International Journal of Scientific Research in Engineering and Management (IJSREM)
Volume: 08 Issue: 05 | May - 2024 SJIF Rating: 8.448 ISSN: 2582-3930

Experimental Study of Recycled Aggregate, Fly Ash and Steel Fiber on Properties of Concrete

Prof. S.K. Gorde[1] Prof. G. P. Walhekar[2] Prof. R D. Vikhe[3]
1. Head, Department of Civil Engineering, P. Dr. V. Vikhe Patil Institute of Technology & Engineering (Polytechnic), Loni, Pravara.
2. Lecturer, Department of Civil Engineering, P. Dr. V. Vikhe Patil Institute of Technology & Engineering (Polytechnic), Loni, Pravara.
3. Lecturer, Department of Civil Engineering, P. Dr. V. Vikhe Patil Institute of Technology & Engineering (Polytechnic), Loni, Pravara.

Abstract: The use of recycled aggregates in concrete opens a whole new range of possibilities in the reuse of materials in the building industry. The utilization of recycled aggregates is a good solution to the problem of an excess of waste material, provided that the desired final product quality is reached.The use of recycled aggregate in concrete can be useful for environmental protection and economical terms recycled aggregates are the materials for the future.The work focuses on the possibilities of the recycled aggregate concrete as structural material with replacement level of 25%,50% and 75% byweight of concrete.

Fly ash is also used as a partial replacement of Portland cement with10, 20 & 30 % by weight of cement in order to improve the properties of RAC. The use of fly ash replacement in Recycled Aggregate concrete (RAC) could improve compressive strength to be higher than that of concrete without fly ash at the same W/B ratio.The fly ash is an organic, non combustible residue of coal after burning in power plant.

The steel fiber are available imperforated, corrugated or with wide end for better bending.The volume fraction of the hook end steel fiber used in this study varied from 0.25%,0.5%a and 0.75 %.

Key words- *Fly Ash, Recycled Aggregate, Recycled Concrete Aggregate, Steel Fiber, Water Cement Ratio.*

I. Introduction:

The protection of the environment is a basic factor, which is a directly connected with the survival of the human race. Parameters like environmental consciousness, protection of natural resources, sustainable development play an important role in Modern requirements for construction works. Globally, the concrete industry consumes large quantitie so natural resources,which are becoming insufficient to meet increasing demands.

RecycledAggregate (RA):-

The main objective of this study is to design a concrete made with different proportions of coarse recycled concrete aggregate (RCA) having a similar 28-day design strength to corresponding natural aggregate the recycled coarse aggregates obtained by crushing concrete debris from various sources, were used in three proportions of 25%, 50% and 75 % (by weight) to produce concrete with various water-cement ratio (w/c) and different compressive strength grades. The Use of recycled aggregate in concrete can be useful for environmental protection and economical terms.

Fly Ash (FA) -Fly ash is known to be a good pozzolanic material and has been used to increase the ultimate compressive strength and workability of fresh concrete. The Influence of fly ash as a cement replacement on the compressive strengths, tensile strengths, and static modulus of elasticity values of recycled aggregate concrete. It is an organic, non combustible residue of a coal after burning in power plant. In this work fly ash is replaced by 10%, 20% and 30 % of weight of cement and mix design is done as per I.S. 10262-2009.The concrete mix is tested experimentally for compression, spilt tension, flexure and workability.

Steel Fiber (SF):-These are available with corrugated or with wide end for better bending. It also has positive effect on tension stiffening behavior, formation of cracks, toughness and long term deformations. It is well known as after failure of concrete, between the cracks which carries tension and hence stiffens the

Response of a reinforced concrete member subjected to tension.

Advantage of RCA :-

i) There is an establishment of assumptions for substantial protection of natural resources of country, which are neither endless nor inexpensive.
ii) The Use of high amounts of raw materials (Aggregates for the production of cement and concrete) which result in the decrease of available natural resources which is continuously sub- graded.
iii) The big volume of old concrete are created from construction works (demolition wastes)
iv) The reuse of old concrete material and save the natural resources.

