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Research Paper

A STUDY OF STRENGTH OF STEEL FIBER REINFORCED CONCRETE WITH FLY ASH

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A study of compressive strength of steel fiber reinforced concrete with fly ash has been studied. M40 grade concrete is designed and steel fibers are mixed in varying percentage, ranging from 0.5% to 1.5%, fly ash has also added and increased by 10%, the initially it was 10% and final percentage was 20% .Concrete cubes of size 150 mm x 150 mm x 150 mm are prepared and tested for compressive strength after 7 and 28 days. A results are analyzed and it is found that there is a reduction in strength with an increment of fly ash.

Keywords: Fiber Reinforced concrete, Fly ash, Mix design, Steel fiber

INTRODUCTION

Concrete is very strong in compression but weak in tension. As a concrete is a relatively brittle material, when subjected to normal stresses and impact loads. The tensile of concrete is less due to widening of micro-cracks existing in concrete subjected to tensile stress. Due to presence of fiber, the micro-cracks are arrested. The introduction of fibers is generally taken as a solution to develop concrete in view of enhancing its flexural and tensile strength.

Fly ash is the fine powder major waste material produced from many thermal power plants. The disposal of fly ash is the one of the major issue for environmentalists as dumping of fly ash as a waste material may cause severe environmental problem. Therefore, the utilization of fly ash as a low cost mineral admixture in concrete instead of dumping it as a waste material can have great beneficial effects. It can be used particularly in mass concrete applications where main emphasis is to control the thermal expansion due to heat of hydration of cement paste and it also helps in reducing thermal and shrinkage cracking of concrete at early ages. The replacement of cement with fly ash in concrete also helps to conserve energy. The introduction of the paper should explain the nature of the problem, previous work, purpose, and the contribution of the paper. The contents of each section may be provided to understand easily about the paper.

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ROLE OF FIBER REINFORCED FLY ASH CONCRETE

Fiber Reinforced Concrete (FRC) is mixtures of cement concrete containing short discrete, uniformly dispersed and randomly oriented suitable fibrous material which increases its structural integrity. The amount of fibers added to concrete mix is measured as percentage of the total wt. of cement. Aspect ratio (l/d) is calculated by dividing fiber length (l) by its diameter (d).

The composite matrix that is obtained by combining cement, Fly ash aggregates and fibers is known as "Fly ash Fiber reinforced concrete". The fiber in the cement fly ash based matrix acts as crack-arresters, which restrict the growth of micro cracks and prevent these from enlarging under load.

MATERIAL SPECIFICATIONS

Cement

The cement used in this experimental work is 43 grade of Ordinary Portland Cement as per IS: 12269-1987. The specific gravity of the cement is 3.15. The initial and final setting times were found as 90 min and 180 min, respectively.

Fine Aggregate

Locally available sand passed through 4:75 mm IS sieve is used. The specific gravity , finesse modulus and water absorption are 2.65, 2.62, and 0.2%, respectively.

Coarse Aggregate

Crushed aggregate available from local sources with a maximum size of 20 mm, and having the specific gravity value of 2.8 and the water absorption of 0.5% has been used as coarse aggregate.

Water

Potable tap water is used for the experimentation.

Fibers

The steel fiber is procured from Stewols India Pvt. Ltd. Nagpur. The steel fibers used in the study are the Indentation steel fibers of 0.5 mm flat and 50 mm length having aspect ratios 100. The constant dosage of fibers varying from 0.5% to 1.5% by total weight of cement is used.

Fly Ash

Fly Ash is available in dry powder form and is procured from Sanjay Gandhi Thermal Power Plant Birsinghpur Pali. The elemental oxides components of fly ash as tabulated below.

Elemental oxides	Fly ash
Silicon di-oxide	63.41
Aluminium oxide	25.88
Calcium oxide	0.34
Magnesium oxide	1.13
Iron oxide	3.14
Phosphorus pentoxide	1.65
Potessium oxide	1.22

Mix Design

Mix design is known as the selection of mix ingredient and their proportion required in a concrete mix. In the present study method for mix design is the Indian standard method. The mix design involves the calculation of the amount of cement. Fine aggregate, coarse aggregate in addition to OPC of 43 grade,

water cement ration 0.40 and super plasticizer which is 1% of cement .The said mixes give the workability of 75 mm using slump cone test. The final proportions for Design mix of M40 are as follows: Cement: Sand: Coarse Aggregate: Water, 1:1.8:3.38.

