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EXPERIMENTAL STUDY ON FIBER REINFORCED CONCRETE WITH RECYCLED AGGREGATE REPLACED BY NATURAL AGGREGATE

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Abstract: *Concrete is one of the most important and widely used material in India in construction field. There are many developments going on in concrete by utilizing locally accessible material. The present focus in concrete technology is towards increasing the strength and durability of concrete to meet the demands of modern era of construction. The main aim of the study is the effect of synthetic fiber in concrete. FRC has high tensile strength and fire resistance property which reduces the loss of damage during fire accidents. In this thesis the strength property were studied by comparing size and proportions of fiber. The polypropylene fiber is used size is 10mm with the proportions of 0%, 0.1% and 0.15% of cement by weight. The study of making the concrete of low cost was also done by utilizing locally available aggregates from scrap buildings in replacement of natural aggregate. The replacement of natural aggregate is done in various proportions like 0%, 5% and 10%, according to previous research papers the proportions are taken. The comparison between all the above proportions were done and tested for its properties. The workability, compression strength and tensile strength were obtained at 7th day, 14th day and 28th day of curing. The result are compared for the best conclusion.*

I. INTODUCTION

The rising demand of infrastructure is stressing our available natural resources. In order to preserve the resources for our upcoming generations it is highly recommended that these resources to be used wisely. On the other hand the waste material generated by demolition of abandoned structures and construction water is creating serious threats to our environment.

The growth in various types of industries together with population growth has resulted in enormous increase in economy worldwide. This increase of the population and goods increases various types of loads.

Increase in the industrial activities has resulted in enormous increase in production of various types of waste material, not only India but all over world. The creation and disposal of non-decaying waste material such as brick, gravels etc. have been posing serious problem to the environment in developed as well as in developing countries. The buildings are used across the world for industrial as well as residential purpose. Crushing at these waste materials at the construction site with the help of portable crushers minimizes the costs of construction and also the pollution generated while transporting waste and new material to and from a quarry. So we use the waste materials from various construction and recycle them to make a new construction. The recycled aggregate are used as a partial replacement of coarse aggregate. Use of fiber increases the strength of concrete. There are several fibers available which are in use in present time.

OBJECTIVES

The main objects covered in this project work are mentions as follows:

- To study the strength property of fiber reinforced concrete.
- To reduce the cost of constructions by using waste aggregate from demoralized building.
- To make environment free from demolished concrete waste.
- To optimize the maximum use of waste aggregate.

II. LITERATURE REVIEW

Limbachiya and Leelawat (2000) found that recycled concrete aggregate had property of 7 to 9% lower relative density and 2 times higher water absorption than natural aggregate. According to their test results, it shown that there was no effect with the replacement of 30% coarse recycled concrete aggregate used on the ceiling strength of concrete. It also mentioned that recycled concrete aggregate could be used in high strength concrete mixes with the recycled concrete aggregate content in the concrete. Sagoe,

Brown and Taylor (2002) stated that the difference between the characteristic of fresh and hardened recycled aggregate concrete and natural aggregate concrete is relatively narrower than reported for laboratory crush recycled aggregate concrete mixes. There was no difference at the 5% significance level in concrete compressive and tensile strength of recycled concrete and control normal concrete made from natural aggregate In the same year They concluded that the properties and the strength characteristic of recycled aggregate concrete were deficiency when compared to the specimens that made by the natural aggregate.

A. M. Shende and A. M. Pande.: Critical investigation for M-40 grade of concrete having mix proportion 1:1.43:3.04 with water cement ratio 0.35 to study the compressive strength, flexural strength, Split tensile strength of steel fiber reinforced concrete (SFRC) containing fibers of 0%, 1%, 2% and 3% volume fraction of hook tain. Steel fibers of 50, 60 and 67 aspect ratio were used. A result data obtained has been analyzed and compared with a control specimen (0% fiber). A relationship between aspect ratio vs. Compressive strength, aspect ratio vs. flexural strength, aspect ratio vs. Split tensile strength represented graphically.

