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An Investigation of Strength and Durability of High Performance Concrete using Eco Sand

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ABSTRACT :The paper deals with making and studying the different properties of high performance concrete using Eco sand and Fly ash. The manufacture of ordinary Portland cement (OPC) due to the calcinations of limestone and combustion of fossil fuel. The order of one ton of every ton of OPC is produced. The OPC is a exemption of Fly ash and the partial replacement of Fly ash instead of OPC. The experimental investigation have been carried to find out the physical and mechanical properties of high performance concrete. The high performance concrete contains cementitious materials and partial replacement of cement with Fly ash 30% constant and replacing fine aggregate with varying Eco sand 10%, 20%, 30%. The various tests can be carried out for high performance concrete using Eco sand and Fly ash. Durability tests can be carried out using alkalinity and water absorption.

KEYWORDS :Eco sand, high performance concrete, fly ash, durability.

I. INTRODUCTION

Concrete is a combination of cement, fine aggregate, coarse aggregate and water. It is best suite for construction material. the coarse aggregate is a form of crushed or angular form and it is equal to limestone or granite. the fine aggregate is form of thin like structure which is a sand. the chemical admixtures is added to increase the workability of concrete.

Eco sand is also a form thin like structure which is abundantly known as sand. It is occurred from cement manufacture, which is used to increase the efficiency in concrete. Eco sand provides best moisture resistivity and reduces pores in concrete because of its micro filling effect. It is a cost effective and better durability compared to other aggregates.

Fly ash is available in thermal power station by the means of combustion of pulverised coal. The two types of Fly ash are Fly ash C and Fly ash F. The Class F fly ash is added in a dosages of 15 to 25 per cent and Class C fly ash at 15 to 40 per cent. Fly ash is used for increase the workability of cement.

II. LITERATURE REVIEW

- [1]. PROF. JAYESHKUMAR PITRODA (2016) , He studied that the replacement of cement with fly ash in the proportion of 10%, 20%, 30% & 40% by weight for the grade of M25 & M40. As fly ash percentages increases compressive strength and split tensile strength decreases.
- [2]. B.P HUDSON(2016) , He replaced 20% cement by weight with 27.5% fly ash by weight. The quality of sand was reduced and coarse aggregate increased by an amount equal to the weight of fly ash added.
- [3]. KARTIEY TIWARI(2012) , The cement has been replaced by fly ash accordingly in the range of 0% 10%, 20%, 30% & 40% by weight of cement for M-25 and M-40mix. As fly ash percentage increases compressive strength and split strength decreases.
- [4]. SAIFUL M, ET AL. (2010) , This paper reports the results of an experimental investigation carried out to study the effects of fly ash. The strength increases with the increase of fly ash up to an optimum value, beyond which, strength values started decreasing.

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- [5]. PHANIKUMAR AND SHARMA (2004), A similar study was carried out by Phanikumar and Sharma and the effect of Fly Ash on engineering properties of expansive soil through an experimental programme. The ash blended expansive soil with fly ash contents of 0, 5, 10,15 and 20% on a dry weight basis.

III.METHODOLOGY

This chapter explains the methods going to be use in this project. Let we have to find out the properties of concrete produced by replacing the natural sand with Eco sand in various percentage 10%, 20%, 30% and OPC cement with fly ash as constant 30%.

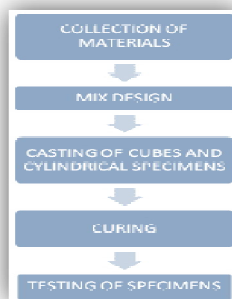


Fig 3.1 : Schematic diagram of Experimental work

IV.MATERIALS

4.1 Materials :

The term concrete is defined as an artificial stone made by mixing sand, stone, cement and water. The composition of concrete cast into a form of the desired shape and size, hardens into a stone-like mass the concrete.

4.2 Cement :

The colour of cement is fine gray powder. The term word cement is find out from roman word opus caementium and it was made from crushed rock with burnt lime as binder.

4.3 Aggregate :

Aggregates is naturally a inert granular materials and it is a form of sand and crushed stone. The aggregates are free from absorbed chemicals and also other finer materials to prevent from deterioration of concrete.

4.4 Fine aggregate :

Sand is naturally obtained as a sea shore and desert. The mass of rock can be crushed into fine like material is known as sand.

