iJRASET
International Journal For Research in
Applied Science and Engineering Technology

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 5 **Issue:** V **Month of publication:** May 2017

DOI:

Volume 5 Issue V, May 2017
ISSN: 2321-9653
International Journal for Research in Applied Science & Engineering Technology (IJRASET)

Enhancement the Strength of Conventional Concrete by using Fly Ash and Synthetic Fiber

Reetesh Khare[1], Mr. V. S. Parihar[2]
[1]Scholar M. Tech (Construction Technology and Management), [2]Asst. Professor, Department of Civil Engineering
Acropolis Institute of Technology & Research, Bhopal (M.P.)

Abstract: In this thesis the study on the enhancement the strength of conventional concrete by using fly ash and synthetic fiber and the results of an experimental study for enhancing compressive strength, split tensile strength and flexural strength of concrete using nylon fibers with the nominal mix, admixture (0.9%)), admixture (0.8%) and fly ash (10%)), (admixture and fly ash and fiber, used in cubes. Were casted with different volume fractions. The samples with added nylon fibers of 1% showed better results in compressive strength and split tensile strength, 1.5% for flexural strength. The cement replacement levels by fly ash are 10%, 15% and 20% for three water-cementitious materials (w/cm) ratio of 0.6, 0.45 and 0.35. Compressive strengths, compacting factors are evaluated at different age levels like at 3 hours, 7 and 28 days for the150 mm cube. The main objective of this thesis is mix the proportion of m10 grade concrete and enhancing its strength as per m30 grade concrete the fiber reinforced concrete is the relatively an effective construction of material in which the main use of the fibers is to bridge across the cracks that develop in concrete and the main aim was to carry out a comparative study on crack width on reinforced cement concrete (rcc) beams with and without the addition of fibers. By providing optimum dosage of volume fraction of asbestos fibers, studies on cracking behavior of asbestos fiber reinforced concrete (afrc) beams were made in concrete under flexure
Key words: - fly ash, synthetic fiber, conventional concrete, admixture, cement content, fibers.

I. INTRODUCTION

Concrete is easily and readily prepared and fabricated in all sorts of shapes and structural systems its great simplicity lies in the fact that its constituents are ubiquitous and are the readily available almost anywhere in the world as a result of its ubiquity of functionality and the flexibility it has become by far the most popular and widely used construction material in the world the material concrete is often confused with the material cement is one of the many constituents of concrete part of the glue that holds the other materials or pigments concrete is made up of the three basic components: water and aggregate (sand, stone) and cement powder is the binding agent for the water and aggregate mixture that hardens into concrete other components can be added to concrete color for appearance and accelerators to reduce curing time (This allows for pouring in cold weather, or early removal of forms.) retarders to slow the set time of (This is a allows concrete to set of properly in hot weather or a delay for a special finish.) air entrainment to help prevent concrete from cracking in the harsh conditions (Small air pockets to capture water and allow it to expand when it freezes without cracking concrete.) This is a will increase the concretes structural integrity. The high-strength of the concrete resists loads that cannot be resisted by normal-strength concrete and the not only does high strength concrete allow for more applications it also increases clearly defined disadvantages can materialize and most of the disadvantages are due to a lack of adequate research under field conditions, although many of the issues are currently being alleviated though the use of improved admixtures and the first, increased quality control is needed in order to maintain the special properties desired and high-strength concrete must meet high-performance standards consistently in order for it to be effective. Second, careful materials selection is necessary. High quality materials must be used. These materials may cost more than materials of lower quality and the tyhird, allowable stress design discourages the use of high-strength concrete and the one solution is to use load factor and resistance design when using high-strength concrete and the fourth, minimum cover over reinforcement or minimum thickness of members may restrict the realization of maximum benefits and fifth available service ability conditions such as deflection can control design, increased capacity may not be fully utilized (Peterman) conventional concrete is prepared from a mixture of coarse and fine aggregates Portland cement (PC) and water and other additives such as fly ash and different types of admixtures such as air-entraining agents, accelerators, retarders, and plasticizers also may be used to improve the concrete's capabilities for the workability and/or strength and before concrete is produced, the components that make up concrete are tested for their qualitative performances and the aggregates for concrete are usually tested for the gradation hardness specific gravity, absorption, and organic material impurities and PC usually is tested for consistency, initial and final set, soundness, and strength (with mortar). Water is tested at the source of supply for its purity and portability and the admixtures usually are considered acceptable on certification from the supplier after mixing the components of fresh concrete is the produced and transported to the field to be poured into its final place for hardening.

