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AN EXPERMENTAL STUDY OF RECYCLED CONCRETE WITH POLYPORPYLENE FIBER

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Abstract— Civil Engineering constructions have to use of recycled materials for permanent sustainable development of country. For that reason in this paper represents the contribution of devoted strength of concrete made of recycled aggregates with polypropylene fiber. Concrete mixes with 25%, 30% and 35% of recycled aggregates with additions of polypropylene fiber 20 µ and 5 cm length of various percentages as 0%, 0.5% and 1% by the volume of cement on M20 grade of cement. As per Indian standards have tested compressive strengths and tensile strength at 1, 7 and 28 days. The results are clearly indicated that 1% fiber with 25% recycled materials is producing high strength of concrete and in addition of fiber to improve the elasticity and reduce shrinkage cracks.

Key Words- Recycled aggregates, polypropylene fiber and Ordinary concrete

I INTRODUCTION

Recycled aggregates have created demand in civil engineering constructions, through which the consumption of primary aggregates by the industry can be reduced. In order to the use of recycled-reused aggregates presents interesting possibilities for economizing on waste disposal sites and conserving natural resources. Demolition of constructed material inert behavior not dangerous these waste materials annually estimated in India 23.75 million tons as per the Hindu online of March (2007). Recycled aggregates Properties and without significant physical, chemical or biological change. Because of the difference in properties of recycled material and possible uncertainties in organic in for the recycled material rubble it might be difficult to provide and guarantee considered properties in concrete. This is probably reason that recycled aggregate is used mainly for non-structural application at present such as road base or a backfill. The ideas to add fibers to a concrete mixture with recycled aggregate may change material properties of such concrete improve behavior; bring about new types of applications and enables saving sources of natural aggregate.

The performance of a wider range of recycled aggregate and concrete both in Laboratory and on large-scale production. It can be further enhanced by the replacement of primary aggregate with recycled materials and the use of low cement combinations. The cost benefit assessment showed that using recycled materials in concrete instead of primary aggregate could lead to significant cost savings represented by Liang, Hong1; Zhu, Huiying2; Byars, Ewan A (2007). The use of recycled aggregate generally increases the drying shrinkage, creep and porosity to water and decreases the compressive strength of concrete compared to those of natural aggregate concrete (Sri and Tam, 1985; Hansen, 1996; Wirquin *et al.*, 2000; Poon *et al.*, 2002; Domingo *et al.*, 2010). High performance cements and concrete can reduce the amount of cementitious materials and total volume of concrete required. Concrete must keep evolving to satisfy the increasing demands of all its users represented by Naik, T.R. & Kraus, R.N.(2003). This presents a great opportunity for the concrete industry to improve its resource productivity by using coarse aggregate derived from construction and demolition waters. Fine recycled aggregate was not considered for RAC production because its application in structural concrete is generally not recommended. The fibrous specimens failed by splitting not by debonding. There is an improvement in 'E' value with fibers addition in both normal and recycled aggregate concrete by experimental and analytical work done M.L.V. Prasad and P. Rathish Kumar (2007). In many parts of the world, dredged sands and mining wastes can be processed for use us fine aggregate. Recycling these wastes in spite of some processing cost is becoming economical, particularly in countries where land is scarce and waste disposal cost are very high and also using recycled aggregate can be mitigated by increasing the cement content into the concrete mixture since it is well-known that the amount of cement has an effect on concrete's compressive strength and porosity to water. Limbachiya, m. C., marrochino, e., & koulouris, a.(2007). Mechanical tests showed significant reduction in compressive strength which could be due to polypropylene fiber melting. Also pozzolans improve the mechanical properties of samples conducted by O. Alidoust, I. Sadrinejad, and M. A. Ahmadi (2007).

In addition, virgin aggregate deposits have already been depleted in many areas, and hauling aggregate over long distances can be much more expensive than using free or low-cost sources of local recycled aggregate. S R Yadav*, S R Pathak,(2009) has concluded that a 25- 30% recycled may not have significant effect on concrete properties based on these Recycled concrete is being used as a road fill, which is better than land fill but is "low-cycling" in the sense that virgin aggregate continues to be used for making new concrete.

