EXPERIMENTAL STUDY BASED ON STRENGTH CHARACTERISTICS OF CONCRETEM 30 BYADDING FLY ASH AND STEEL FIBER

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ABSTRACT: This paper deals with experimental study on behavior of concrete M30 after adding a constant percentage 0.5% of steel fiber by the weight of concrete and replacement of cement by the weight of fly ash in the percentages of 0,3.5,7,10.5,14 and 17.5 % respectively . In the present study the Compressive strength, Split tensile strength, Flexural strength of steel fiber and fly ash based M30 concrete have been checked and the obtained results are compared with the control mix. Concrete related test were performed for the curing age of 7days and 28 days. Test results shows that at 0.5% replacement of steel fiber and 10.5 % replacement of cement by the weight of fly ash enhance the strength characteristics of M30 concrete as compare to the control mix for both the curing age of 7days and 28 days respectively.

Keywords: Steel fiber reinforced concrete, Fly ash, Compressive strength, Flexural strength, Split tensile strength.

I. INTRODUCTION

Concrete is an advanced material as per construction point of view. It provides more durability to the structure and easily moulded in the desired shape. Due to the ease of construction and fast rate of construction, it saves the time of human beings to build the residential structure, commercial structure etc. Generally, we use Cement, sand, coarse aggregate for making the concrete with a desired quantity of water. Sometimes we use some admixture with the concrete to make it more powerful than the ordinary concrete, to save the natural resources and to control the environmental pollution.

II. MATERIAL AND ADMIXTURE:

In this experimental study, Cement, sand, coarse aggregate, water, fly ash and steel fibers were used.

- Cement: Ordinary Portland cement of 43 grade Ultra-tech cement was used in this experimentation conforming to I.S-8112- 1989.
- Fine Aggregate: Locally available sand zone provided by material supplier with specific gravity 2.65, water absorption 2% and fineness modulus 2.91, conforming to I.S. – 383-1970.
- Coarse Aggregate: Crushed stone of 20mm size having specific gravity 2.70 confirming code book IS 393- 1970 has been used in this study.
- Water: Tap water from lab having pH value 7.8 was used for the experimentation.
- Steel Fibers: - Steel fiber used in this study was collected from Rawalwasia steel plant in Hisar. Steel Fibers collected from the lathe machines are of length 25-35 mm, width 2-3 mm and thickness of 0.2-0.5 mm are used to reinforce the concrete mix. The shape of the fiber used was spiral.
- Fly ash: In the experimental work Class F- type fly ash was used.

III. CONCRETE MIX PROPORTIONS

Concrete M30 grade has been prepared as per I.S-10262:2009. The ratios of concrete ingredients are given in table no. 3.1

TABLE 3.1 CONCRETE MIX PROPORTIONS

Mix Design ation	Water	Cement	Fine Agg.	Coarse Agg.
MX0	186	413	674.69	1121.58
Ratios	.45	1	1.63	2.72

TABLE 3.2 FLY ASH AND STEEL FIBERS BASED CONCRETE MIX

Mix	% F. Ash	S.F % age	Water kg	Cem e-nt (kg)	C .A. (kg)	Fine Agg. (kg)	F. Ash (kg)	S.F. In Kg
M1	0	0	15	33.500	91.000	54.520	0	0
M2	3.5	0.5	15	32.202	90.702	54.222	1.172	.895
M3	7	0.5	15	30.857	90.702	54.222	2.345	.895
M4	10.5	0.5	15	29.685	90.702	54.222	3.517	.895
M5	14	0.5	15	28.512	90.702	54.222	4.690	.895

M6	17.5	0.5	15	27.340	90.702	54.222	5.862	.895

IV. RESULT ANALYSIS

COMPRESSIVE STRENGTH TEST
SPLIT TENSILE STRENGTH TEST
FLEXURAL STRENGTH TEST

TABLE 4.1 COMPRESSIVE STRENGTH TEST

Mix	%age of S.F.	%age of fly ash	7 Days C.S (N/mm^2)	28 Days C.S (N/mm^2)
M0	0	0	22.44	37.85
M1	0.5	3.5	22.82	38.44
M2	0.5	7	23.48	38.89
M3	0.5	10.5	24.07	39.41
M4	0.5	14	23.56	38.81
M5	0.5	17.5	21.85	37.70

TABLE 4.2 SPLIT TENSILE STRENGTH TEST

Mix	%age of S.F.	%age of fly ash	7 Days S.T.S (N/mm^2)	28 Days S.T.S (N/mm^2)
M0	0	0	1.55	2.78
M1	0.5	3.5	1.79	2.99
M2	0.5	7	2.02	3.22
M3	0.5	10.5	2.12	3.45
M4	0.5	14	2.00	3.02
M5	0.5	17.5	1.79	2.69

TABLE 4.3 FLEXURAL STRENGTH TEST

Mix	%age of S.F.	%age of fly ash	7 Days F.S. (N/mm^2)	28 Days F.S. (N/mm^2)
M0	0	0	3.35	5.36
M1	0.5	3.5	3.67	5.60
M2	0.5	7	3.88	5.87
M3	0.5	10.5	4.09	6.04
M4	0.5	14	3.67	5.45
M5	0.5	17.5	3.17	4.77

FIGURE 4.4 FLEXURALTEST

V. CONCLUSIONS

Based on the results obtained in the present study, the following conclusion can be drawn-

a) An acceptable quantity of steel fibers and fly ash gives positive results to the concrete as compared to the control mix.

b) It also increases the cube compressive strength of concrete in 28 days to an extent of 4.12% at the dosage of 0.5% of addition of waste steel fiber by the total weight of concrete and 10.5% replacement of cement by the weight of fly ash.

c) After adding the steel fiber the ductility of concrete improves & also its post-cracking load carrying capacity.

d) It increases the split tensile strength of concrete in 28 days up to 24.10 % at the 0.5% of fiber and 10.5% of fly ash addition.

e) The flexural strength of concrete after 28 days increases 12.68% after adding 0.5% of waste steel fiber and 10.5% of fly ash in concrete.

f) The results obtained from the present study indicates that it is feasible to add the steel fiber and fly ash for increasing the strength characteristics of concrete mix, thus the steel fiber and fly ash can be used as an additive material for the production of concrete to control the waste disposal problems and to maximize the strength of concrete.

VI. FUTURE SCOPE

a) The effect of steel fiber in concrete with fly ash at different percentages other than used in present study can be investigated.

b) The time dependent effects such as fatigue creep and durability can be investigated.

c) The effects of different kind of steel and polymer fiber at high temperature can also be further investigated.

d) Further study will be carried out with different ratio of steel fibers and a constant ratio of fly ash for same concrete mix.

e) Same percentage of admixture which are used in present study will be study with different concrete mix like M25, M35, M40 etc to find out effects of these admixtures on the strength characteristics of different concrete mix.

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