Experimental Investigation on Strength Properties Advance Reinforced Concrete

Mr. M.Vijayakumar[1], Dr.P.Krishnakumar[2], Mr.M.Athipathy[3]
[1, 3]Assistant Professor, Dept of Civil Engineering,
[2]Associate Professor Dept of Civil Engineering
[1, 2, 3] Rathinam Technical Campus,

Abstract- *The main objective of this paper is to investigate the effect of steel fibre of M20 grade HVFA (High Volume Fly Ash Concrete) concrete with proportion 0.48 water cement ratio. Here cement is partially replaced by 75%, 80%, and 85% of F- class fly ash of by weight. Also dosage of steel fiber in percentage of 0.5%, 1%, and 1.5% by weight of concrete is used. Aspect ratio of steel fibre used us 60. Compression strength test, split tensile test were performed according to guidelines. The result were compared with results of control mix concrete. Due to addition of steel fiber Compression strength, split tensile strength has increased.*

Keywords- High volume fly ash concrete,Fly ash, steel fiber, split tensile strength test, compression strength test.

I. INTRODUCTION

Concrete is mostly wide construction material in the world due to its ability it can be mould and shape. However concrete has some deficiencies as listed below, Low tensile strength, Low post cracking capacity, Brittleness and low ductility, Limited fatigue life, not capable of accommodating large deformations, Low impact strength. These properties can be improved by the use of steel fiber reinforced concrete. The fibers are dispersed and distributed randomly in the concrete during mixing, and thus improve concrete properties in all directions. The fiber helps to arresting the internal widening cracks and fly ash helps as an admixture for improving the properties of concrete.

II. OBJECTIVE

- To investigate the utilization of fly ash as a replacement of materials and influence of this fly ash on the strength on concrete made with high cement replacement level.
- To find out the compressive strength and split tensile strength of concrete at different percentage of cement replaced by fly ash use a dosage of steel fibre.

III. MATERIALS

A. ***Ordinary Portland Cement (OPC)***

The cement used in this experimental work is 43 grades Ordinary Portland Cement. All properties of cement are tested by referring IS 12269 - 1987 Specification for 43 Grade Ordinary Portland cement. The specific gravity of the cement is 3.15. The initial and final setting times were found as 90minutes and 180 minutes respectively. Standard consistency of cement was 31.25%.

B. ***Aggregates:***

The aggregates are normally divided into two categories, namely fine and coarse. Fine aggregate normally consists of natural, crushed, or manufactured sand. Coarse aggregates can be made of natural gravel or crushed stone. In the present study the sand confirm to zone II as per Indian standards. The crushed aggregate used were 12.5mm.A maximum size of 10mm to 14 mm is usually selected as coarse aggregates up to 20 mm may be used in FRHVAC.

Fine aggregate:

Locally available sand passed through 4.75mm IS sieve is used. The specific gravity of 2.84 and ineness modulus of 3.895 are used as fine aggregate. The loose and compacted bulk density values of sand are 1094and 1162 kg/m3 respectively, the water absorption of 1.491%.

Coarse Aggregate:

Crushed aggregate available from local sources has been used. The coarse aggregates with a maximum size of 20mm having the specific gravity value of 2.958 and fineness modulus of 7.136 are used as coarse aggregate. The loose and compacted bulk density values of coarse aggregates are 1467 and 1629kg/m3 respectively, the water absorption of 1.30%. 10MSA:-Crushed aggregate available from local sources has been used. The coarse aggregates with a maximum size of 10mm having the specific gravity value of 3.016and fineness modulus of 5.829 are used as coarse aggregate. The loose and compacted bulk density values of coarse aggregates are 1531 and 1726kg/m3 respectively, the water absorption of 1.835%.

C. Fly ash:

Fly ash a by-product of the combustion of pulverizes coal in thermal power plants. Fly ash is used in developing FRHVAC to make up the demand for higher powder content. Fly ash is ranging in diameter from less than1µm up to 150µm. they are use full in enhancing the deformability and stability of the fresh FRHVACClass F normally produced from bituminous coal has been used.

D. Steel fiber:

The inclusion of fiber especially steel fibers in FRHVAC significantly enhances the flexural strength, ductility and toughness.

Because of its non-flexibility it gives more strength. The most important thing describing a fiber is its aspect ratio. Aspect ratio is the length of fiber divided by an equivalent diameter of fiber, where equivalent is the diameter of the circle with an area equal to the cross sectional area of fiber. Steel fiber having aspect ratio 60 with geometry of cylindrical hooked ends used.