The use of recycled aggregate is possible only for that with acceptable grading in the range of 0/32 mm on account of a technology simplification. V Vytlačilová (2010). Increase in cement content (over 300 kg/m3) allows to reduce significantly the porosity to water and to enhance the compressive strength of recycled aggregates concrete represented by Athanas KONIN and David Mangoua KOUADIO (2011). N.Sivakumar et. al (2014) has conducted on experimental investigation was found that recycled coarse aggregates can be used for making high strength concretes by adjusting the w/c ratio and admixture contents of the mix.

II MATERIALS AND METHODS:

1.1The Ordinary Portland cement

The Ordinary Portland Cement of 20 grade conforming to IS: 4031(Part1) 1996 was used in this study. Fineness test, Standard consistency test, setting time of cement, compressive strength of cement and specific Gravity of 20 grade were 1.6%, 31.6%, initial setting at 27min, final setting at 582 min, 332 Kg/cm^2 and 3.06.

1.2 Fine aggregates

Fine aggregates were locally available river sand grading zone II of IS 383-1970, Specific gravity, bulking of sand and Moisture content were 2.64, 13.79% and 4.7%.

1.3 Coarse aggregates

Coarse aggregates were also available in local crushed granite stones grading zone IS 383 -1970, Specific gravity, Impact test, crushing test, Flakiness and Elongation index were2.54, 18.2%, 15.3%, 11% and 11%. Water has available in college premises for casting and curing of specimens. Recycled aggregates have specific gravity; Crushing value and impact value were 2.38, 23.2% and 20.32%.

1.5 Polypropylene fiber

Polypropylene fibers are found to be suitable to increase the impact strength. They possess very high tensile strength, but their low modulus of elasticity and higher elongation. (Namaan A.E et.al. 1993). Tensile strength- 200-700 (MPa), Tensile modulus = 0.5-0.8 (GPa), Tensile strain (%) (Max-min)= 15-10, Fiber diameter= 0.5-0.32 μ, Alkaline stability = excellent.

III Results and Discussion:

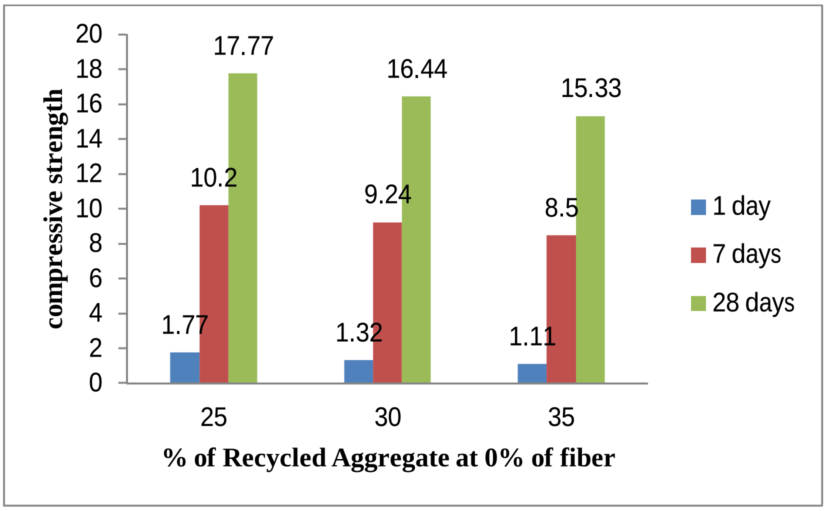
Table I

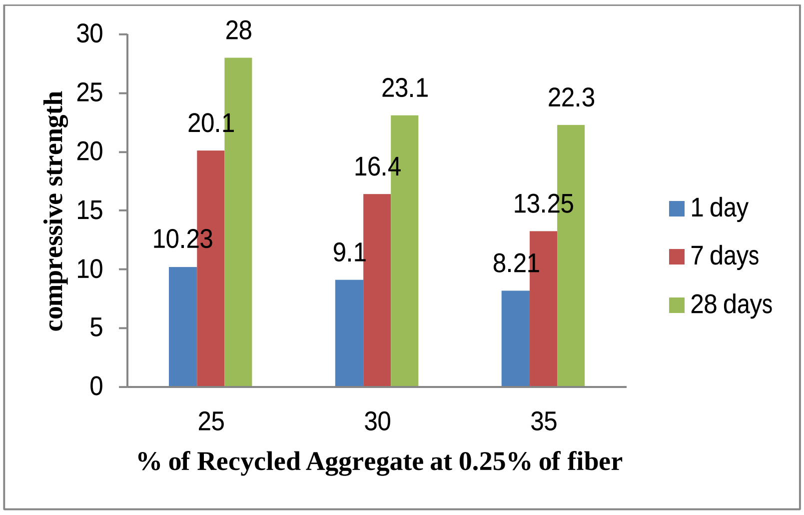
COMPRESSIVE STRENGTH AND TENSILE STRENGTH BEHAVIOR AT DIFFERENT % OF RECYCLED AGGREGATES AND DIFFERENT % OF FIBER