The aggregate is the main ingredient which strengthen the concrete. Many researchers have found that the demoralized building the aggregate can be reused by cleaning the used aggregate. The strength of concrete will be reduced due to use of used aggregate but it can be improved by using polypropylene fiber concrete. Thus in this thesis the strength is improved by using fibers of size 10mm with proportion of 0%, 0.1% and 0.15% of cement by weight. To reduce the cost of construction aggregates are replaced by waste aggregate with proportion of 0%, 5% and 10%. Test for compressive and tensile strength were done at 7th day, 14th day and 28th day.

III. MERATIAL AND METHODOLOGY

Portland cement:

On mixing the water, cement hardens and hence all the ingredients are bounded together. Portland cement is the most common cement used and is composed of alumina, silica, lime, iron, and gypsum. Small amounts of other ingredients are also included.

Aggregates:

Most of the concrete mixtures consist of both coarse and fine aggregates, and help in increasing the strength of concrete with respect to what cement can provide alone. Nowadays, sand, gravel, crushed stone, recycled materials, including blast furnace slag, glass (mostly for decorative purposes), and ground-up concrete are used as aggregates.

Water:

The water in the concrete mix should be clean and free of impurities. The change in water content with respect of cement decides the properties of the cement like how easily the concrete flows, but also affects the final strength of the concrete. Excess water implies to easier flow of concrete, but decreases its strength.

Polypropylene Fiber

Polypropylene fibers for utilizing in textiles, carpet, and tire cord are produced by extruding molten polymer through spinnerets and stretching to their final thickness and weight. The polymer melt must be homogeneous, gel free, and without oversize additive agglomerates to achieve high quality fiber and yields. Filtration of the procedure feedstreams, additive slurries, and polymer melt itself are important to help eliminate fiber breaks and enhance fiber strength and uniformity. Not only is fiber worth improved, but manufacturing rates can be higher with less procedure downtime.

RE USE OF DEMORALIZED AGGREGATE IN CONCRETE

The application of Aggregate Concrete in construction has started since end of world war-2 by demolished concrete. In the 1970s, the United States began to reintroduce the use of RAC in non-structure uses such as fill materials, foundations, and base course.

Currently India has taken major initiatives in developing the infrastructure such as buildings, highways, power projects and industrial structure etc.

With the demolition of abandoned structure the increase in debris is a very serious threat, causing environmental problems. To protect the environment this demolition debris can be crushed to form Recycled Aggregate. On studying the nature of this Recycled Aggregate it has been found that by replacing natural aggregate with Recycled Aggregate to some extent the property of concrete remains unchanged. Now a day Recycled Aggregate is being used in developing the infrastructure such as highways, buildings, industrial structures and power projects.

IV. RESULT ANA ANALYSIS

All the experiments were performed as per IS Standards test procedures. The results are noted down in the tabular format.

SIEVE ANALYSIS OF COURSE AGGREGATE

The aggregate which pass through 75 mm IS sieve and entirely retain on 4.75 mm IS sieve is known as coarse aggregate.

Sieve analysis of course aggregate:

S. No.	I.S. Sieve No.	Weight Retained (g)	Cumulative Weight Retained (g)	Cumulative % Retained on Each Sieve	% Passing	Remarks %
1	40	0	0	0	100	FM=3.28%
2	25	220	220	4.4	95.	
3	20	2130	2350	47	53	
4	16	1670	4020	80.4	19.	
5	10	835	4855	97.1	2.9	
6	4.75	115	4970	99.4	0.6	
7	Pan	0	0	0	0	

Fineness Modulus of Coarse Aggregates:

FM = $\frac{\text{Sum of cumulative \% retained}}{100}$ = 3.28 %

IMPACT TEST FOR NATURAL AGGREGATE:

Impact test for Natural Aggregate:

