

**Crumb rubber and nylon fibre as a partial replacement of sand in concrete.**Asst Prof. Ms Megha Thomas<sup>1</sup>, Mohmedali Chunawala<sup>2</sup>,

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**Abstract**—Due to increase in the production of tyre, it is difficult to dispose the waste tyre as their is inadequate land. Although the basic material used in concrete are aggregate, cement , water. But in this study the performance of crushed particles of crumb rubber and nylon fibres are used and also nylon fibres combinely and differentially as a partial replacement of sand at M30 grade of concrete mix at different dosages of crumb rubber as 1%, 2% ,3% and nylon fibre as 2.5%, 5%, 7.5% and 10% are used. As different specimen of beams and cubes of size (150x150x150 for cubes) and (150x150x700 for beams) are casted and their effect on compressive as well as flexural strength.

**Keywords**-Waste tyre rubber, nylon fibre , compressive strength and flexural strength..

**I. INTRODUCTION**

Large amount of waste tyre accumulate in the world every year and the easy process to decompose the rubber is by burning but because of burning of rubber a large amount of smoke and pollution although according to the property of nylon fibres it is also used.

**II. RESEARCH OBJECTIVE**

Use of waste tyre rubber particle in concrete can gives a efficient way of utilizing rubber and by using rubber in concrete gives better environmental benefits. The waste tyre rubber provides a concrete with good engineering properties by partial replacement of waste tyre crumb rubber particle to the fine aggregate in concrete.

**III. LITERATURE REVIEW**

**Review Paper 1:** Zeno, Daniela, Ovidiu, Mihai. Sound absorbing materials made by embedding crumb rubber waste in a concrete matrix. Construction and Building Materials 124 p(755-763). Elsevier 2016.

Materials made of concrete with added SBR were obtained and it was found that the sound absorption coefficient was above 0.5 (the limit defining sound absorbing materials) for all samples containing rubber, in contrast to the control samples (without SBR).

Some exceptional values of the sound absorption coefficient (of 0.82 and 0.93) has been obtained on samples having a larger number of rubber grains on the surface.

Evenness of the sound absorbing coefficient – and a quite good values range of 0.6-0.7 – has been obtained by simply producing artificial, macroscopic pores in the composite material. SBR addition in concrete brought a significant decrease in compressive strength at all ages, of up to 15 MPa.

**Review Paper 2: Afia S. Hameed, A.P Shashikala.** Suitability of rubber concrete for railway sleepers. *Perspective in Science* 8 p(32-35). Elsevier 2016.

Experimental investigations were carried out to study the mechanical properties like fatigue strength and impact resistance of rubber concrete and ordinary concrete as per Indian standards and ACI standards. The following conclusions are arrived at.

1. Presence of crumb rubber in concrete has increased the resistance to crack initiation under impact load by 80—110%.
2. Impact load at failure was 50% high for concrete with crumb rubber. This is due to the energy absorption capacity of the crumb rubber.
3. Failure cycle for the crumb rubber concrete was high which increases the damage life.
4. In railway sleeper, presence of crumb rubber shows 40—60% increase in impact strength when compared to prestressed concrete sleeper.

**Review Paper 3: Giulo, Piergiorgio, Matteo, Cesare, Andrea, Valeria.** Crumb Rubber in cold recycled bituminous mixes: Comparison between traditional Crumb rubber and Cryogenic rubber. *Construction and Building Materials* 68 p(370-375). Elsevier 2016.

Based on the experimental data shown in this study, the following conclusions have been reached:

1. The replacement of fine RAP with Crumb Rubber improved the self-compaction of the mixtures while influenced their volumetric characteristics after compaction.
2. The final density of gyratory compacted samples shows that rubber help into attaining higher degrees of compaction. In particular an increase of 1.1% and 2.1% is achieved respectively by adding TCR and CCR to the RAP mixtures. The difference between the two mixtures with rubber may be attributed mainly to the difference in gradation.
3. As with HMA, the studied Cold Mixes containing 100% RAP are shown to have a volumetric variation after compaction. The presence of rubbers enhances this variation with a reduction in % qm up to 4.7% for the TCR mixture and 2.9% for the CCR.

**Review Paper 4: Xiaobin, Changwen, Jiaping, Jinxiang.** Influence of Crumb rubber on frost resistance of concrete and effect mechanism. *Procedia engineering* 27 p(206-213). Elsevier 2012.