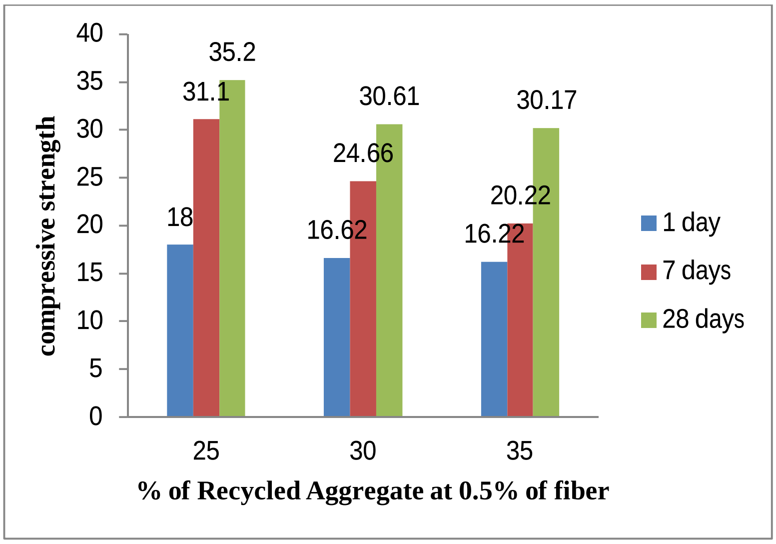
% of fiber	recycled aggregates	Compressive strength (N/mm^2)			Tensile strength (N/mm^2)		
		1 day	7 days	28 days	1 day	7 days	28 days
	25%	1.77	10.2	17.77	1.47	1.9	2.02
0% fiber	30%	1.32	9.24	16.44	1.2	1.61	2.1
	35%	1.11	8.5	15.33	1.1	1.3	1.4
	25%	10.23	20.1	28	1.55	1.96	2.2
0.25 % of fiber	30%	9.1	16.4	23.1	1.3	1.82	2.16
	35%	8.21	13.25	22.3	1.23	1.53	1.58
	25%	18	31.1	35.2	1.68	2.01	2.3
0.5% fiber	30%	16.62	24.66	30.61	1.36	1.9	2.22
	35%	16.22	20.22	30.17	1.26	1.62	1.65

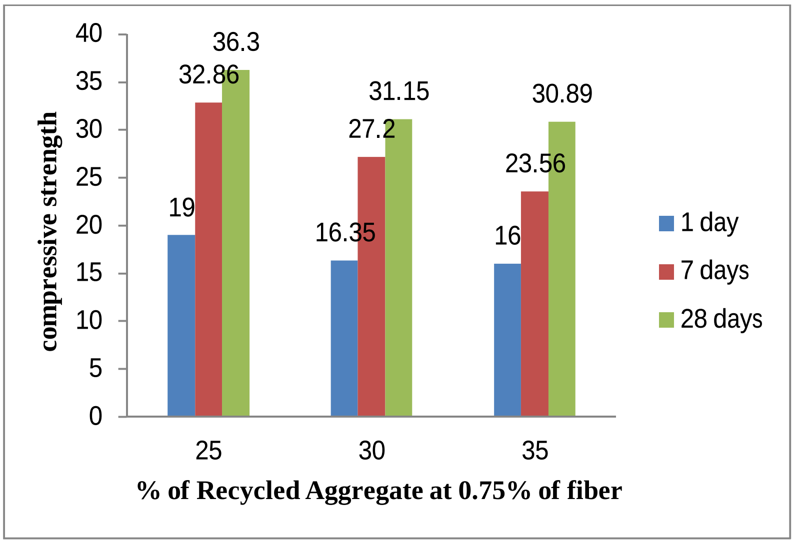
	25%	19	32.86	36.3	1.83	2.16	2.34
0.75% fiber	30%	16.35	27.2	31.15	1.5	2.02	2.26
	35%	16	23.56	30.89	1.33	1.65	1.73
	25%	19.95	31.9	37	1.92	2.2	2.4
1% fiber	30%	17.12	25.21	31.39	1.78	2.12	2.3
	35%	16.8	21.1	31.04	1.59	1.73	1.83
1.25	25%	19.1	26.3	34.3	1.5	1.86	2.32
	30%	16.82	22.65	27.25	1.63	1.7	2.2
	35%	16.1	20.03	26.15	1.55	1.66	1.75

