International Journal of Trend in Scientific Research and Development (IJTSRD)
Volume 4 Issue 5, July-August 2020 Available Online: www.ijtsrd.com e-ISSN: 2456 – 6470

A Research on Concrete using Crumb Rubber and Round Crimped Steel Fibre

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ABSTRACT

The research is aimed to study about the behaviour of concrete when crumbed rubber and Round crimped steel fibre is used in concrete. Round crimped steel fibre will give a better result as far as tensile strength on the concrete and by mixing it with the crumb rubber will be beneficial result in compressive strength as well, and environmental issue to use removal of waste tyres. Rubbers from waste tyres used for fragmentary or fractional substitution of coarse aggregate in conventional concrete, the ensuing thing called crumbed Rubber concrete (CRC). Substitution of characteristic fixings in concrete by waste material is a supportable methodology in development. Utilization of rubber in concrete was effective as it improves twisting quality in flexural individually but another influence is low rigidity of concrete. To take this, fibre was introduce in concrete. The present study is aimed at determining the behaviour of concrete on addition of crumb rubber and Round Crimped steel fibre by the volume of coarse aggregate by partial replacement. RCSF is taken 1% in constant quantity and crumb rubber in 7%, 14%, 21% in M20 concrete. There are two main test are conducted on the specimen compression test and flexural test to determine the behaviour of the concrete mix.

KEYWORDS: *Concrete, Round Crimped Steel Fibre (RCSF), crumbed rubber, steel fibre, compression test, flexural test, slump value*

How to cite this paper: Shivank Singh Parihar | Rahul Pandey | Ajeet Saxena "A Research on Concrete using Crumb Rubber and Round Crimped Steel Fibre" Published in International Journal of Trend in Scientific Research and Development (ijtsrd), ISSN: 2456-6470, Volume-4 | Issue-5, August 2020, pp.986-989, URL: www.ijtsrd.com/papers/ijtsrd33019.pdf

IJTSRD33019

I. INTRODUCTION

Dumping of waste tire on land represent a significant natural issue of expanding noteworthiness. Throughout the years, removal of waste tyres has gotten the biggest issues for the earth. Creative answers for fathom the tire removal issue have for a long while time been being developed. Dumping of waste tyres on land represent serious Environment issue. As the automobile industry is growing up the utilized rubber tyres cumulated on the planet throughout the years. Indian tyre market consumption volume of 184 Million units in 2018 and waste generated through it, estimated that 60% are disposed of through illegal dumping and land filling and Burning. To dispose of this elastic waste these tyres are set in a dump, or discarded by just filling them in huge gaps in the ground and this dump fill in as an incredible respect to mosquitoes and these mosquitoes spread numerous sicknesses this become genuine and risky. A significant improvement that occurred throughout the entire existence of cement was the utilization of rubber in concrete for auxiliary components. This system was very effective as far as opposing the full-scale racks in concrete and in bestowing twisting quality in flexural individuals. The explanation was to by one way or another influence the low rigidity of cement by deliberately putting the rubber. In any case, concrete as a material stayed powerless in strain and fragile. To take this, fibre fortification was created. The presence of Fibre Reinforced Concrete is significant accomplishment in solid innovation. While the utilization of straws in blocks and in mortar originates before the utilization of traditional Portland concrete cement, the utilization of cutting-edge filaments in concrete has specify significant chances. It truly realizes that solid is exceptionally weak material and which its strain limit is low. Due to this issue, the utilization of FRC has expanded in the course of the most recent thirty years. Strands are added to improve the quality of the solid and furthermore, they are added to upgrade the post-split conduct of cement. In FRC, breaks are tied by filaments control their development and giving post-split malleability. Fibre as support is viable in restricting breaks at both smaller scale and full-scale levels.

Crumb Rubber

Crumb rubber is obtained by two methods which are used to change over scrap tyres in to rubber, and the method are Cracker mill process; cracker mill is very key machine, used for manufacturing of crumb rubber by scrap rubber tyres and other rubber material. Here greater than 4.75 mm is used to replace with coarse aggregate.

Fig. 1 Crumb rubber

Round Crimped Steel Fiber

- Round crimped steel fiber is a new type of reinforced fiber. It is fabricated by cold-drawn low carbon steel wire and Corrugated profile adds pull-out resistance compared with plain steel fibers.
- It is excellent in shrinkage control.
- When encountered by initial cracking, slower loss of bearing capacity than the other fiber types.
- It gives Huge pull-out resistance because of its special structure.

Fig. 2 Round crimped steel fiber

II. OBJECTIVES

Following are the objectives of the study-

1. To investigate the impact of supplanting aggregate with waste materials over a set of properties.
2. To get best possible % of substitution of ingredients with this waste material.
3. To study the Investigation on Optimal Use of Round Crimped steel fibre and Crumb Rubber in the strength of concrete.