II. LITERATURE REVIEW

Rana A. Mtasher, Dr. Abdulnasser M. Abbas & Najaat H. Nema, In the Strength Prediction of Polypropylene Fiber Reinforced Concrete" test results showed that the increase of mechanical properties (compressive and flexural strength) resulting from added of polypropylene fiber was relatively high. D. L. Venkatesh Babu, In this Flexural Behavior of Hybrid (Polypropylene) Fibre Reinforced Concrete Beams" test results showed that use of Hybrid(polypropylene) Fibre reinforced concrete improves flexural performance of the beams during loading The concrete with E- glass fibre showed an increase in compressive strength of about 11.45% at Vf = 2.0% and increase in split tensile strength of about 26.19% at Vf = 1.5%. The toughness indices of E - glass fibre concrete may be due to brittle character of the glass fibre [P.Baruah and S. Talukdar, 2007] the glass fibre can restrain the expansion of specimens effectively. The expansion of composite decreases with increasing glass fibre volume fraction at each curing age for each set of concrete specimens [Bing Chena, Juanyu Liub,2003] and the addition of the polypropylene fibres to plain concrete increases the compressive strength in the range of 4% to 17% and the reduction in maximum crack width is to an extent of 21% to 74% [K.Anbuvelan et al. 2007]and the cement matrix improves the flexural and tensile behavior of cement matrix by the addition of glass fibres. The performance of these composites with aging depends on the matrix mix in ingredients. The durability of Glass fibre reinforced cement composite improves with the addition of metakaolin to the concrete mix [Shashidhara Marikunte et al 1997] by replacing 35 -50% of the cement with the fly ash there was 5-7% reduction in the water requirement of forobtaining the designated slump, and the rate and volume of the bleeding water was either higher or about the same cosplitred with the control mixture [Ravina and Mehta, 2000].

The addition of steel and polypropylene fibers provide better performance for the concrete and the addition of fly ash in the concrete mixture may adjust the workability and strength losses caused by fibres [Topcu and Canbaz, 2007]. In corporating of the fibres into plain mortar results decreases in compression strength, however the addition of pozzolanas helped this loss of strength. The addition of the SF in glass fibre mortar improved the performance over the plain mortar [R.M. de Gutie´rrez, 2005]. Steel fibers are added to the concrete matrix to provide increased flexural and tensile strenth, toughness, and dynamic strength (impact resistance) 8. Steel fiber reinforced concrete (S-RC) is generally more difficult to handle than conventional concrete and requires special considerations in planning and workmanship The workability of concrete is measured by means of slump, flow table spread, compacting factor, or modified flow table method. Lessard [5] explained that, these methods are not satisfactory for the concrete of flowing consistency. The slump test, although used extensively, reaches its practical limit at about220-250 mm. The ability of the superplasticizers to increase the slump of concrete depends on the type, dosage, and time of addition of the super plasticizer, w/c ratio, nature and amount of cement, aggregate, temperature, etc and the generally, the superplasticizers are used at higher dosages than are conventional water reducing admixtures Ramachndran [6] stated that, the chemical nature of the superplasticizer determines its effectiveness in increasing the slump. For example, to obtain a slump of about 260mm from an initial value of 50 mm, it may be necessary to add 0.6% SMF or MLS-based superplasticizer, whereas this could be accomplished with only 0.4% SNF. Lessard [5] obtained data on the relative amounts of SMF and SNF needed to attain the same slump value, for example, to obtain slump of 185-190 mm (w/c = 0.3), the dosage required for SMF and SNF were 1.9 liter and 1.3 liter ,respectively .Also for obtaining slump of 230-240 mm at w/c of 0.22,the corresponding dosages were 2.3 liter and 1.6 liter the same conclusions were state by Ramachndran [6] had show that, the calcium salt of polystyrene sulfonate at dosage of 0.1%,increase the slump from 8cm to 18 cm whereas 0.15% sodium salt of SNF would be needed to achieve the slump gain. Kantro and Popescu [7] concluded that, the amount of water reduction (15-35%) achievable with a particular superplasticizer depends on the dosage and the initial slump.