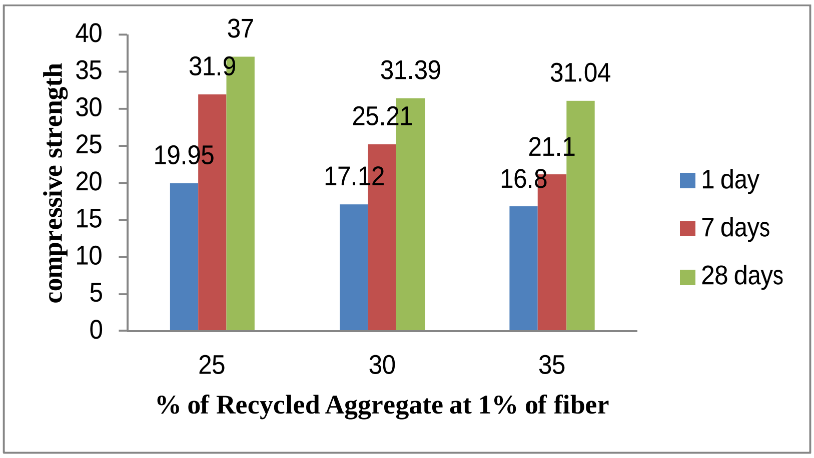
Compressive strength results at 1,7,28 days and different % of recycled aggregates at % of fiber






40
35
30
25
20
15
10
5
0
compressive strength
35.2
31.1
30.61
30.17
24.66
20.22
18
16.62
16.22
1 day
7 days
28 days
25
30
35
% of Recycled Aggregate at 0.5% of fiber


40
35
30
25
20
15
10
5
0
compressive strength
36.3
32.86
31.15
30.89
27.2
23.56
19
16.35
16
1 day
7 days
28 days
25
30
35
% of Recycled Aggregate at 0.75% of fiber


40
35
30
25
20
15
10
5
0
compressive strength
37
31.9
31.39
31.04
25.21
21.1
19.95
17.12
16.8
1 day
7 days
28 days
25
30
35
% of Recycled Aggregate at 1% of fiber

