

# EFFECT OF REPLACEMENT OF COURSE AGGREGATE BY SCRAP TYRE RUBBER : EXPERIMENTAL STUDY

Mr. Chothe Onkar K.<sup>1</sup>, Mr. V.S.Kadam<sup>2</sup>, Patil Vikram<sup>3</sup>, Patil Pravin<sup>4</sup>

<sup>1</sup>Assistant Professor, Department of Civil Engineering, Bharati Vidyapeeth's college of Engineering, Kolhapur Maharashtra, India

<sup>2</sup>Assistant Professor, Department of Civil Engineering, Bharati Vidyapeeth's college of Engineering, Kolhapur Maharashtra, India

<sup>3</sup> Student, Department of Civil Engineering, Bharati Vidyapeeth's college of Engineering, Kolhapur Maharashtra, India

<sup>4</sup> Student, Department of Civil Engineering, Bharati Vidyapeeth's college of Engineering, Kolhapur Maharashtra, India

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**Abstract** - Solid waste management has most important because tyre rubber waste is increasing at a fast rate. Tyre rubber waste is non biodegradable nature so that its used as a fuel in many industries which is not environment friendly. Concrete has notice as a alternative source of recycling the tyre rubber waste. Aggregate can replaced by tyre rubber waste. In this study, affects on concrete has been observe by experimental results. In this experimental study M20 grade concrete used as reference point. Tyre rubber waste used as a course aggregate in 5% , 10%, 15% replacement for conventional aggregate. As per this percentage cost benefit and strength ratio also identified.

**Key Words:** Tyre rubber Shredded rubber, compressive test , workability test, unit weight loss,

## 1. INTRODUCTION

Recycling of waste is the most important process but tire and rubber recycling is most problematic source of waste. This material is ecologically problematic because their large production , cheap availability , bulk and its non biodegradable nature. In India production of tyre not exactly calculated but increasing trend of use of road transportation will definitely create problem in future. Total number of four wheelers and two wheelers registered up to 1997 in India were 0.5 million ,2.25 million 4.7 million , 26 million respectively. An annual cumulative growth rate of 8% is expected. In construction industry , concrete is the most commonly used material. In concrete, rubber can be used as a replacement for aggregate (2).

In many research paper shredded tyre rubber is used to replace course aggregate. This shredded tyre rubber are usually from tow wheeler or four wheeler regular vehicles. Previous studies have shown that the strength and workability of concrete decreases as per the rubber particles increases. Many researcher had got the experimental result of compressive strength , flexural strength, unit weight decreases as the percentage of rubber aggregate increases (8).

The present study is to produce rubberized concrete by partial replacement of course aggregate. The purpose of

this study is to see the behavior of concrete with different proportion of scrap tyre rubber. For that concrete mixed with shredded rubber on 5% 10% 15% of course aggregate and workability , compressive strength for 7days ,28days and unit weight measured.

## 2. EXPERIMENTAL PROGRAMME -

Portaland cement , 20 mm aggregate , uncrushed river sand of less than 5mm maximum size as fine aggregates were used for concrete mix. For this research, shredded tyre rubber replaced to the 20mm course aggregate by 5%, 10%, 15% in volume. For the concrete mix water cement ratio taken as 0.45. There were 12 cubes casted for taking compressive strength. There were casted three cubes for each percentage of replacement.



Fig1. shredded scrap tyre rubber

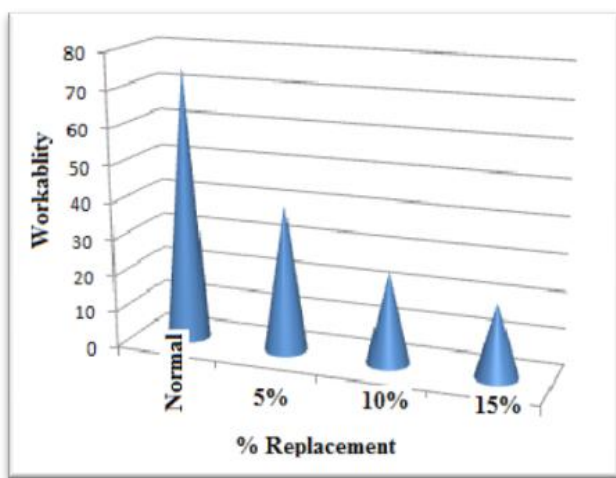
### 2.1. Workability test-

Workability of fresh concrete measured each replacement of shredded rubber and normal concrete which is shown in table. The result shows that workability decreases as per the percentage of scrap rubber increases. In this situation superplasticser would to use for better workability. Suitable workability could be achieved by using

superplasticiser. 0.45 water cement ration is used for this concrete mix. As per below results, workability decreases as per percentage of shredded rubber increases in concrete. For that point of view, 5% to 10% replacement preferable for casting in any project.

**Table no.1** - Results of workability test

% replacement	Slump value (mm)
Normal	75mm
5%	40mm
10%	25mm
15%	20mm



**Chart no.1**- Graph of workability test result

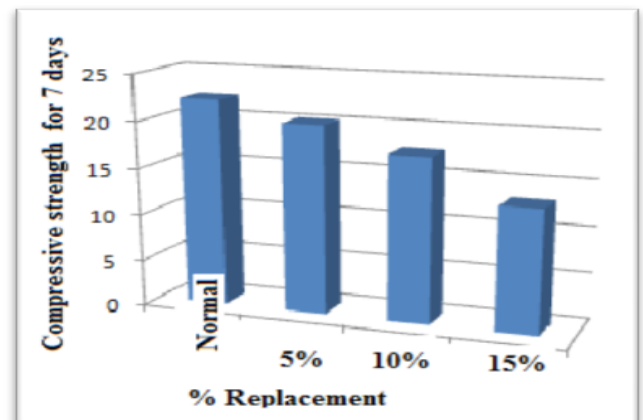
## 2.2. Compressive strength test-

For the compressive strength test, 24 cubes of size 150 x 150 x 150 mm were prepared. This cubes were divide in to four groups like normal concrete cubes, for 5% replacement, 10% replacement, 15%replacement. Compressive strength of cubes obtained after 7days, 28days as per following table. For each test and for each mix three specimens were tested. Compressive value in the table are average of three cubes value. Compressive test were carried out on cubes of dimensions 150 × 150 × 150 mm . As per below result for 7days & 28days, compressive strength decreases as a percentage of shredded rubber increases. Compressive strength reduced in percentage 0.8%, 6.37%, 29.67% respectively for 5% 10% 15% replacement by shredded rubber. For that point of view, 5% replacement of shredded rubber is preferable.

i) compressive strength after 7 days

**Table no.2**- Compressive strength after 7days

% replacement	Compressive strength	Compressive strength reduced in %
Normal	22.25 MPa	0
5%	20.18 MPa	9.30
10%	17.62 MPa	20.81
15%	13.20 MPa	40.67

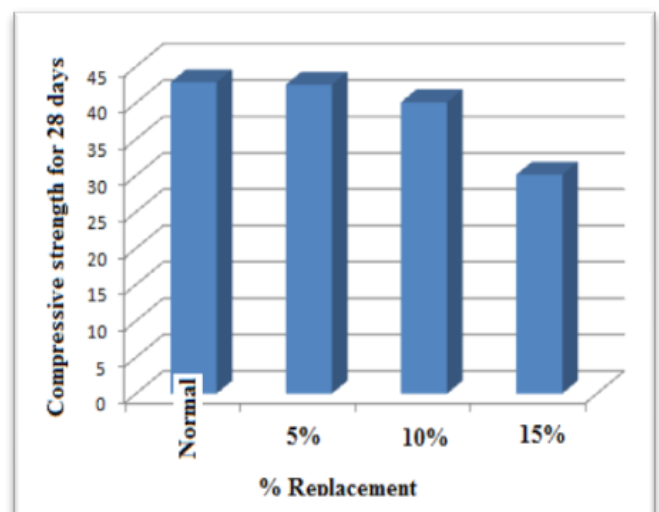


**Chart no.2**- Graph of Compressive strength after 7days

ii) compressive strength after 28days

**Table no.3**- Compressive strength after 28days

% replacement	Compressive strength	Compressive strength reduced in %
Normal	42.83 MPa	0
5%	42.50MPa	0.8
10%	40.10 MPa	6.37
15%	30.12 MPa	29.67



**Chart no.3**- Graph of Compressive strength after 28 days

### 2.3. Unit weight of rubberised concrete

The unit weight values used for the analysis of this section are measured from the concrete cube samples after 28 days. From the table, it was found that for 15% replacement of aggregate unit weight reduction up to 13.40%. Unit weight reduction by 2.73%, 5.86%, 13.40% measured for 5% , 10%, 15% replacement of aggregate respectively.

**Table no. 4 - Unit weight of rubberised concrete**

% Replacement	Unit weight (kg)	% reduction
Normal	8.43	0
5%	8.20	2.73
10%	7.94	5.86
15%	7.30	13.4

### 2.4. Cost comparative statement-

Quantity for the 1  $M^3$  are calculated for cost comparison between comparative study of normal concrete and rubberized concrete. Following table indicate the quantity and respective cost which saved by replacing shredded rubber.

**Table no. 4- Cost comparative statement**

% replacement	Cement / $M^3$ (bags)	Sand / $M^3$ (brass)	Aggregate / $M^3$ (brass)	Shredded rubber / $M^3$ (brass)	Cost saved * Rs/ $M^3$
0%	8	0.14	0.830	0	0
5%	8	0.41	0.273	0.015	13.05
10%	8	0.41	0.261	0.029	26.1
15%	8	0.41	0.247	0.044	39.15

\* as per the location cost can be changed.

### 3. CONCLUSION -

Based on the experimental results and analysis, the following conclusions have been arrived

1. It was observed that compressive strength was reduced 9.3%, 20.18%, 40.67% with increasing the amount of rubber in concrete 5%, 10%, 15% of aggregate volume. As per other researcher study compressive strength can be increases by using silica fume. In addition, according to other researchers, compressive strength of rubberized concrete depended on two factors, one grain size and shape of rubber, second percentage added. as well as flexural and tensile strength also decreases with increase the amount of rubber in concrete.

2. Workability of concrete also decreases as per increasing the rubber. for maintain the workability, super plasticizer have to add. As per other researchers, workability decreases

with course aggregate but increases with fine aggregate of rubber.

3. Unit weight of concrete block decreases with increasing rubber percentage in concrete. This will act as a light weight concrete. if cost comparative study taken in to consideration, then cost can be saved as more as possible with increase in percentage of rubber in concrete. but there is limitation for using rubber in concrete because of it affect on strength.

4. If age of concrete and design consideration take it into account , aggregate can be replaced with 5% of shredded rubber for major project. In that percentage compressive strength could not change as per design strength. as well as this would help in the conservation of environment.

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