4.5 Coarse aggregate :

Aggregates is mainly used filler for concrete and also used to reduce the weight of cement added in concrete. Aggregates are obtained from crushed angular material like limestone or granite.

4.6 Eco sand :

Eco sand is also a form thin like structure which is abundantly known as sand. It is occurred from cement manufacture, which is used to increase the efficiency in concrete.

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Fig 4.2. Eco sand

4.6 Experimental investigation :

The standard size of cube such as 150mm × 150mm × 150mm should be used. The Mix design procedure should have considered in Indian standard guidelines for M40 grade. The casting specimen mould will be removing the after 24 hours and then cured under water for the period of 7,14, and 28 days.

Table 4.1. Percentage quantities of raw materials

Mix	Natural sand(%)	Eco sand (%) replacing of fine aggregate	Fly ash (%)replacing of cement
M1	Nominal mix	0	0
M2	90	10	30
M3	80	20	30
M4	70	30	30

4.7 Test for fresh concrete :

To study the workability of concrete will be conducting by slump cone test on fresh concrete.

a) Slump Flow Test

The slump flow test is used appraise the horizontal free flow of in the absence of obstructions. It was first developed in Japan for use in assessment of underwater concreting.

4.8 Test for hardened concrete:

In hardened concrete destructive test such as compressive, split tensile and flexural strength and non destructive test such as Ultra sonic pulse velocity method and rebound hammer test are conducted.

a) Compressive Strength

The compression test is used to determine the hardness of cubical specimens of concrete. Cubes of size 100 mm x 100 mm x 100 mm are casted. The specimen should be given sufficient time for hardening approximately 24 hrs and then it should be cured for 28 days. Compressive strength is calculated by the following formula,

$$\text{Compressive strength} = \text{Load/cross-sectional area of the cube}$$



Fig 4.3. Compression testing machine

b) Split tensile strength

This is an indirect test to determine the tensile strength of the cylindrical specimens 150 mm diameter and 300 mm height. The split tensile strength can be calculated using the formula,

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$$F_t = 2p/\pi DL$$

Where f_t = Split tensile strength of the specimen in N/mm²

P = Maximum load in N applied to the specimen

D = Diameter of the specimen in mm

L = Length of the specimen in mm



Fig 4.4 Spilt tensile strength

c) Flexural strength test

Flexural strength tests are carried out on the rectangular beams and its sizes 500×100×100. The flexural strength of the beam is calculated by using the formula,

$$F_r = 3PL/bd^2$$

Where f_r = Flexural tensile strength of specimen in N/mm²

P = Maximum load in N

L = Length of the specimen in mm

b = Width of the specimen in mm

d = Depth of the specimen in mm



Fig 4.5. Flexure strength

4.9 Density :

Density is most important factor in high performance concrete and it is used find out the density for hardened concrete. Normal density of concrete is 24 to 25 kN/m³. The density is calculated for above three mixes and it is tabulated as below and graph is plotted as shown.

4.10 Durability :

It is defined as the ability of concrete to resist weathering action, chemical attack, and abrasion while maintain its properties. The cube specimens are taken for acid curing and the cube specimen are immersed in acid curing for 30 days. The hydrochloric acid (HCL) with pH 2to 5 % in which weight of water is added. After 30 days the cube specimens are taken out for acid curing and the weight losses for cubes to be measured. The tabulation for acid curing and graph is shown below.

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V. RESULTS AND DISCUSSION

5.1 Density of concrete :

The density values are tabulated below as compared with 28 days strength and density. The density achieved as per the normal density of concrete. The density of concrete is gradually increased with reference to strength.

Table 5.2 Density of concrete

28 days Strength (mpa)	Density kN/m ³
39.76	22.4
35.67	23.6
32.50	24.5

5.2 Durability of concrete :

Durability of concrete is done with acid curing and weight losses is to be measured. The weight losses are measured and tabulated as below. The weight loss due to acid curing and it is achieved after 30 days.

Table 5.3 Durability of concrete

Mix	Initial weight (kg)	Weight loss due to acid attack test (kg)
M1	8.46	8.24
M2	8.38	8.17
M3	8.04	7.98

5.3 Compressive strength :

The compressive strength for 30% fly ash constant and varying 10%, 20%, 30% Eco sand is tabulated. The 7,14,28 days strength is gradually increased as compared to conventional concrete.