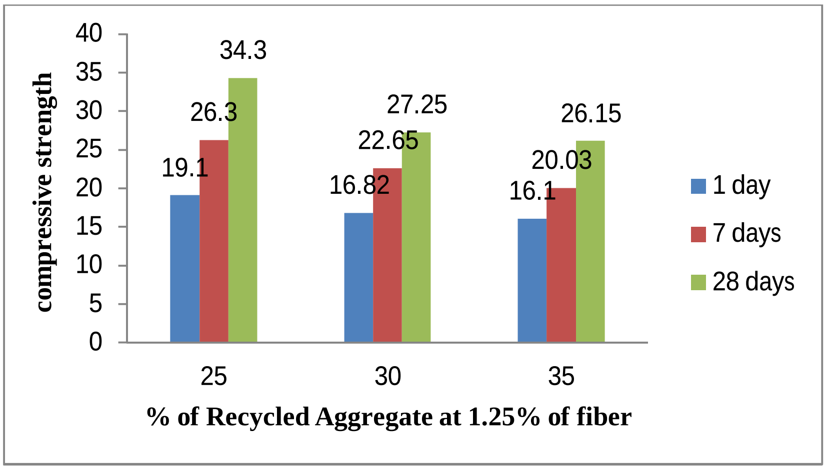
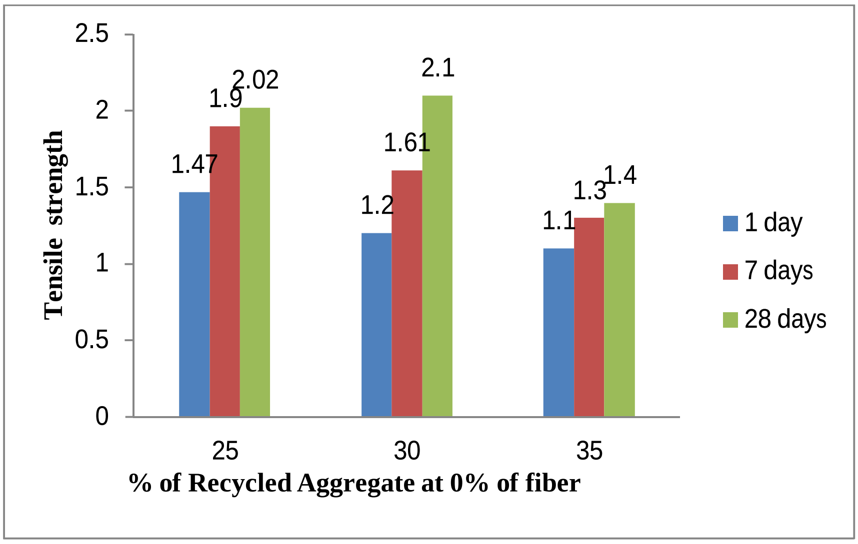
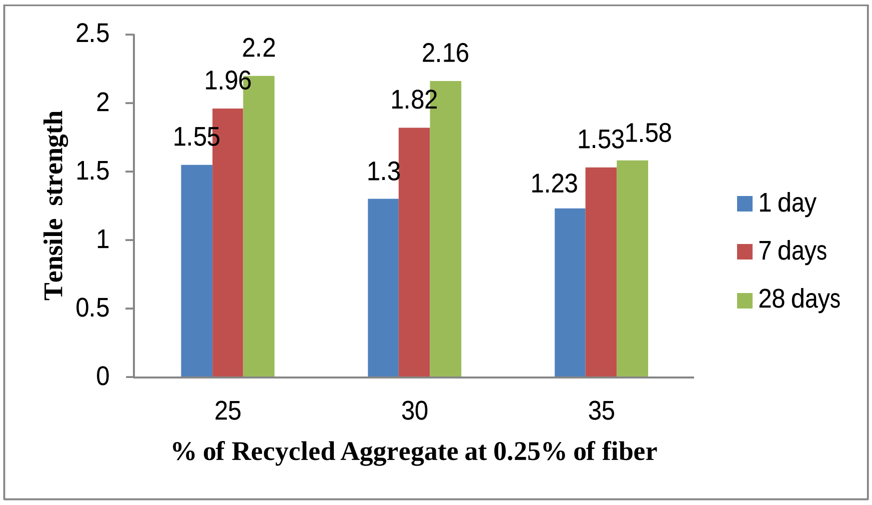
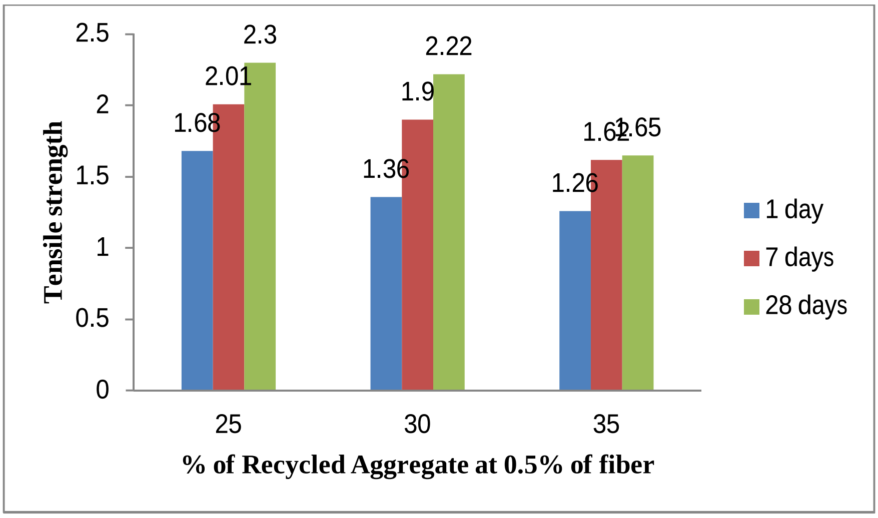