III. MATERIALS AND METHODS

A. Materials

1) Fine Aggregate (River Sand):

a) The river sand having density of 1460 kg/m^3

b) Fineness Modulus (FM) of 2.51 was used.

c) The specific gravity was found to be 2.6.

Volume 5 Issue V, May 2017
ISSN: 2321-9653
International Journal for Research in Applied Science & Engineering Technology (IJRASET)

2) *Coarse Aggregate:*
a) Natural granite aggregate having density of 2700kg/m^3
b) Fineness modules (FM) of 6.80 wa
c) The specific gravity was found to be 2.60 and
d) Water absorption as 0.31%.
3) *Admixture:*
a) Commercially available Super-plasticiser has been used to enhance the workability of fresh concrete for selected proportions of ingredients.

B. Test Method

In this study, mix proportions yielding 10 MPa characteristic strengths, and 0.5% percentages of Polypropylene fibres by weight of cement were considered. For each proportion of concrete, fibre content was kept constant of 0.5%. For each of these mix proportions, three standard cubes of size 150mm x150mm x150mm were cast and tested as per IS: 450-2000 [10] to determine the compressive strength of concrete and the while the mixing operation is in progress, 80% of water is added first and mixed for about 5 min then the remaining water is added and mixed thoroughly. For each mix, a total of 3 cubes of 150x 150 x 150 mm and , After 24 hrs the specimens are demoulded, immersed in water all mixes are tested for workability in terms of slump , vee-bee, compacting factor (CF) and flow table test as per Indian Standard IS:456-2000. The main purpose of these tests is to the check the consistency and the uniformity of the concrete from batch to batch and Slump values are not so consistent indicating the fact, that this is not a good measure of workability for FRC. It is in general noticed that conventionally popular tests like slump and compacting factor tests are not as appropriate and accurate in determination of workability of fibre reinforced concrete as they are for plain concrete this is essentially because of interlocking of fibres there by affecting normal workability due to concrete ingredients and the still upon vibration the fibre reinforced concretes exhibited the needed workability for placement.

Fig 3.1 Use of concrete Cube

C. Compressive Strength Test

The compressive strength of mixes is determined by cubes of size 150mm x 150mm x 150mm as per IS 456-1000 [10] at the rate of 9 specimens for each mix. The cubes are casted with designed mix proportions to yield characteristic strengths of 10 MPa with fibre contents of 0.5% keeping the replacement of cement by fly ash at 10%. All the cube specimens are compacted on a table vibrator for 2 Minutes. After 24 hours the cubes are removed from moulds and immersed in fresh water for 28 days of curing before testing. The specimens are tested under a digital compression testing machine of 50.0 tons capacity.

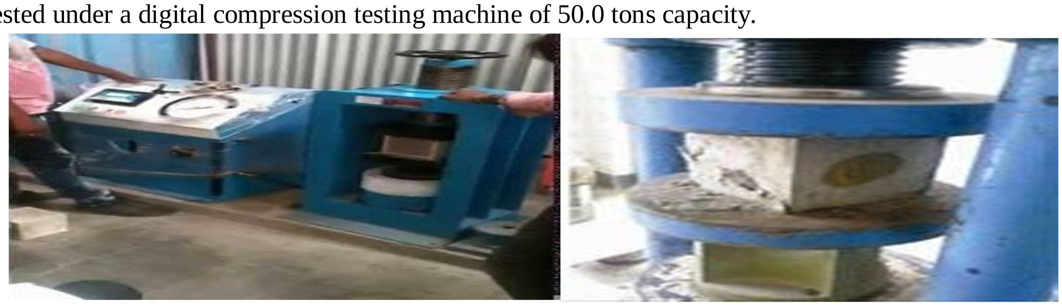


Fig 3.2 Compressive Strength Test of Cube

Volume 5 Issue V, May 2017
ISSN: 2321-9653
International Journal for Research in Applied Science & Engineering Technology (IJRASET)