II. Experimental Programme:-

The quantity of ingredient materials and mix proportions as per design is as follows –

Table-1- Identification Marks of ingredient Materials–

Sr. No.	ID Mark	Percentage Variation of		
		RA%	FA%	SF%
1	RAC-A-1	25	10	0.25
2	RAC-A-2	25	20	0.5
3	RAC-A-3	25	30	0.75
4	RAC-B-1	50	10	0.25
5	RAC-B-2	50	20	0.5
6	RAC-B-3	50	30	0.75
7	RAC-C-1	75	10	0.25
8	RAC-C-2	75	20	0.5
9	RAC-C-3	75	30	0.75

Table 2: Proportion of Material used for M20 grade of concrete–

Type	Cement	Fine	Coarse	W/C
NC	1	1.77	3.97	0.47
RAC	1	1.77	4.07	0.47
NC-Normal Concrete. RAC-Recycled Aggregate Concrete.				

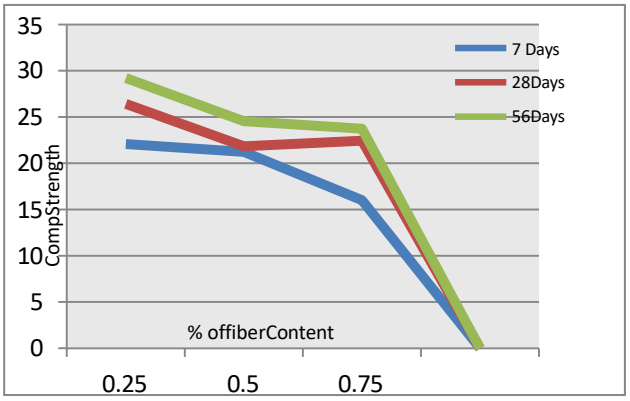
Graph on Compressive Strength:

Table-3-Averages Compressive Strength of **Plain Concrete –**

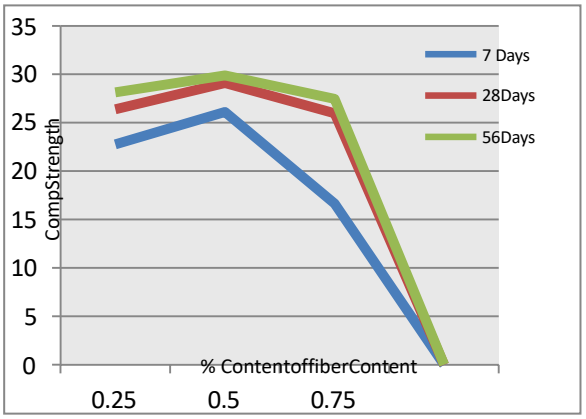
Sr No	Id mark	Average strength (Mpa)		
		7 days	28 days	56 days
1	Plain cement concrete	17.99	25.77	27.97

Table 6:-Compressive Strength are as follows-

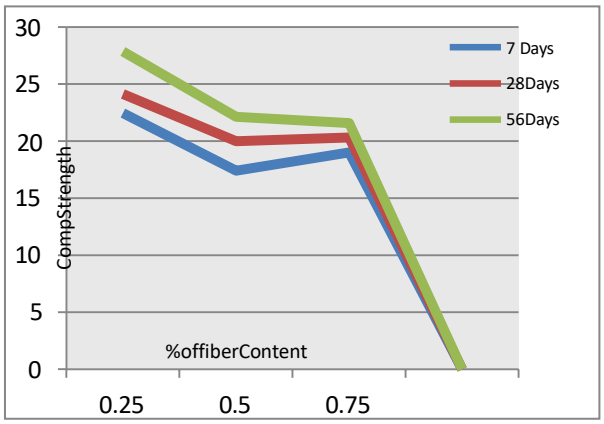
Sample ID	%of fiber / No of days	0.25%	0.5%	0.75%
RAC-A	7	22.07	21.23	16.00
	28	26.41	21.84	22.44
	56	29.22	24.55	23.76
RAC-B	7	22.77	26.11	16.66
	28	26.39	29.11	25.99
	56	28.13	29.88	27.45
RAC-C	7	22.46	17.41	19.02
	28	24.13	20.00	20.33
	56	27.87	22.14	21.59



Graph-2- Average Compressive strength of RAC-A Vs Steel Fiber.



Graph-3 Average Compressive Strength of RAC-B Vs Steel Fiber.



Graph 4-Average Compressive Strength of RAC-C Vs Steel Fiber.