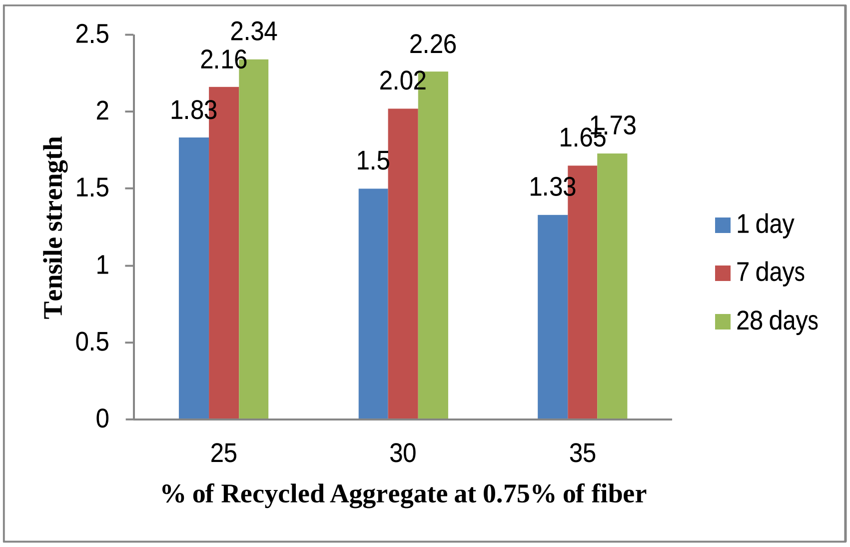
Fig 1: Compressive strength results of different % recycled material and % of fiber

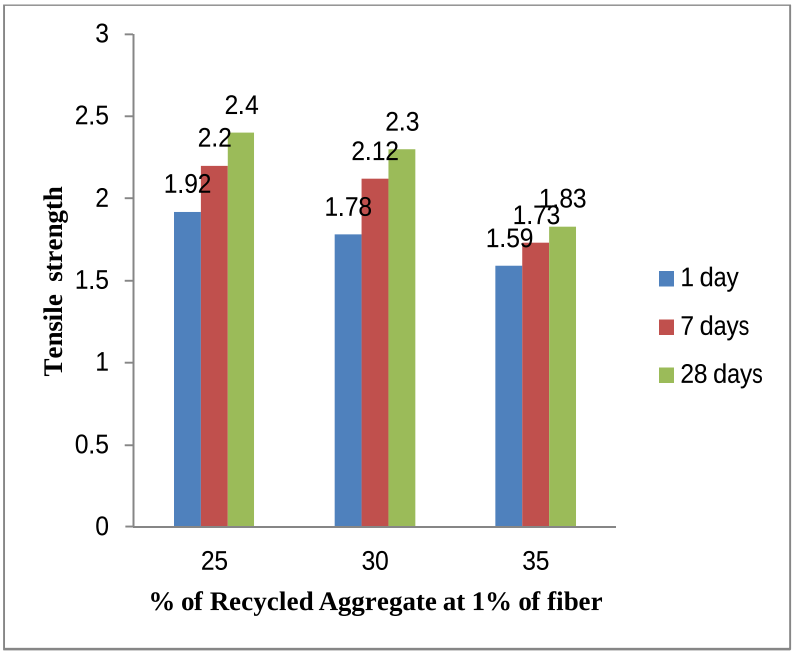
3.3 TENSILE STRENGTH RESULTS:






Tensile strength
2.5
2
1.5
1
0.5
0
2.3
2.01
1.68
2.22
1.9
1.36
1.62
1.65
1.26
25
30
35
% of Recycled Aggregate at 0.5% of fiber
1 day
7 days
28 days


Tensile strength
2.5
2
1.5
1
0.5
0
2.34
2.16
1.83
2.26
2.02
1.5
1.65
1.73
1.33
25
30
35
% of Recycled Aggregate at 0.75% of fiber
1 day
7 days
28 days


Tensile strength
3
2.5
2
1.5
1
0.5
0
2.4
2.2
1.92
2.3
2.12
1.78
1.83
1.73
1.59
25
30
35
% of Recycled Aggregate at 1% of fiber
1 day
7 days
28 days