1. The size of crumb rubber has obvious influence on the freeze-thaw resistance of CRC. The freeze-thaw resistance of CRC increases with increasing the fineness of crumb rubber, when the size of crumb rubber is less than 60 mesh. In contrast, the freeze-thaw resistance of CRC reduces with increasing the fineness of crumb rubber when the size of crumb rubber exceeds 60 mesh.
2. It is detrimental to improve the freeze-thaw resistance of CRC when the volume of 6 mesh crumb rubber exceeds 60kg/m<sup>3</sup>.
3. The influence of crumb rubber on the freeze-thaw resistance of CRC is not significantly affected when the volume of 20 mesh crumb rubber does not exceed 30kg/m<sup>3</sup>; The 20 mesh crumb rubber has negative effects on the freeze-thaw resistance of CRC when the volume of crumb rubber exceeds 30kg/m<sup>3</sup>, and the freeze-thaw resistance of CRC gets worse with the increasing of volume of 20 mesh crumb rubber.

**IV. EXPERIMENTAL STUDY**

- i. Materials used are crumb rubber and nylon fibres by passing through 1.18 mm IS sieve and retaining 600 μ IS sieve are used and nylon fibre vice and versa.
- ii. Compressive Strength are determined by mixing the crumb rubber in M30 concrete and also nylon fibre. The following are the mixes done in this study:

Mix	No. of specimens		No. of cubes	No. of beams
	Crumb rubber	Nylon fibre		
Control mix			9	3
Mix 1	1%	0%	9	3
mix 2	2%	0%	9	3
Mix 3	3%	0%	9	3
mix 4	0%	2.5%	9	3
mix 5	0%	5%	9	3
mix 6	0%	7.5%	9	3
mix 7	0%	10%	9	3
mix 8	1%	2.5%,5%,7.5%	9	3
mix 9	2%	% gives max strength	9	3
mix 10	3%	% gives max strength	9	3

**Table 1: Mixes for concrete according to % of C.R and Nylon fibres.**

Total no of cubes: 90.

Total no of beams: 33.

Volume of cubes:  $(0.15 \times 0.15 \times 0.15) \times 90 = 0.30 \text{ m}^3$

Volume of beams:  $(0.15 \times 0.15 \times 0.7) \times 33 = 0.52 \text{ m}^3$

Total volume of concrete =  $0.82 \text{ m}^3$

Cement Content for the above volume = 512.65 kg

Water Content " " " " = 230 litre

Fine aggregates " " " " " " = 570.96 kg

Coarse aggregates " " " " = 1017.06 kg

- iii. Now the following are the results obtained by above mixes in the compressive strength of cubes, at 7, 14 and 28 days.