Batching, Mixing and Casting

The coarse Aggregates and fine aggregates were weighed first with an accuracy of 0.5 g. The Concrete mixture was prepared by hand mixing on a watertight platform. Cement, the coarse and fine aggregates were mixed thoroughly. To this mixture, the required quantities of fibers (fibers 0.5% to 1.5% weight of cement) were added. These were mixed to uniform color. Then water was added carefully so that no water was lost during mixing. The moulds were filled with 0.0% 0.5% 1.0% and 1.5% fibers and vibration was given to the cube moulds using table vibration. The top surface of the specimen was leveled and finished. After 24 h of mould preparation, specimens were transferred to curing tank where in, they were allowed to cure for 7, 28 days.

EXPERIMENTAL METHODOLOGY

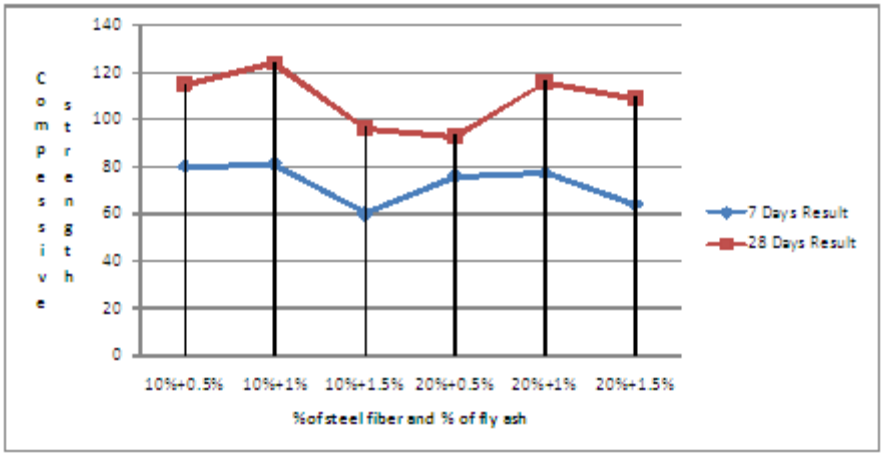
Compressive Strength Test

In the present study method suggested in IS:10262-2009 is used for mix design. The

Table 1: Compressive Strength (Tone) at 7, 28

Fly Ash % by wt.	Fiber % by wt.	After 7 Days	After 28 Days
10%	0.5%	80.0 Tone	115.0 Tone
10%	1%	81.0 Tone	124.0 Tone
10%	1.5%	60.0 Tone	96.0 Tone
20%	0.5%	76.0Tone	93.0Tone
20%	1%	77.0 Tone	116.0 Tone
20%	1.5%	64.0 Tone	109.0 Tone

Figure 1: Compressive Strength Result



compressive strength of concrete is one of most important properties of concrete in most structural applications. For compressive strength test, cube specimens of dimensions 150 mm x 150 mm x 150 mm were cast for M40 grade of concrete. After curing, these cubes were tested on Compression Testing machine as per IS 516-1959. The failure load was noted. In each category three cubes were tested and their average value is calculated.

EXPERIMENTAL RESULT

Hardened Concrete Strength Results

Compressive Strength test result after 7, 28 days of curing are given in Table 1 and further highlighted in Figure 1.

CONCLUSION

The study on the effect of steel fibers with Fly Ash can still be a promising work as there is always a need to overcome the problem of brittleness of concrete and disposal of fly ash produced from power plants. The following conclusions could be drawn from the present investigation.

1. Density of concrete is more as the percentage of steel Fiber increases with Fly Ash content 10%.
2. Super plasticizer agent is required to produce workable mix.
3. For small quantity of fly ash (10% and 20%) Compressive Strength is more for 1.0% Steel Fibers.

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