Table 5.4 Compressive strength

Mix	Compressive strength N/mm ²		
	7 days	14 days	28 days
Conventional mix	31.11	36.34	41.34
M1	32.34	37.67	42.12
M2	33.56	38.10	44.23
M3	34.50	39.00	45.66

5.4 Spilt tensile strength :

The spilt tensile strength is calculated as given formula and it's values are tabulated. The strength is increased at all levels compared to conventional concrete.

Table 5.5 Spilt tensile strength

Mix	Spilt tensile strength N/mm ²		
	7 days	14 days	28 days
Conventional mix	3.2	3.4	3.9
M1	2.9	3.2	3.8
M2	2.6	3.0	3.6
M3	2.5	2.6	2.7

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5.5 Flexure strength :

The flexure strength for 7,14,28 days strength is calculated and tabulated as below. The maximum flexure strength is achieved at all levels.

Table 5.6 Flexure strength

Mix	Flexural strength N/mm ²		
	7 days	14 days	28 days
Conventional mix	5.0	5.2	5.4
M1	4.7	4.9	5.1
M2	4.4	4.6	4.7
M3	3.8	3.9	4.2

5.6 Compressive strength :

The 7,14,28 days compressive strength is plotted in graph below and it's X axis is mix ratios and Y axis is strength. The strength is increased as compared with conventional concrete.

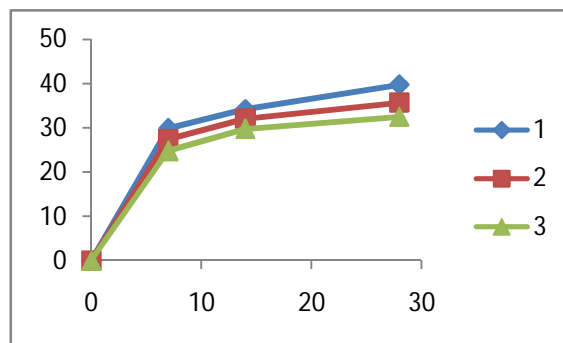


Fig 5.6 Compressive strength

5.7 Spilt tensile strength :

The spilt tensile strength is plotted as graph shown below. The strength is plotted for 7,14,28 days and it's 28 days strength is increased as compared with conventional concrete.

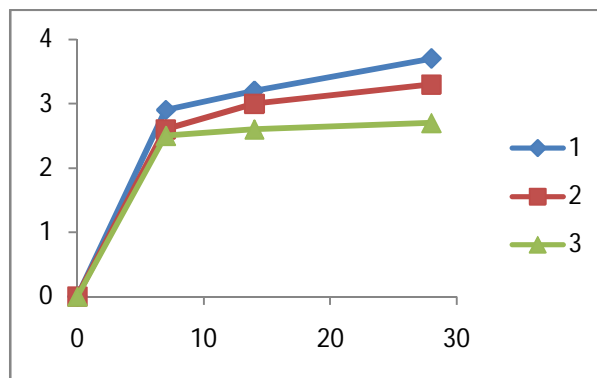


Fig 5.7 Spilt tensile strength

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5.8 Flexure strength :

The flexure strength is plotted as graph shown below. The strength is increased at 28 days and it is attained a maximum flexure strength. The flexure is occurred at centre point of the prism. The strength is increased after 14 days as shown in graph.

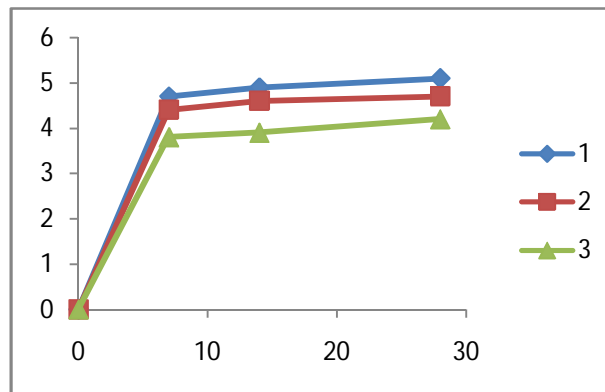


Fig 5.8 Flexure strength

V. CONCLUSION

On the basis of the results obtained from this experimental work, the following conclusions have been drawn,

- The compressive strength increased at all trial mixes compared to conventional concrete due fly ash as constant(30%).
- The split tensile strength and flexure strength was achieved their strength compared to conventional concrete.
- With the help of Acid attack test, the durability of concrete was attained its losses of weight compared to normal concrete specimens .

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