IV. MIXPROPORTION

Table 1: Mix proportion

MIX PROPORTION	75% (Kg/m^3)	80% (Kg/m^3)	85% (Kg/m^3)
Cement	99	80	60
Fly ash	297	316	336
Water	140	140	140
Fine aggregate	790	790	790
Course aggregate	1073	1073	1073
Water cement ratio	0.354	0.354	0.354

V. RESULT AND DISCUSSION

COMPRESSIVE STRENGTH TEST RESULTS:

Table 2: Compressive strength

Sl. No	% of fly ash added	7 days Collapse load(KN)	14 days Collapse load(KN)	28 days Collapse load(KN)
1	0	300	380	450
2	75	220	340	530
3	80	210	320	480
4	85	190	280	360

SPLIT TENSILE TEST RESULT:

Table 3: Split tensile strength

Sl.no	% of fly ash added	7 days	14 days	28 days
		FCU (KN/M)	FCU (KN/M)	FCU (KN/M)
1	0	80	150	210
2	75	80	120	230
3	80	70	110	190
4	85	50	80	150

VI. CONCLUSION

Following conclusion have been drawn from the experimental studies carried out to investigate the influence of steel fibres on strength characteristics of concrete.

- 75% replacement of cement by fly ash produced the optimum strength in compression (220 kN) which is 17% increase from controlled mix concrete.
- 75% replacement of cement by fly ash produced the optimum strength in split tensile strength(80 kN/m) which is 20% increase from control mix concrete.
- Compressive strength decreases for 80% and 85% replacements respectively
- Split tensile strength decreases for 80% and 85% replacements respectively
- It is concluded that among the three replacement ratios 75% proves to be optimum.

REFERENCES

[1] Chandramouli k, Srinivasa Rao P, Pannirselvam N, Sravana P. (April 2010) “Streangth properties of glass fiber concrete”.

[2] K.Srinivasa Rao, S.Rakesh Kumar A. Laxmi Narayana (2013) “Comparison of performance of standard concrete and fiber reinforced standard concrete exposed to elevated temperature”.

[3] N. Ganesan, P.V. Indira and Ruby Abraham (Sep 2007) “Steel fibres reinforced high performance concrete beam – column joints subjected to cyclic loading”

[4] Yogesh ulape, Giridhar naruli, (April 2015) “Experimental investigation on steel fiber reinforced concrete using metakaolin”.

[5] IS: 10262 -2009 “Concrete mix proportioning”..

[6] IS: 456-2000 “Indian standard code of practice for plain and reinforcement concrete fourth revisions”..

[7] IS: 383-1970 “Specification for coarse and fine aggregate”.

[8] Falah M.Wegian,Anwar A.Alanki,Hana M.Alsaeid,Fahad A.Alotaibi(2011), “Influence of Fly Ash on Behavior of

Fiber Reinforced Concrete Structures", *Journal of Applied Sciences,11(17):3185-3191.*

[9] IS 383:1970, Specification for coarse and fine aggregates from natural sources for concrete (second revision), *Bureau of Indian standards, New Delhi, India.*.

[10] IS: 10262-2009, Recommended guidelines for concrete mix design, *Bureau of Indian standards, New Delhi, India*

[11] IS: 516-1959, Indian standard methods of tests for strength of concrete, *Bureau of Indian Standards, New Delhi, India.*

[12] Y. Mohammadi, S.P. Singh b, S.K. Kaushik (2008), "Properties of steel fibrous concrete containing mixed fibres in fresh and hardened state", *Journal of Construction and Building Materials 22 - 956–965*.

[13] B. Krishna Rao, V. Ravindra(2010), "Steel Fiber Reinforced Self compacting Concrete Incorporating Class F Fly Ash", *International Journal of Engineering Science and Technology Volume 2(9), 4936-4943.*

[14] Ghandour, E.I.M., J.B. Kahil and S.A. Atta, (1985) 'Distribution of carbonates, bicarbonates and pH values in ground water of Nile Delta Region of Egypt', Ground Water, 23: pp. 35–41.

[15] Gholami S, Srikantaswamy S (2009) 'Analysis of agricultural impact on the Cauvery river water around KRS dam', World App.l Sci J 6(8): pp. 1157–1169.

[16] Joshi DM, Kumar A, Agrawal N (2009) 'Assessment of the irrigation water quality of River Ganga in Haridwar District', J Rasayan Chem 2: pp. 285–292.

[17] Ilker Bekir Topcu, M. Canbaz (2007), "Effect of different fibers on the mechanical properties of concrete containing fly ash" *Journal of Construction and Building Materials 21,1486–1491*.