III. METHODOLOGY

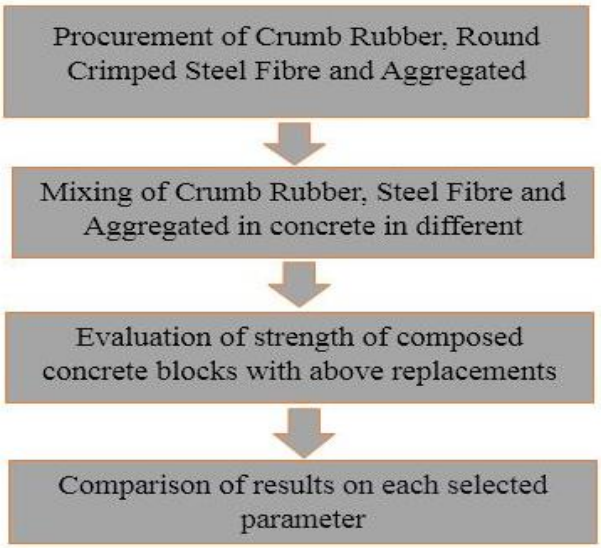

Fig. 3 Flow chart of methodology

Materials are used for the research work: -

1. Ordinary Portland Cement (OPC 53 GRADE)
2. Fine Aggregate (ZONE III)
3. Coarse Recycled Aggregate (SIZE 20 MM)
4. Round Crimped Steel fibre (1100 MPA)
5. Crumb Rubber (Greater than 4.75mm)
6. Water (IS 456:2000)

IV. EXPERIMENTAL RESULTS

MAIN TEST PERFORMED: -

1. Compressive strength test.
2. Flexure strength test.

Table 1 Composition of specimen

Sample	Tyre (%) By Weight Of Aggregate	Remaining Aggregate By Weight Of Natural Aggregate	Steel Fibre (%) By Volume Of Concrete
CC	0	100	0
M1	7	92	1
M2	14	85	1
M3	21	78	1

Table 2 Compressive strength of different mix

S. No.	TYPE OF MIX	COMPRESSIVE STRENGTH (N/mm²)		AVERAGE COMPRESSIVE STRENGTH (N/mm²)	
		7 DAYS	28 DAYS	7 DAYS	28 DAYS
1	CC	13.26	21.11	13.02	20.62
		12.27	20.61		
		13.52	20.15		
2	MD1	14.02	23.30	13.85	23.13
		13.63	23.56		
		13.82	22.53		
3	MD2	12.30	19.40	12.06	18.81
		11.60	18.23		
		12.30	18.80		
4	MD3	10.20	15.33	10.26	15.18
		10.80	15.35		
		9.80	14.86		

Table 3 Tensile test result by using flexural test

S. No.	TYPE OF MIX	FLEXURAL STRENGTH (N/mm²)		AVERAGE FLEXURAL STRENGTH (N/mm²)	
		7 DAYS	28 DAYS	7 DAYS	28 DAYS
1	CC	2.33	2.88	2.30	2.91
		2.24	2.94		
		2.34	2.91		
2	MD1	2.51	3.18	2.47	3.13
		2.47	3.09		
		2.37	3.12		
3	MD2	2.25	2.51	2.18	2.56
		2.18	2.62		
		2.10	2.57		
4	MD3	2.03	2.37	1.63	2.27
		1.98	2.29		
		1.87	2.16		