D. Design of the M10

1) *Mix Calculations:*The mix calculations per unit volume of concrete shall be as follows

a) Volume of concrete = 1 m3

b) Volume of cement = [Quantity of cement/specific gravity] x [1/1000]

c) Volume of water = [Quantity of water/1] x [1/1000]

d) Volume of chemical admixture = [Quantity of admixture/specific gravity] x [1/1000] (SP 2%by mass of cement)

e) Volume of all in aggregates (e) =a – (b + c + d)

f) Quantity of coarse aggregates = e x Volume of Coarse Aggregate x specific gravity of Coarse Aggregate

g) Quantity of fine aggregates = e x Volume of Fine Aggregate x specific gravity of Fine Aggregate.

2) *Mix Design: M10 Grad*

a) *Target Mean Strength:*

Fm=fck+ks
=10+ (1.65*3.5)
=15.775

b) *W/c Ratio:* =0.6 % of entrapped air= 2% of volume

c) *Water Content:*

WC=186+ (0.02*186)
=190 kg

d) *Cement Content:* CC =320 kg

e) *Total Volume of Aggregate (V1):*

V1 =1-(190/1000)-(320/3150)-(2/100)
=0.6884

f) *Fine Aggregate Content:*

FA=p1 *v1*gs1*1000
=0.4*0.6884*2.6*1000
=715.96kg

g) *Coarse Aggregate Content:*

CA=0.6*0.6884*2.67*1000
=1102.26

3) *Mix Proportion by Weight (kg/cum):*

TABLE 1

WATER	CEMENT	FA	CA (60% of20mm)	CA (40% of10mm)
190	320	715.96	661.356	440.904

4) *Mix Proportion by Ratio:*

TABLE 2

WATER	CEMENT	FA	CA (60% of20mm)	CA (40% of10mm)
0.6	1	2.261	2.066	1.377

5) *Mix Design: M30 Grade:*

a) *Target Mean Strength:*

Fm=fck+ks
=30+ (1.65*5)
=38.25

b) *W/c Ratio:* =0.45 % of entrapped air= 1.5% of volume

Volume 5 Issue V, May 2017
ISSN: 2321-9653
International Journal for Research in Applied Science & Engineering Technology (IJRASET)

c) *Water Content:*
WC=186+ (0.015*186)
=188.8 kg

d) *Cement Content:* CC =420kg

e) *Total Volume of Aggregate (V1)*
V1 =1-(188.8/1000)-(420/3150)-(1.5/100)
=0.6628

f) *Fine Aggregate Content:*
FA=p1 *v1*gs1*1000
=0.4*0.6628*2.6*1000
=689.312 kg

g) *Coarse Aggregate Content:*
CA=0.6*0.6628*2.67*1000
=1061.8

6) *Mix Proportion by Weight (kg/cum):*

TABLE 3

Water	Cement	FA	CA (60% of20mm)	CA (40% of10mm)
188.8	420	689.312	637.08	424.72

7) *Mix Proportion by Ratio:*

TABLE 4

Water	Cement	FA	CA (60% of20mm)	CA (40% of10mm)
0.45	1	1.641	2.011	1.023

IV. RESULTS AND DISCUSSIONS

A. *Sample Results*

TABLE 5

Sample 1 (Nominal Mix)				
w/c	Days	Cube 1	Cube 2	Cube 3
0.6	3	5.68	9.85	9.99
0.6	7	9.85	11.5	13.5
0.6	28	15.4	17.3	19.8

TABLE 6

Sample 3 (Admixture (0.8%) + Fly Ash (10%))				
w/c	**Days**	**Cube 1**	**Cube 2**	**Cube 3**
0.35	3	26.1	26.6	27.7
0.35	7	28.1	29.9	30.78
0.35	28	31.2	31.8	32.1