**Compressive Test Results 1:**

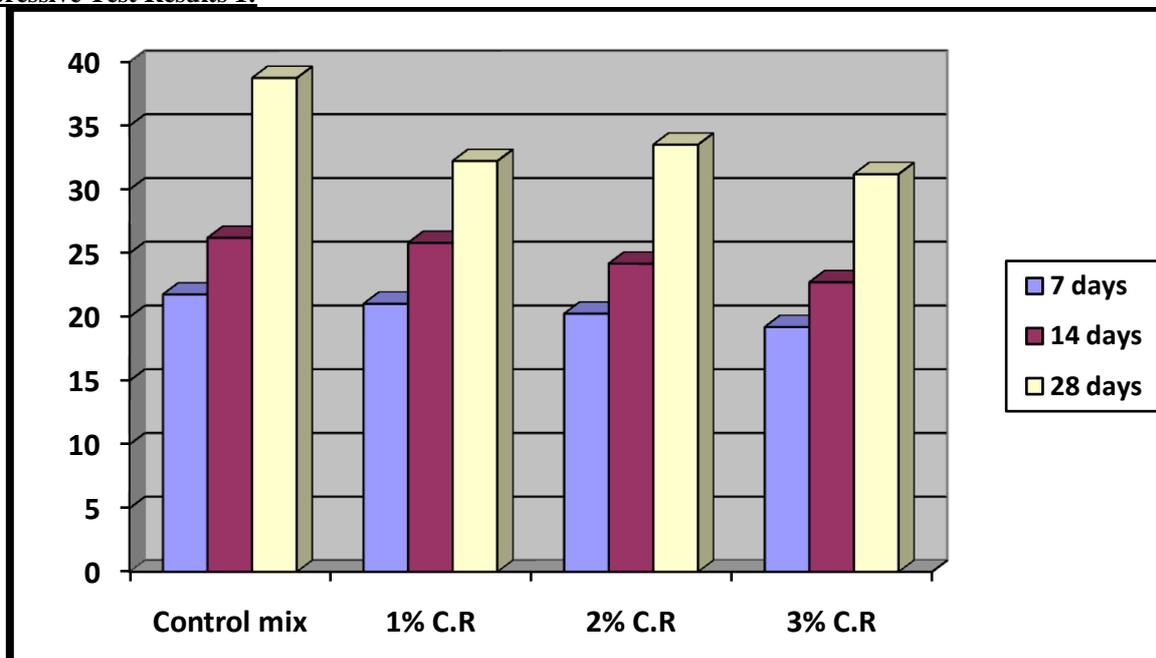


Figure 1: Compressive strength of specimens at 0%, 1%, 2% and 3% C.R

	7 days	14 days	28 days
Control Mix	21.76	26.2	38.74
1% C.R	21.03	25.81	32.23
2% C.R	20.25	24.18	33.51
3% C.R	19.21	22.72	31.2

**Compressive Test Results 2:**

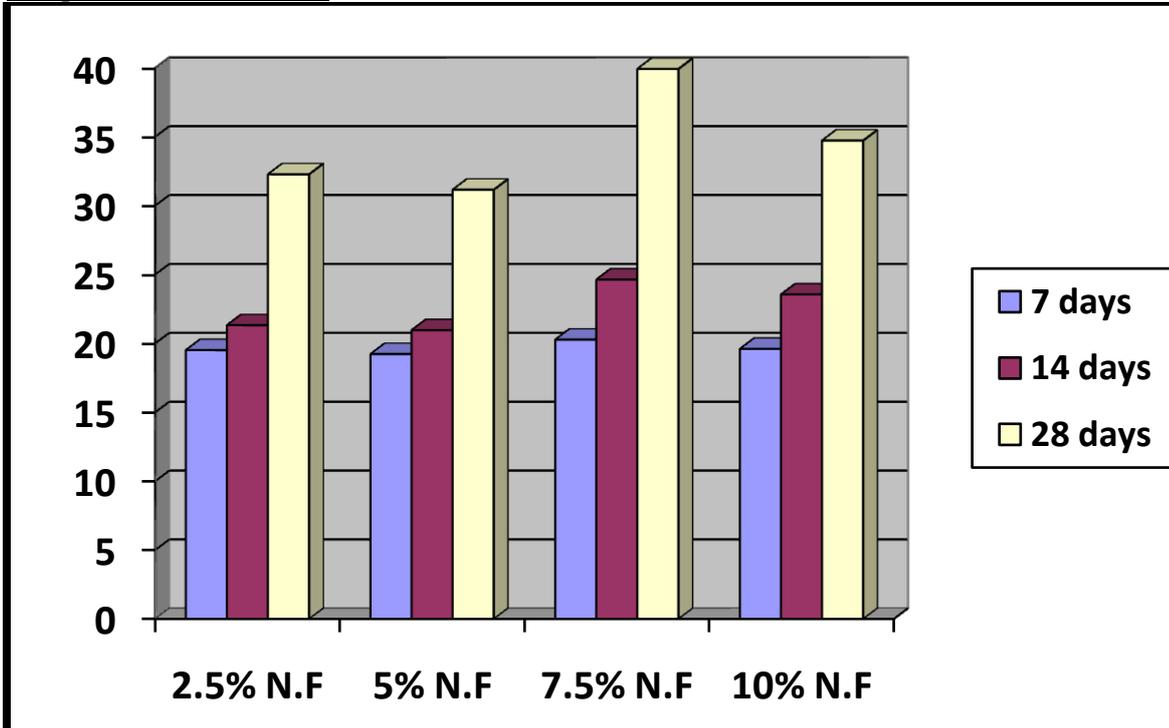
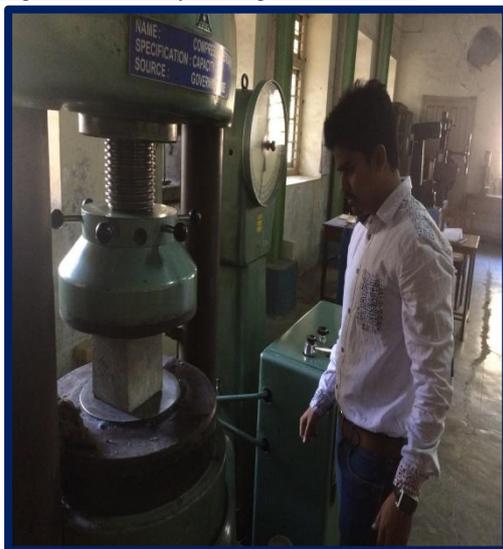


