on the investigation. A Comprehensive

Study had been carried out on various journals and books related to the high strength concrete with manufactured sand and various admixtures. The appropriate materials necessary for the preparation of specimens for experimentations have been achieved. The quantity of specimens and the tests to be conducted have been predetermined. The percentage of replacement 0%, 5%, 7.5%, 10% in silica fume. The maximum strength attains the percentage of 5.

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