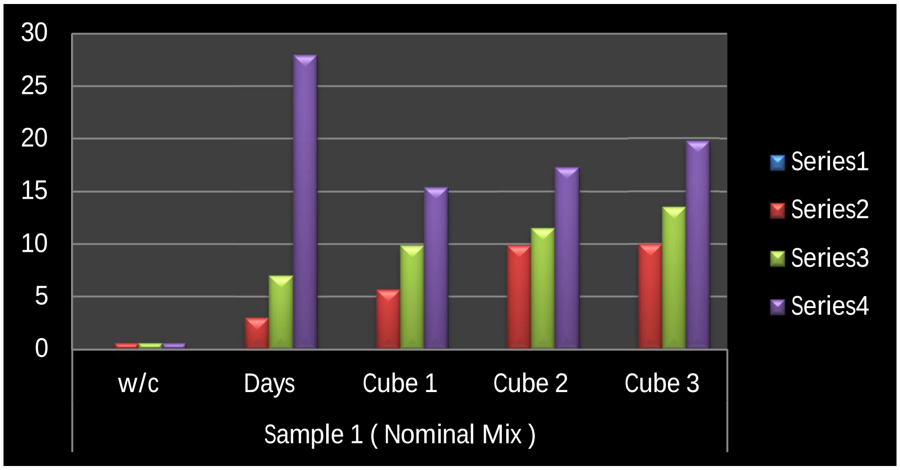
TABLE 7

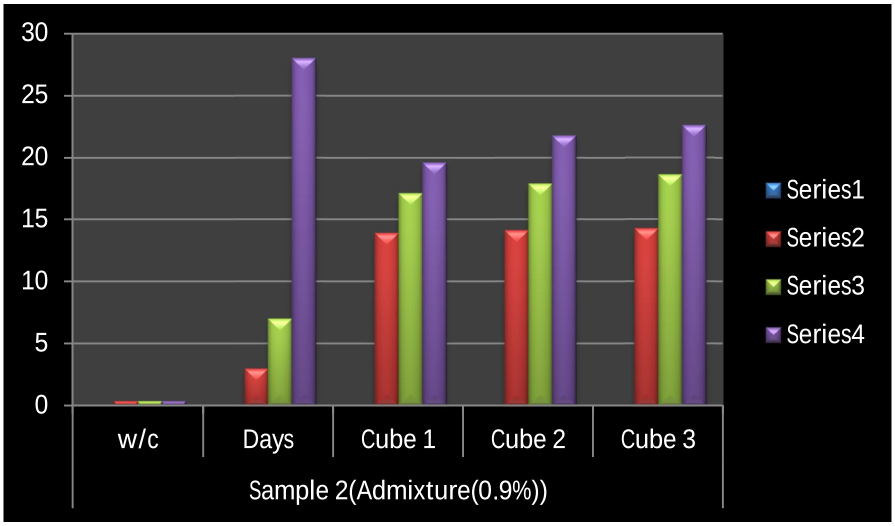
Volume 5 Issue V, May 2017
ISSN: 2321-9653
International Journal for Research in Applied Science & Engineering Technology (IJRASET)

Sample 4 (Admixture + Fly ash + Fiber)				
w/c	**Days**	**Cube 1**	**Cube 2**	**Cube 3**
0.35	3	26.3	28.2	30.6
0.35	7	29.8	31.6	33.9
0.35	28	32.1	34.7	35.3