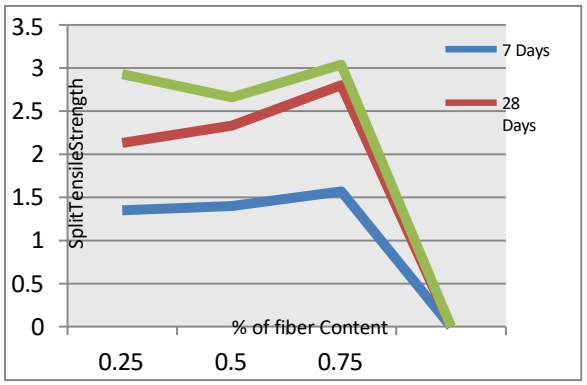
Graph on Split Tensile Strength:-

Table7: Average Split Tensile Strength Of **Plain Concrete-**

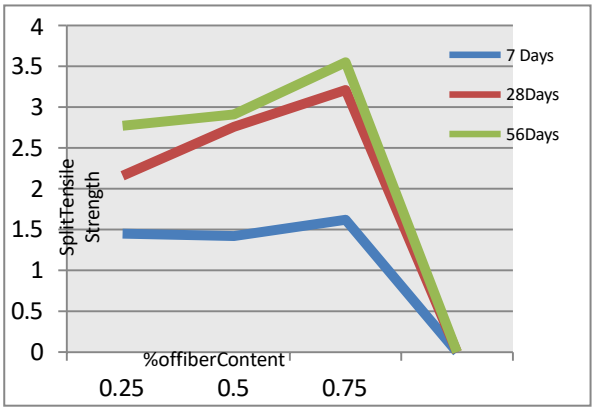
Sr no	Id mark	Split Tensile strength(Mpa)		
		7 days	28days	56days
1	Plain	1.33	2.71	2.99

Table8: Split Tensile Strength are as follows-

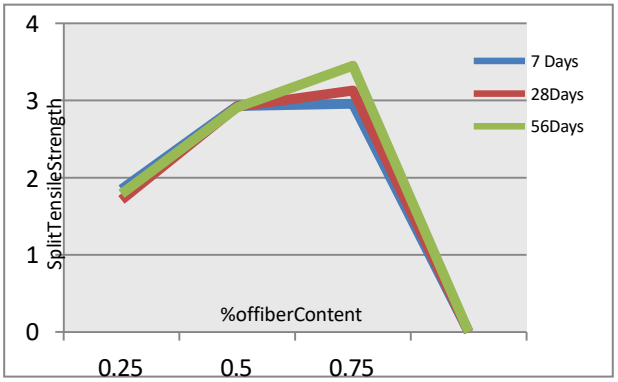
Sample ID	%of fiber / No of days	0.25 %	0.5 %	0.75%
RAC-A	7	1.35	1.40	1.57
	28	2.13	2.33	2.8
	56	2.93	2.66	3.04
RAC-B	7	1.45	1.42	1.62
	28	2.16	2.76	3.21
	56	2.77	2.91	3.55
RAC-C	7	1.85	1.71	1.79
	28	2.93	2.92	2.91
	56	2.96	3.13	3.45