S. no.	Total wt. of dry sample (A) in gm	Wt. of aggregate retained 2.36 mm sieve in gm	Wt. of aggregate passing 2.36 mm sieve in gm (C)	Aggregate impact value= (C/A)x100
1.	398	276	67	16.83
2.	356	287	76	21.34

Aggregate impact value (%) = 19.1

CRUSHING TEST FOR NATURAL AGGREGATE:

Crushing test for Natural Aggregate:

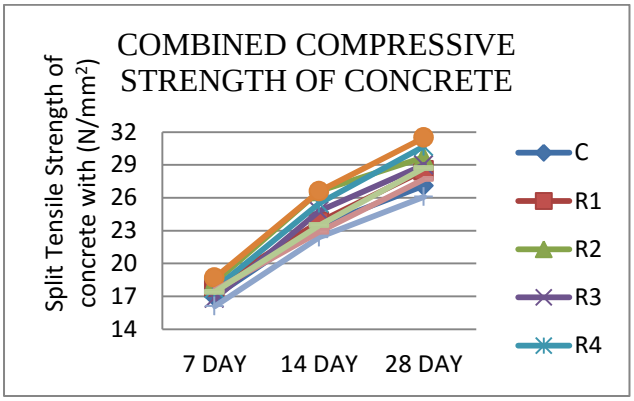
S. No.	Total wt. of dry sample in gm	Wt. of aggregate retained on 2.36 mm sieve in gm	Wt. of aggregate passing 2.36 mm sieve in gm	Aggregate crushing value
1	3000	2590	410	13.67
2	3456	2780	676	19.56

CA crushing value (%) = 19.61

COMPRESSIVE STRENGTH TEST WITH 10MM SIZE FIBER

Concrete mix	Quantity of fiber used	7-days Average (MPA)	14-days Average (MPA)	28-days Average (MPA)
0%	0	16.8	23.8	29
	0.1	17.7	25.5	30.7
	0.15	18.7	26.6	31.5
5%	0	17	23.47	27.1
	0.1	17.9	23.8	28.5
	0.15	18.3	24.6	29.7
10%	0	14.9	17.4	20.1
	0.1	15.56	17.9	21.7
	0.15	16.4	18.5	22.7

COMPRESSIVE STRENGTH OF 10MM LENGTH PP FIBER

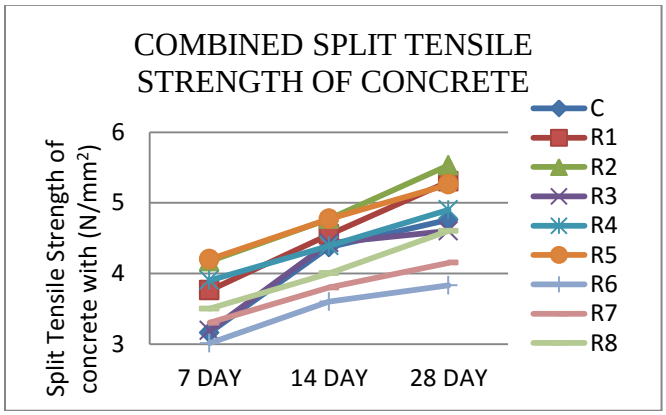


From Graph, the recycled aggregate replacing partially in the place of natural aggregate. The amount of natural aggregate left in India is very less now due to high construction rate thus one of the alternate material should be found. Old buildings are getting demoralized to construct new building, the disposal of scrap is an environmental thus the aggregate can be cleaned and washed to reuse. It is replaced in many proportions such as 0%, 5% and 10% with the PP fiber of length 10mm with three proportions 0%, 0.1% and 0.15% of cement by weight. The naming shows the ratios. The standard compressive strength were found at 28th day of curing i.e 29 N/mm², 30.7 N/mm², 231.5 N/mm², 27.1 N/mm², 28.5 N/mm², 29.7N/mm², 20.1 N/mm², 21.7 N/mm² and 22.7 N/mm² for C, R1, R2, R3, R4, R5, R6, R7 and R8 respectively. The maximum compressive strength is which maximum amount of fiber i.e 0.15% is added in natural aggregate concrete. But when aggregate is replaced with waste aggregate by 5% gives result for M20 Grade of concrete, the result is 18.3 N/mm², 24.6 N/mm² and 29.7 N/mm² at the age of 7th, 14th and 28th day of curing respectively. From the above result we got that the use of fiber with recycled aggregate increases the strength.

TENSILE STRENGTH TEST

Concrete mix	Quantity of fiber used	7-days Average (MPA)	14-days Average (MPA)	28-days Average (MPA)
0%	0	3.3	4.3	4.76
	0.1	3.9	4.69	5.48
	0.15	4.2	4.77	5.53
5%	0	3.16	4.37	4.6
	0.1	3.76	4.55	4.9
	0.15	4.17	4.77	5.26
10%	0	3.01	3.6	3.83
	0.1	3.08	3.8	4.15
	0.15	3.12	4	4.6

SPLIT TENSILE STRENGTH OF 10MM LENGTH PP FIBER



From Graph 8, the recycled aggregate replacing partially in the place of natural aggregate. The amount of natural aggregate left in India is very less now due to high construction rate thus one of the alternate material should be found. Old buildings are getting demoralized to construct new building, the disposal of scrap is an environmental thus the aggregate can be cleaned and washed to reuse. It is replaced in many proportions such as 0%, 5% and 10% with the PP fiber of length 10mm with three proportions 0%, 0.1% and 0.15% of cement by weight. The naming shows the ratios. The standard compressive strength were found at 28th day of curing i.e 4.76 N/mm², 5.48 N/mm², 5.53 N/mm², 4.6 N/mm², 4.9 N/mm², 5.26 N/mm², 3.83 N/mm², 4.15 N/mm² and 4.6 N/mm² for C, R1, R2, R3, R4, R5, R6, R7 and R8 respectively. The maximum compressive strength is which maximum amount of fiber i.e 0.15% is added in natural aggregate concrete. But when aggregate is replaced with waste aggregate by 5 % gives result for M20 Grade of concrete, the result is 4.17 N/mm², 4.77 N/mm² and.5.26 N/mm² at the age of 7th, 14th and 28th day of curing respectively. From the above result we got that the use of fiber with recycled aggregate increases the strength.

V. CONCLUSION

1. The ingredients of is having strength as per IS standards.
2. The Compressive Strength of low cost fiber reinforced concrete of 10mm size in proportion of 0%, 0.1% and 0.15% at 28th day is: For 0% replacement of aggregate 29 MPa, 30.7 MPa and 31.5 MPa, for 5% replacement of waste aggregate by natural aggregate is 27.1 MPa, 28.5 MPa and 29.7 MPa,, for 10% replacement of waste aggregate by natural aggregate is 20.1 MPa, 21.7 MPa and 22.7 MPa respectively.
3. The Tensile Strength of low cost fiber reinforced concrete of 10mm size in proportion of 0%, 0.1% and 0.15% at 28th day is: For 0% replacement of aggregate 4.76 MPa, 5.48 MPa and 5.53 MPa, for 5% replacement of waste aggregate by natural aggregate is 4.6 MPa, 4.9 MPa, 5.26 MPa, for 10% replacement of waste aggregate by natural aggregate is 3.83 MPa, 4.15 MPa and 4.6 MPa respectively.
4. Both results of compressive and tensile strength is decreasing as natural aggregate is replaced by waste aggregate from demoralizes structure. But the strength is above M20 grade of concrete.
5. Polypropylene fiber of 6mm size with proportion of 0.15% of cement by weight gives better result when replaced with re used aggregate by natural aggregate by 5%. The strength is above M25 grade of concrete.
6. As percentage of fiber increasing strength of concrete increasing.

IV. REFERENCE

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