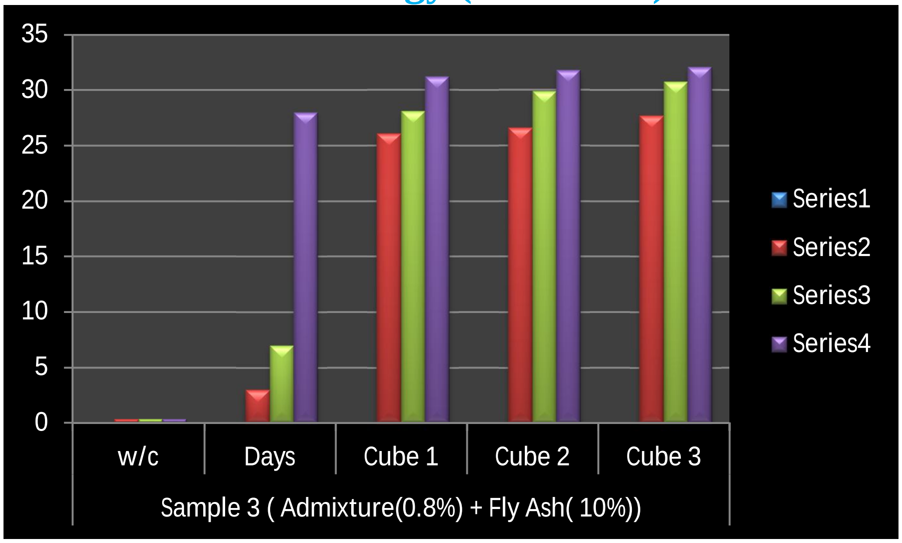
TABLE 8

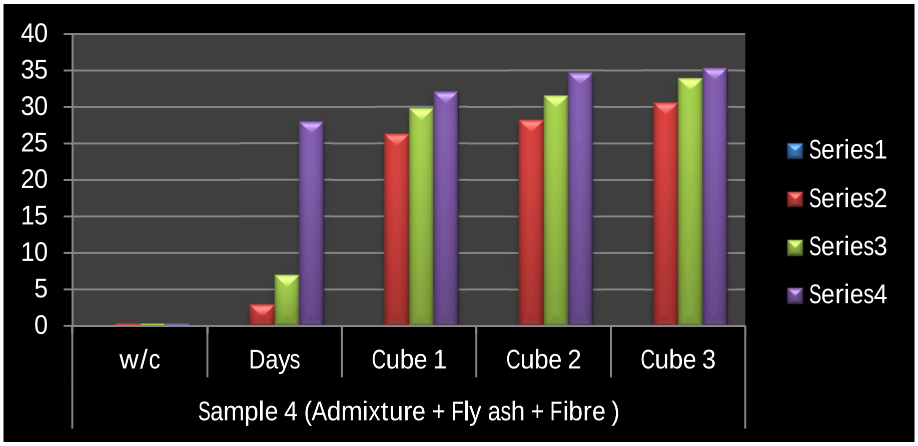
B. Graphical Result





Sample 2(Admixture (0.9%))				
w/c	**Days**	**Cube 1**	**Cube 2**	**Cube 3**
0.35	3	13.9	14.1	14.3
0.35	7	17.1	17.9	18.6
0.35	28	19.6	21.75	22.6