Graph- 5 -Split Tensile Strength of RAC-A Vs Steel Fiber



Graph-6-Split Tensile Strength of RAC-B Vs Steel Fiber



Graph-7-Split Tensile Strength of RAC-CVs Steel Fiber

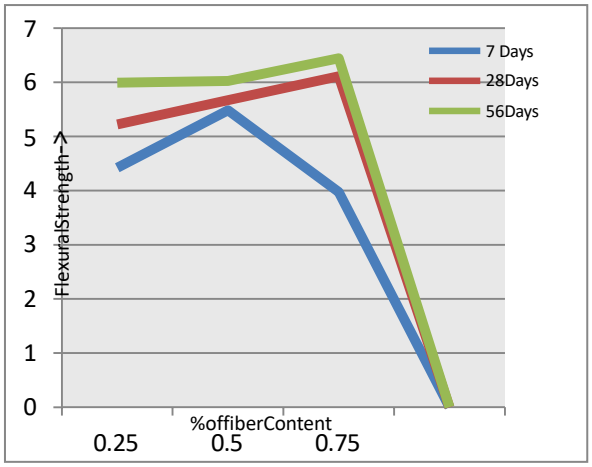
GRAPH ON FLEXURAL STRENGTH TEST:-

Table 9: Average Flexural Strength of Plain Concrete-

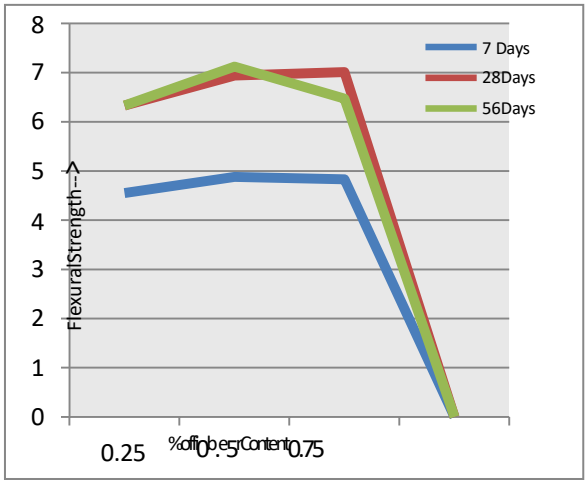
Sr no	Id mark	Flexural strength (Mpa)		
		7 days	28days	56days
1	Plain	4.31	4.82	5.11

Table10: Flexural Strength are as follows-

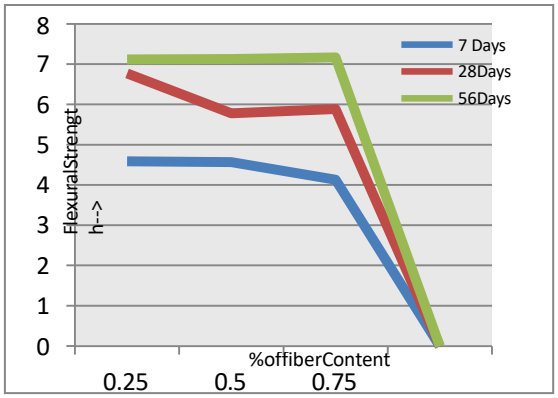
SampleID	%of fiber / No of days	0.25 %	0.5 %	0.75 %
RAC-A	7	4.42	5.48	3.97
	28	5.22	5.67	6.11
	56	5.99	6.02	6.44
RAC-B	7	4.55	4.88	4.83
	28	6.33	6.94	7.01
	56	6.33	7.12	6.47
RAC-C	7	4.59	4.57	4.13
	28	6.77	5.78	5.89
	56	7.12	7.13	7.17



Graph-8-Flexural Strength of RAC-AVs Steel Fiber



Graph -9- Flexural Strength of RAC-B Vs Steel Fiber.



Graph-10- Flexural Strength of RAC-C Vs Steel Fiber.

CONCLUSION-

1. Compressive strength increases by 24.28 % , 26.79% and 23.92% at 7 , 28 and 56 days respectively when 50 % RA , 20 % FA and 0.5%SF are used. Split Tensile Strength increases by 42.66%, 3.87 % and 21.77 % at 7 ,28 and 56 days respectively when 75% RA , 30 FA and 0.75 % SF are used.

2. Flexural strength increases by22.73%, 35.27 % and 37.77 % at 7 , 28 and 56 days respectively when 50 % RA , 5 % FA and 0.5 % SF are used.

3. RAC-C-1 mix which contains 75 % RA , 10 % FA and 0.25 % SF gives least porosity of 6.84 % from which it can be concluded that this is the good mix from durability point of view.

REFERENCES

[1] Amnon Katz, “Treatments for the Improvementof RecycledAggregate”, Journal of materials in civil engineering (ASCE), Vol.16, 2004, pp. 597-603.

[2] C.J .Zega,Y.A.Villagra´n-Zaccardi,A. A. Di Maio, “Effect of natural coarse aggregate type on the physical and mechanical properties of recycled coarse aggregates”, Materials and Structures, RILEM,Vol.43, 2010, pp. 195–202.

[3] J.-Zh. Xiao,J.-B. Li,Ch. Zhang, “On relationships between the mechanical properties of recycled aggregate concrete: An overview”, MaterialsandStructures,RILEM,Vol.39, 2006, pp. 655–664.

Author

1. Prof. S.K. Gorde

The Author has pursued his degree in civil Engineering. The total experienced is 14 years in teaching as well as 01 year on construction site. He has also Guide the other Project. He is doing practice on Building Construction site.

2. Prof. G. P. Walhekar

The Author has pursued his degree in civil Engineering. The total experienced is 06 years in teaching as well as 02 year on construction site. He has also Guide the other Project. He is doing practice on Building Construction site. Also working as Chartered engineer.

3. Prof. R D. Vikhe

The Author has pursued his degree in civil Engineering. The total experienced is 05 years in teaching as well as 01 year on construction site. He has also Guide the other Project. He is doing practice on Building Construction site.