Figure 2: Compressive strength of specimen at 2.5%,5%,7.5%,10% N.F

	7 days	14 days	28 days
2.5% N.F	19.51	21.32	32.27
5% N.F	19.23	20.96	31.2
7.5% N.F	20.27	24.63	39.92
10% N.F	19.6	23.55	34.94

Also the figure of mine by testing is as follows:



**Compressive Test Results 3:**

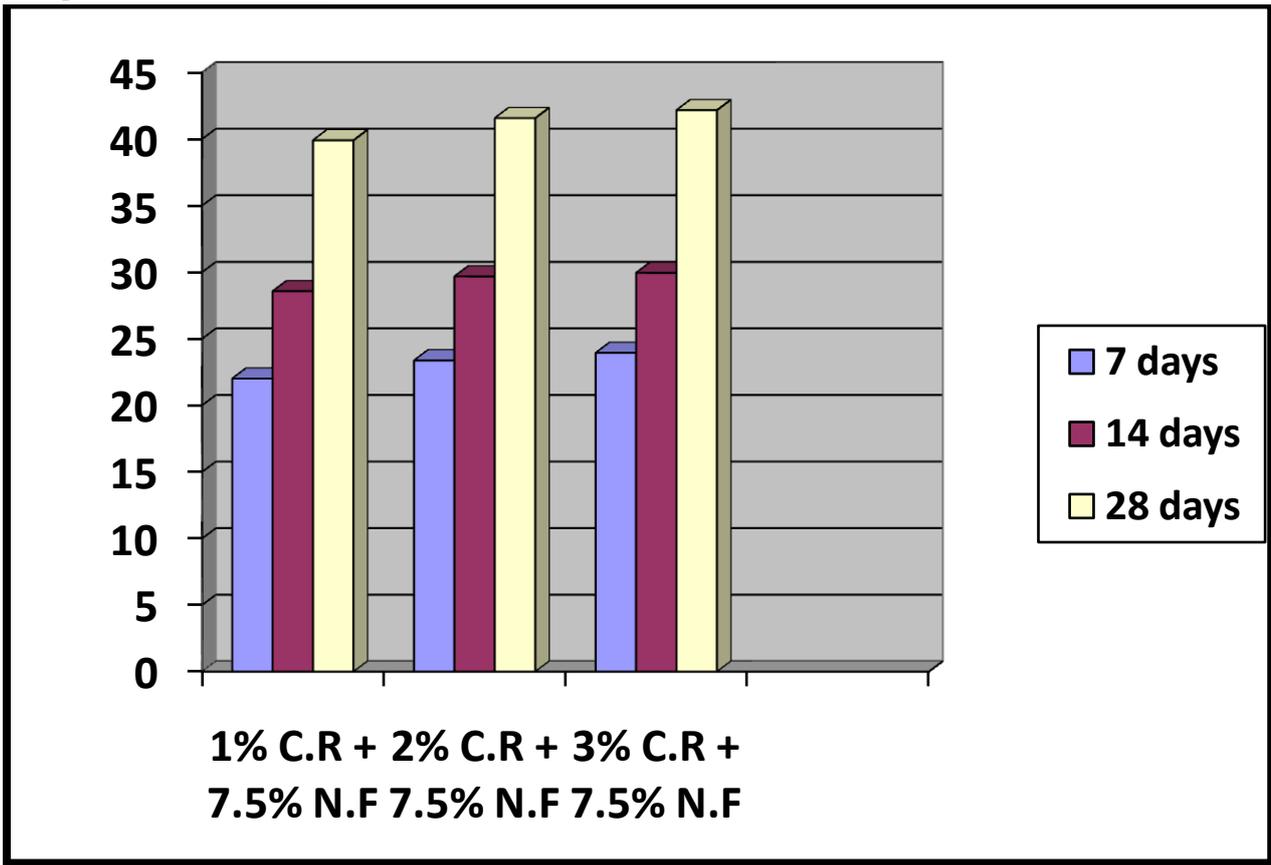


Figure 4: Compressive strength of specimen at 1%,2%,3% C.R + 7.5% N.F

	7 days	14 days	28 days
1% C.R + 7.5% N.F	22.01	28.57	39.91
2% C.R + 7.5% N.F	23.37	29.68	41.57
3% C.R + 7.5% N.F	23.94	29.95	42.17

iv. Now the flexural strength of the beam are determined by the above mixes by using both crumb rubber and nylon fibre so that the maximum strength of the beam can be determined.

**Flexural Strength Test Results:**

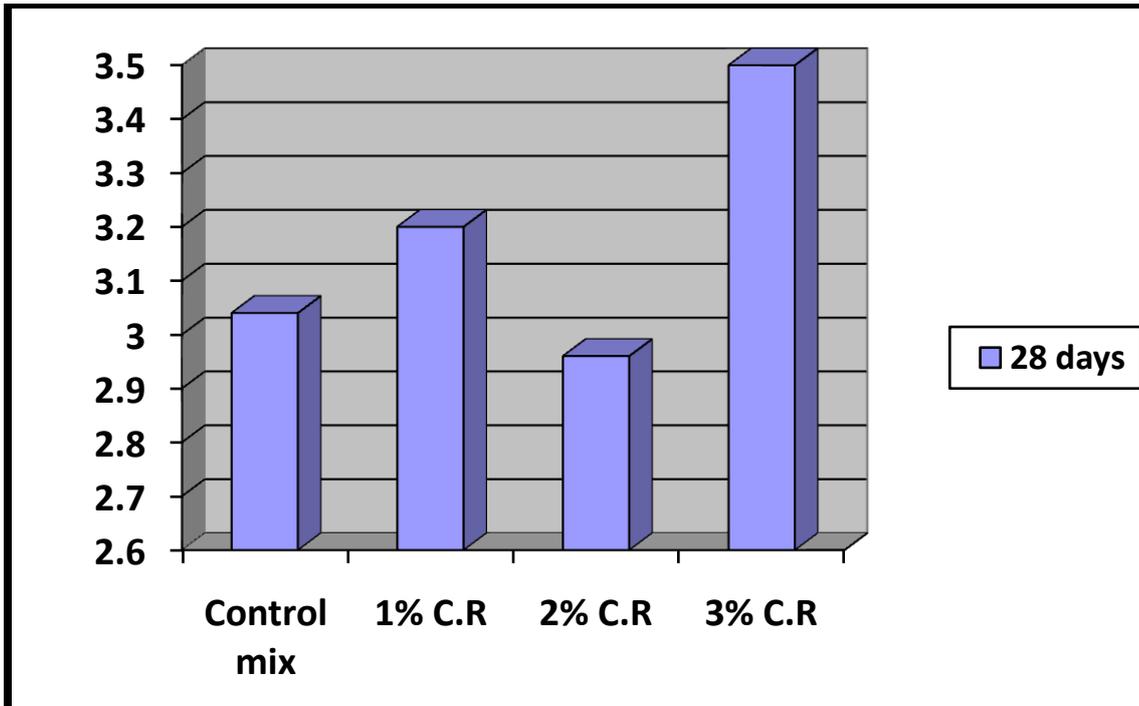


Figure 5: Flexural strength of specimen at 1%,2% and 3% C.R

	28 days
Control Mix	3.04
1% C.R	3.2
2% C.R	2.96
3% C.R	3.5



**Conclusion:**from the above the tests and observation we came to the conclusion that the compressive strength of cube decreases by increasing the % of crumb rubber but the flexural strength increases and combinely the effect of nylon fibre also plays an important role as at 3% crumb rubber and 7.5% of nylon fibre shows increase in the strength so that due to cheap available material it can be used in the construction of roads and also in building construction. So finally the durability of this mix can be found out at further study by RCPT method at 48 days.

**References**

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