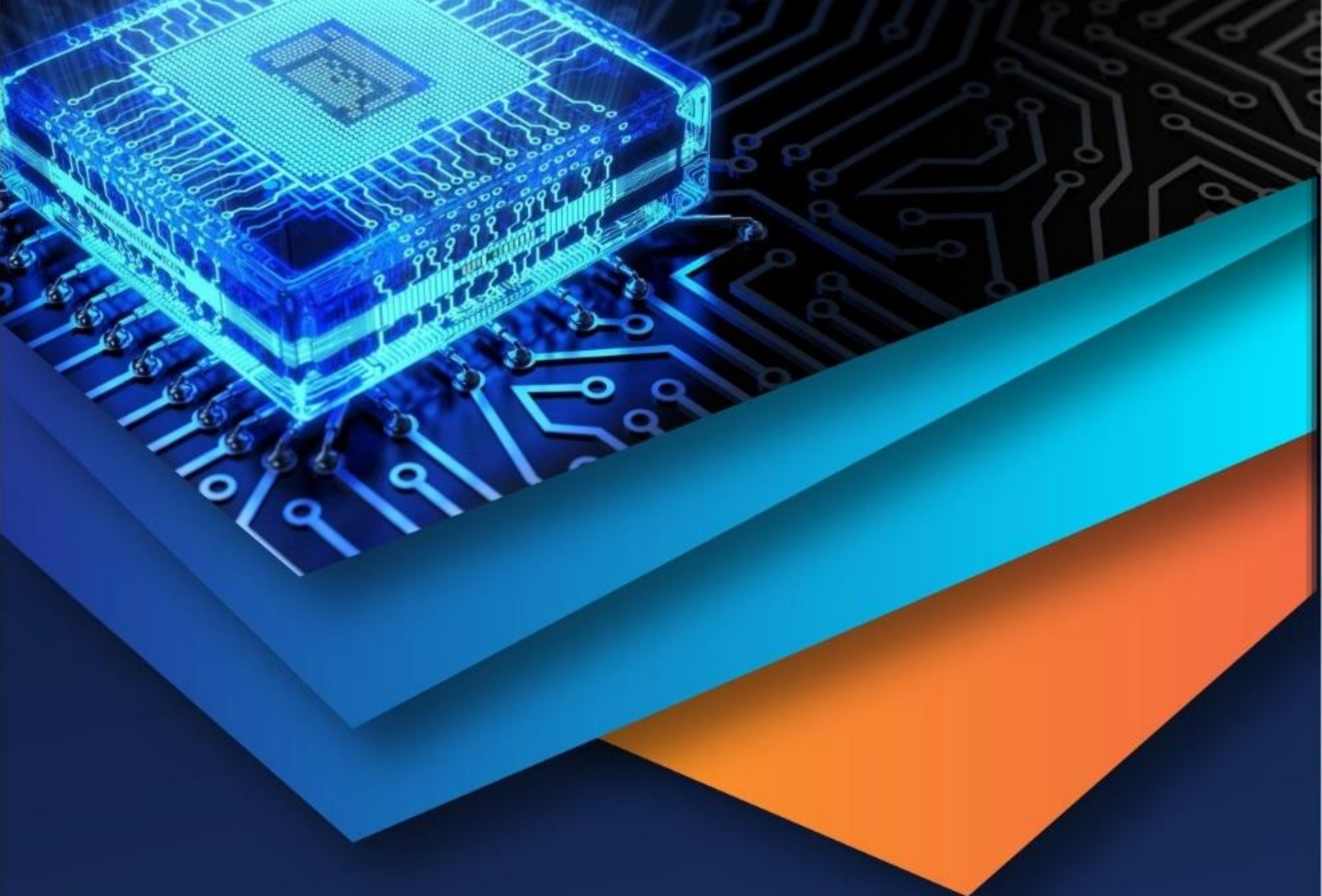


V. CONCLUSIONS

Adding additives to the concrete mix enhances the properties of the mix. Fly Ash plays an important role as a binding material and proves to be very economical by keeping the same mix proportion of M10 grade mix; the concrete's strength can be considerably increased to a certain extent with the help of admixtures and fibers. Keeping the same mix proportion of low grade concrete (M10) and increasing its strength equal to M30 grade proves to be very economical. Adding admixture to the concrete increases its workability.

REFERENCES

[1] IS 456:200, 'Indian Standard Code of Practice for Plain and Reinforced Concrete', Bureau of Indian Standards, New Delhi.
[2] IS: 10262-1982, 'Recommended Guide Lines for Concrete Mix Design', Bureau of Indian Standards, New Delhi.
[3] IS: 383-1970, 'Indian Standard Specification for Coarse and Fine Aggregates from Natural Sources for Concrete', Bureau of Indian Standards, New Delhi.
[4] IS: 516-1959, 'Methods of Test for Strength of Concrete', Bureau of Indian Standards, New Delhi.
[5] IS: 8112-1989, 'Specification for 43 Grade Ordinary Portland Cement (First Revision with Amendment No.3)', Bureau of Indian Standards, New Delhi.
[6] Ramujee, K.; (2013), 'Strength properti**es of polypropylene fiber reinforced concrete', International Journal of Innovative Research in Science, Engineering and Technology, Vol 2, pages 3409-3413.**
[7] Saxena, J., Saxena, A.; (2015), 'Enhancement the Strength of Conventional Concrete by using Nylon Fiber ', International journal of engineering and science, Vol 5(2), pages 56-59.
[8] Yakhlaf, M., Saifuddin, M., Soudki, K.A.; (2013), 'Properties of freshly mixed carbon fiber reinforced self consolidating concrete', Construction and building materials, Vol 46, page 224-231.
[9] Ramualdi, J.P. and Batson, G.B., The Mechanics of Crack Arrest in Concrete, Journal of the En- gineering Mechanics Division, ASCE, 89:147-168 (June, 1983)
[10] ACE Committee 544, State-of-the-Art Report on FibreReinforced Concrete, ACIConcreteInterna- tional, 4(5): 9-30 (May, 1982).



10.22214/IJRASET

45.98

IMPACT FACTOR: 7.129

IMPACT FACTOR: 7.429

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY