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Experimental Study on Strength of Recycled Aggregate Concrete Using PP Fiber

Harshit Nigam¹, Harsh Gupta²

M.Tech Student, Department of Civil Engineering, J.N.C.T Rewa, India¹

Assistant Professor, Department of Civil Engineering, J.N.C.T Rewa, India²

ABSTRACT: In this thesis we have discuss about the use of Recycled Aggregate (RA) in the concrete and the effects on its Compressive Strength and Split Tensile Strength by progressively replacing the natural aggregate (NA) with recycled aggregate. The recycled aggregate will be collected from the demolished buildings and it is partially replaced by natural aggregates with various proportions of 0%, 15%, 25% and 35%. The concrete is designed for M 20 grade, the ratio is 1:1.46:3.25 with water cement ratio 0.5 from mix design (IS 10262). To improve the tensile strength in recycled aggregate concrete polypropylene fiber is used. The size and proportion of polypropylenes fiber is kept constant for the entire ratio as 6 mm and 15 % by volume of cement. The material test of cement, coarse aggregate and recycled aggregate is performed as per IS code. To check the workability of the concrete slump cone test is performed for all the ratios. To analyze the hardened concrete, compression strength test and tensile strength test are performed at 7th day, 14th day and 28th day with curing. The size of mould used is 150 x 150 x 150 mm and 300 x 150mm for compression and tensile strength respectively.

KEYWORDS: Recycled concrete, PP fiber, Slump cone value, Mix Design, Compression Test and Tensile Strength Test.

I. INTRODUCTION

Concrete made with Portland cement has certain characteristics: Concrete relatively strong in compression where as weak in tension and tends to be brittle. Another reason behind weakness of the concrete is that cracks start to form when concrete is placed and before it gets fully hardened. The cracks are major factor of weakness in concrete in large onsite applications leading to subsequent failure, generally lack of durability and fracture. The weakness in tension of concrete can be overcome by the use of conventional steel bar reinforcement and to some inclusion of a sufficient volume of fibers. Polypropylene (PP) is made by synthetic hydrocarbon polymers which are extracted by the processes of hot drawing the material through a die. In this study we are comparing Tensile and Compressive Strength with conventional concrete.

II. LITERATURE

According to the previous paper they are lots of work done with reuse of aggregate that is recycled aggregate concrete. Thus according to Ahmad Mujahid he said thus strength of recycled aggregate is less than normal concrete and Mr. Shiv Anand has said his paper by using fiber the strength of concrete is cause than normal concrete. Many more authors discussed about poly propylene fiber and recycled aggregate concrete used but none of them has used both material same concrete. In this thesis the aggregate is replaced partially with recycled aggregate with poly propylene fiber.

III. MATERIAL AND METHODOLOGY

A. 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.

B. Cement

Portland cement of 43 Grade is used in this work. The cement is bought from Prism Cement Plant Rewa.

C. 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. 20mm and 5mm graded coarse aggregate and fine aggregate were used.

D. Recycled Aggregate

The Collection of recycled aggregate was bought from a demolished building near Sirmour Chowk, Rewa. The aggregates were cleaned properly and sieved for 20mm graded size.

E. Polypropylene Fiber

The fibres are used either as short size and discontinuous fiber material for production of fiber reinforced concrete. Polypropylene twine is abundantly available, alike all manmade fibers of a consistent quality and cheap also. The fiber is cut into size 6mm length.



Fig (a). Polypropylene Fiber



Fig. (b). Recycled Concrete Aggregate

IV. METHODOLOGY

First of all collect the demolished material cement, sand, aggregate and polypropylene fiber. Then all waste material are mixed with proportion according to IS 10262. The proportions are 0%, 15%, 25% and 35% and polypropylene fiber is 15% of cement volume are mixed and then mould are made to cube for compression and cylindrical for tensile strength test. After that the rest on the watertank for curing and curing days are 7th, 14th and 28th after that tested by UTM as compression and tensile strength.

Concrete consists of three major components, viz. water, Portland cement, and aggregates. Properties of the final product i.e. cement changes according to the change in the ratio of its components and hence consequentially help the engineer in deciding the proper use of the same according to his need. To get a certain specific property in cement, Admixtures are added and hence enhance its required characteristics.

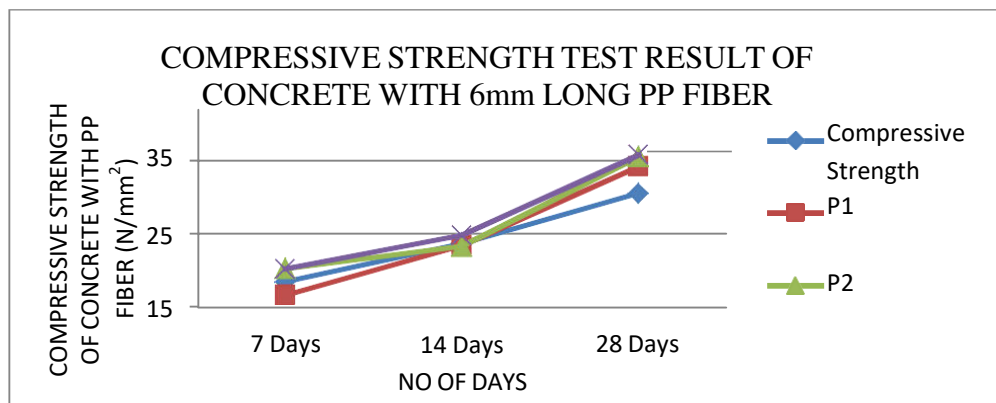
V. RESULT AND DISCUSSION**A. Compressive Strength Test Of Concrete With 15% Of Pp Fiber**

The 28 days strength obtained for M 20 grade of concrete is 30.45Mpa. The results reported in table 1 are presented in the from graphical variation, where in the compressive strength is plotted against curing period.

Table 1. Compressive Strength Test of Concrete With 15% Of PP Fiber

Name	Proportion of recycled aggregate	Quantity of ingredients (Kg/m ³)					Compression strength		
		Cement	Sand	Aggregate	RCA	PP Fiber	7 th Day	14 th Day	28 th Day
C0%		384.35	580.4	1176.1	0	0	18.56	23.72	30.53

P1	15%	384.35	580.4	999.68	176.4 2	57.6	16.74	23.48	34.19
P2	25%	384.35	580.4	882.1	294.0 3	57.6	20.31	24.34	35.48
P3	35%	384.35	580.4	764.46	411.6 4	57.6	20.25	24.83	35.74



Graph 1. Compressive Strength

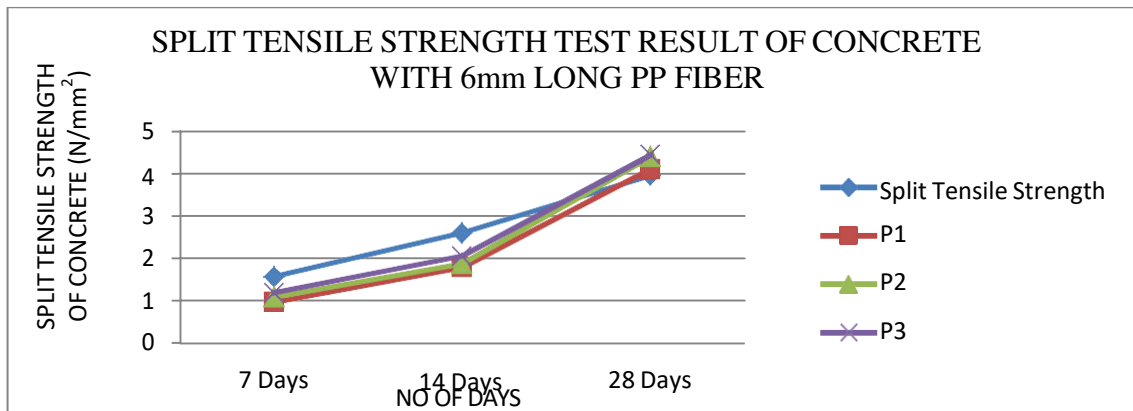
In Graph No.1, it shows that the Compressive Strength of Concrete with 15 % PP Fiber Reinforced Concrete with addition RCA proportion of 15%, 25%, and 35% is 34.16 N/mm², 35.48 N/mm² and 35.74 N/mm² Respectively. It shows that mixing of PP Fiber in Concrete increases the Strength. The best result is obtained by replacing 35% of aggregate by recycled aggregate with 15% of PP Fiber of size 6mm.

B. Test on Split Tensile Strength of Concrete

Split tensile strengths of PP fiber concretes were found to be higher compared to reference concrete. It can be observed that the fiberconcrete specimens containing longer PP fiber show the best split tensile strength among all concretes.

Table2 . Tensile strength of concrete with 15 % PP fiber

Name	Proportion of recycled aggregate	Size	Quantity of ingredients (Kg/m ³)					Tensile strength		
			Cement	Sand	Aggregate	RCA	PP fiber	7 th Day	14 th day	28 th day
T	0%	-	384.35	580.4	1176.1	0	0	1.62	2.62	3.97
P1	15 %	6 mm	384.35	580.4	999.68	176.42	57.65	0.99	1.81	4.12
P2	25 %	6 mm	384.35	580.4	882.1	294.03	57.6	1.11	1.9	4.15
P3	35 %	6 mm	384.35	580.4	764.46	411.64	57.6	1.21	2.07	4.76



Graph 2 Tensile Strength

From the Graph 2, the Tensile strength with proportion of recycled aggregate at 35% of fiber reinforced concrete with size of 6 mm gives better result, its strength increases from 1.62 N/mm² at 7 day to 4.76 N/mm² at 28 days.

VI. CONCLUSIONS

Based on the test specimens made with the available local materials, the following conclusions can be derived:

- A. Tensile Strength and Compressive Strength of Concrete increases with increase in fiber content upto 35%.
- B. It is observed that Tensile Strength and Compressive Strength of concrete is easily reinforced with 6 mm long fiber.
- C. Keeping Fiber length at 6 mm & using various percentage of PP Fiber it is observed that compressive & Split tensile strength at 28 days are higher at 35% of fiber content (35.74 N/mm² & 4.76 N/mm²).
- D. It is concluded further that compressive & split tensile strength of concrete at 28 days, reinforced with PP Fiber.
- E. Since use of these fibers reduces the density of concrete hence may be termed as light weight concrete.

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