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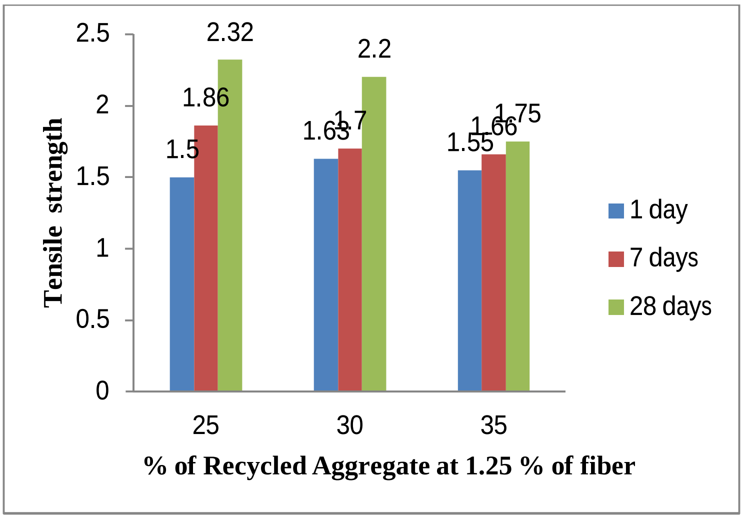

Fig 2: Tensile strength results of different % recycled material and % of fiber

The cube compressive Strength results at 1, 7 and 28 days for different levels of such as 0%, 0.25%,0.5%,0.75% ,1%and 1.25% of fiber with 25%, 30% and 35% of recycled materials are presented in table above table and compressive strength graphs are presented in fig1.0 and tensile strength graphs are presented in fig2.0. The development of optimum compressive and tensile strength results for different mixes was plotted in the form of fig 3, 4 and table 1 and 2.

Table- II

VARIATION OF OPTIMUM COMPRESSIVE STRENGTH RESULTS OF 25%, 30%, 35% OF RECYCLED CONCRETE WASTE MATERIAL WITH FIBER MATERIAL

% of recycled concrete	% of fiber					
	0%	0%	0.50%	0.75%	1%	1.25%
25%	17.77	28	35.2	36.3	37	34.3
30%	16.44	23.1	30.61	31.15	31.39	27.25
35%	15.33	22.3	30.17	30.89	31.04	26.15

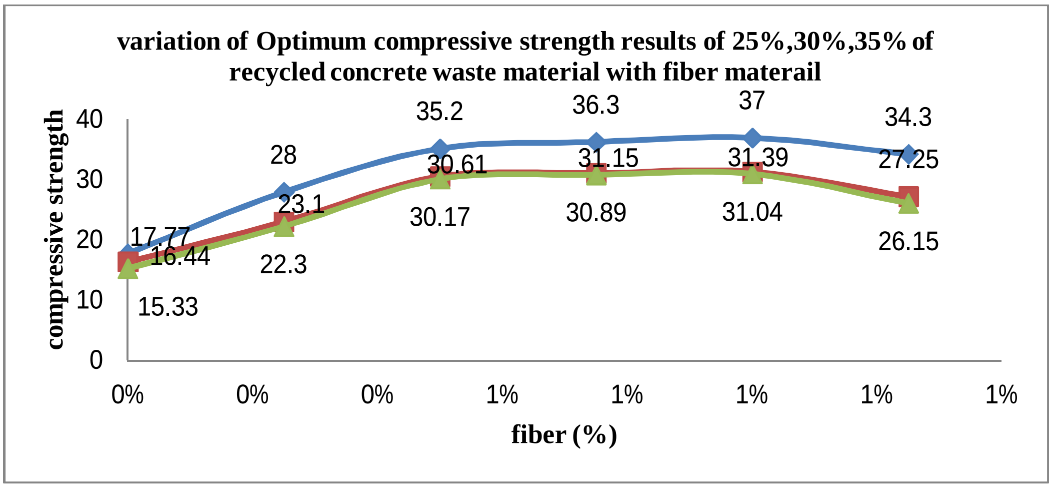

Fig 3: Variation of Optimum compressive strength results of 25%, 30%, and 35% of recycled concrete waste material with fibre material

The split tensile strength results at 1, 7 and 28 days for different levels of such as 0%,0.25%, 0.5% 0.75%,1% and 1.25% of fiber with 25%, 30% and 35% of recycled materials are presented in table the development of tensile strength with days for different mixes was plotted in the form of the graph as shown in figure.