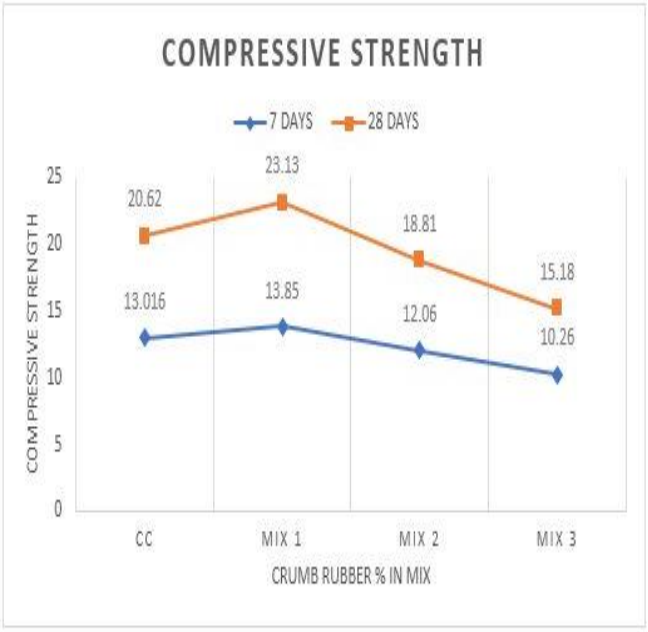

Fig. 4 Graph representing Comparison of Compressive Strength in 7 and 28 days

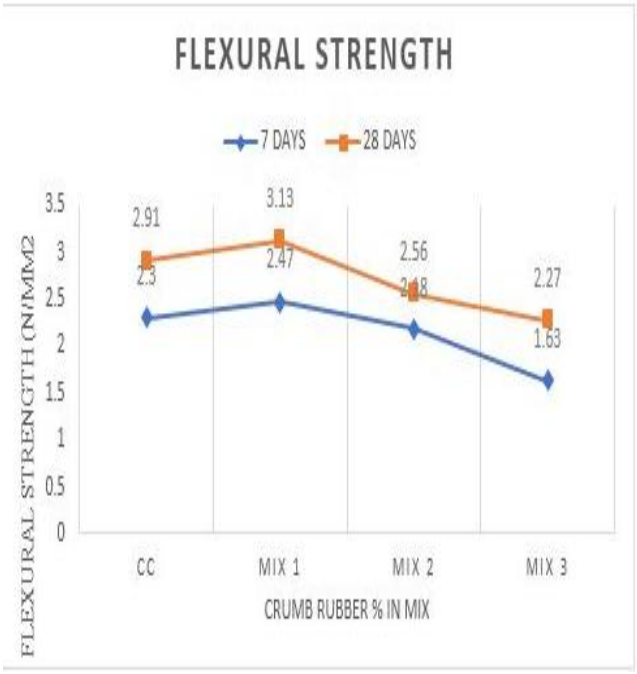

Fig. 5 Graph representing Comparison of Flexural Strength in 7 and 28 days

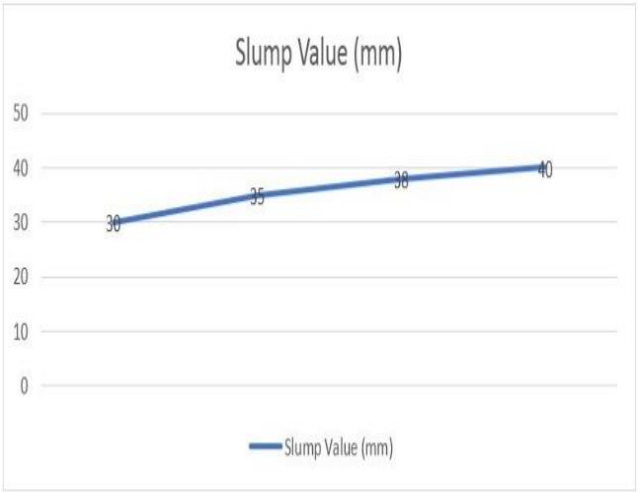

Fig. 6 Graph representing Slump Value

V. CONCLUSIONS

Following conclusions are drawn from the above research:

1. In this research work it was concluded that the maximum compressive strength is obtained by addition of 7% crumb rubber and 1% round crimped steel fibre (RCSF) as a fractional substitution of coarse aggregate gives the best results in all strength parameters compared to controlled mix proportions.
2. The most noteworthy compressive quality of test of MIX1 was watched 12.17% higher as contrasted and control concrete mix (CC). The increasing % of compressive quality of tests MIX1, MIX2, MIX3 are 12.13% (Higher), 8.77% (Lower), 26.38 %(Lower) respectively as compared with the control concrete mix.
3. The compressive strength of the concrete decrease about 8.77%and 26.38% when 15% and 21% respectively as aggregate is replaced by crumb rubber. With the addition of crumb rubber, the reduction in strength cannot be avoided.
4. The flexural strength is likewise raised somewhat by ideal e raised steel fibre and crumb rubber.
5. The flexural strength of sample of MIX1 was seen to be 7.56 % higher as compared with the control concrete mix (CC). The increasing % of flexural strength of tests MIX1, MIX2, MIX3 are 7.56 (Higher), 12.02% (Lower), 21.99 % (Lower) separately as contrasted and the control concrete mix.

VI. FUTURE SCOPE OF WORK

1. In this research it was observed that, how hybrid fibres improve the inbuilt properties of concrete as compressive strength and flexural strength however some other parameters can also be checked by like vibration test and impact test split cylinder test etc., can also be done in the future.
2. This work can be proceeded by extension of research investigation, so other properties of harden concrete such as durability, impact resistance, and propagation of cracks can also be investigated.
3. Earthquake resistant material implementation can also be investigating in future.

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