TABLE III

VARIATIONS OF OPTIMUM TENSILE STRENGTH RESULTS OF 25%, 30%, and 35% OF RECYCLED CONCRETE WASTE MATERIAL WITH FIBER MATERIAL

% of recycled concrete	% of fiber					
	0%	0%	0.50%	0.75%	1%	1.25%
25%	2.02	2.13	2.3	2.33	2.4	2.32
30%	1.98	2.08	2.22	2.26	2.3	2.2
35%	1.4	1.48	1.6	1.73	1.83	1.75

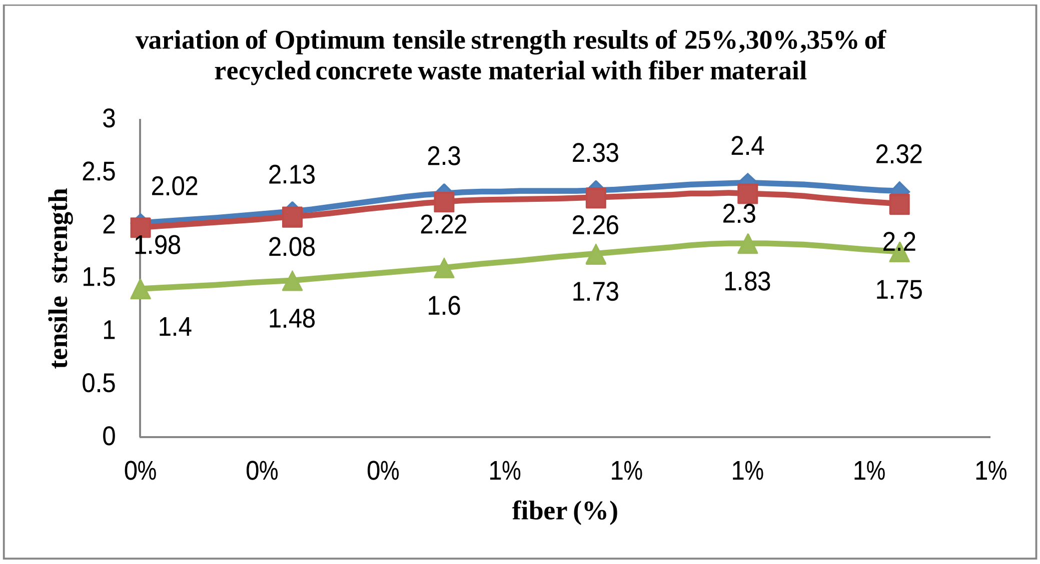

Fig 4: Variation of Optimum tensile strength results of 25%, 30%, and 35% of recycled concrete waste material with fibre material

Mix design depends on water absorption as well as aggregates. Since, these properties depend on motor content. The strength of concrete decrease with increase in the % of recycled aggregate, this may cause due to loose mortar around the recycled aggregate which don't allow paper bonding between cement paste and aggregate. Due to for this reason % of recycled concrete increases then compressive strength and as well as tensile strength decreases. In addition of fiber to recycled concrete the fiber material up to 1% it will be increases beyond that it will be decreases With reference to above tables and graphs % of optimum content 1% fiber at a level of 25% recycled material.

IV CONCLUSIONS

The results indicate that compressive strength, tensile strength are decreased marginally with the use of recycled coarse aggregates and hence to increase their strength fiber can be used as reinforcing material in concrete as result of formation of "FIBER (Polypropylene) REINFORCED RECYCLED CONCRETE"

1. Recycled aggregates, polypropylene fiber are application for fiber reinforced concrete and improve the properties of concrete.
2. 0.5% of fiber with 25% of recycled aggregates is suitable for small constructions and adoptable for non-structural constructions.
3. 1% of fiber with 25% of recycled aggregate suitable for heavy structures.
4. Remain percentage of fiber and recycled materials have not given good strength of compressive and tensile strength in our observation.
5. FRRC (FIBER (Polypropylene) REINFORCED RECYCLED CONCRETE) will reduce environmental damages caused by incorrect disposal, extend the useful life of landfills and preserve finite natural resources.
6. When compared FRRC with ordinary concrete. The results are FRRC have the good strength hence, add recycled aggregates and polypropylene fibers.
7. 0.5% of Polypropylene fiber with 25% of recycled concrete and ordinary concrete and 1% of Polypropylene fiber with 25% of recycled concrete and ordinary concrete for achieve good benefits of compressive and split tensile strength.

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