

# Use of Waste Tire Rubber Chips as a Partial Replacement to the Coarse Aggregates in Concrete

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## ABSTRACT

Concrete is one of the most extensively used construction material all over the world. Many scientists and researchers are in quest for developing alternate construction material that are environment friendly and contribute towards sustainable development. Huge amount of rubber tire waste is being generated day by day which creates the disposal problems and has many environmental issues as this scrapped rubber waste is an elastic material having less specific gravity, energy absorbent material can be used as a replacement material for obtaining lightweight concrete. The scrapped rubber can not be discharge of easily in the environment as its decomposition takes much time and also produces environmental pollution .In such a case the reuse of rubber would be a better choice. In order to reuse rubber wastes, it is added to concrete to enhance the properties of concrete. The objective of this study is to test the properties of concrete by replacing the waste rubber chips partially to the coarse aggregate in concrete with different percentage as 10%, 20% and 30% on volume basis. By literature review it is observed that it helps to reduce cracks and also helps to increase the durability and ductility of concrete. Because of rubber compressive strength of concrete decreases. So, to increase the compressive strength we are adding glass fiber to the weight of cement in concrete at percentage 0.5%, 1% and 1.5%. The glass fiber having high tensile strength, good thermal conductivity and also good chemical resistance.

**Keywords :** Reinforced Concrete, Workability, Compressive Strength, Tensile Strength, Bond Strength

## I. INTRODUCTION

In recent decades worldwide growth of automobile industry and increasing use of the cars as the main means of transport have tremendously boosted the tyre production. This has generated massive stockpiles of used tyres. In the early 1990's extensive research project where carried out on how to use used tyres in different applications. Scrap Tyres is composed of ingredients that are non-degradable in nature at ambient conditions. They usually produced Environmental mal-effects. One of the method for utilisation of these material is there used in concrete and other building products. From the micro economic perspective, the following issues should be

compared and evaluated when considering the application of such materials in the concrete:

1. Collection processing and transportation cost of scrap tyres
2. Reduction in the environmental cost of landfilling and increasing in landfill voids
3. Saving in the virgin material used to make concrete by substituting tyre rubber.
4. Rubber based is highly durable material and it is highly resistant to most of natural environment. As a result, disposal of used tire is a major concern as inappropriate disposal can to significantly environmental anesthetic problems. This is especially true in developing countries, where

environmental legislation is usually the only driving force behind the prudent management of used tires. Following the implementation of various EU directives, reuse and material recovery are considered as the most environmentally viable ways for managing waste material.

## II. Problem Statement

- Worldwide growth of automobile industry and increasing use of the cars as the main means of transport have tremendously boosted the tire production. This has generated massive stockpiles of used tires.
- Scrap Tires is composed of ingredients that are non-degradable in nature at ambient conditions. They usually produced Environmental mal-effects.

### • Objectives

Using recycled tyre Rubber in cement concrete can provide an efficient way of utilising rubber in addition to environmental benefits the use of tyre rubber particles could provide a new type of concrete with unique mechanical and fracture characteristics all the recycle tyre rubber has been widely used in highway Asphalt they are limited studies on its application in cement concrete some experimental work to examine the strength and toughness property of rubberized Portland cement concrete.

While concrete containing rubber did not exhibit brittle failure under compression or split tension there result indicates that there was always A reduction in the compressive strength when aggregate were replaced by a rubber some studies also show that by replacing a portion of aggregate with the rubber chips the compressive strength of concrete was decreased, while its toughness and ability to absorb fracture energy was significantly enhanced.

Mechanical properties of concrete containing tyre rubber particles have been investigated in many studies although the strength of rubber filled concrete to was reduced all of these studies show that adding waste tyre rubber to traditional concrete could result in an increase in the formal ability and ductility of rubberized concrete members therefore due to the higher toughness the waste tyre rubber filled concrete is expect to have higher fracture and cracking resistance.

The objective of the study is to introduce rubber chips in various precaution which is replaced by aggregate contain used in concrete mix for the improvement of impact strength of concrete.

The main goal of this recharge is to find the means of dispose of the rubber by placement the rubber in Portland cement concrete mix and still provider final product with good engineering properties for certain specified Engineering applications

## III. SCOPE OF PROJECT WORK

- Grade of concrete (M30).
- Aggregate  
10mm sized crushed angular aggregate.  
20 mm sized crushed angular aggregate
- Course aggregate
- Waste tyre Crumb rubber particle of size passing through 1.18 mm and retaining on 600  $\mu$
- Glass Fiber 6mm in length and 12  $\mu$  diameter
- Water :- Normal potable water
- To find out Workability of concrete.
- To find out Compressive strength
- To find out Tensile strength
- To find out Bond strength

**IV. RESULTS AND DISCUSSION**

**Workability**

The water cement ratio 0.41 is taken

W/C Ratio	% Replacement	Slump
0.41	00%	78mm
	05%	84mm
	10%	87mm
	15%	92mm
	20%	98mm

It is observed that with increase in rubber content workability of concrete increases.

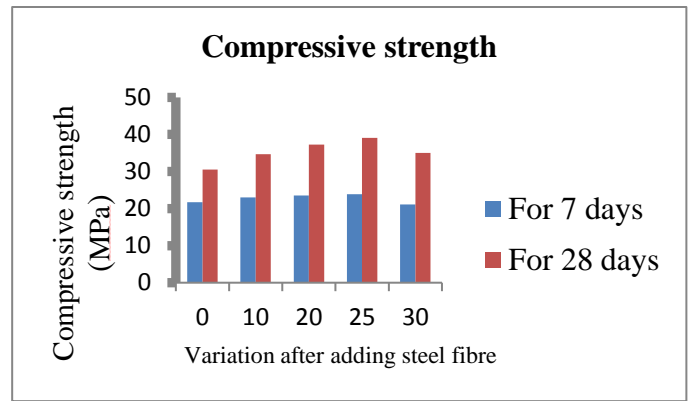
Compressive strength Compressive strength of cubes. Decreasing compressive strength of concrete increase by adding steel fibre in it.

% Replaced	3 Days	7 Days	28 Days	% decreased
Normal	11.38	22.05	31.87	0%
05%	10.26	20.23	28.50	11%
10%	8.64	16.50	23.18	27%
15%	7.98	15.13	21.18	33%
20%	7.6	13.76	18.90	41%

Table – Compressive strength of concrete after adding rubber chips.

% of steel fibre	3 Days	7 Days	28 Days
Normal	11.38	22.05	31.87
0.5%	11.36	22.06	31.86
1.0%	11.4	22.04	31.70
1.5%	11.35	22.03	31.83
2.0%	11.36	22.04	31.86

Table- Compressive strength of concrete after adding steel fibre



**Split tensile strength**

% of rubber in concrete	28 Days Strength	Avg. strength
Normal	3.93	4.02
	4.02	
	4.12	
5%+0.5% steel fibre	3.99	4.04
	2.99	
	2.95	
10%+1% steel fibre	3.97	4.045
	4.01	
	4.14	
15%+1.5 steel fibre	3.95	4.07
	4.15	
	4.12	
20%+2% steel fibre	3.93	4.05
	4.11	
	4.1	

Table- split tensile strength after adding steel fibre

**Flexural Strength**

From the result it was observed that higher the content of waste tire rubber chips decreases flexural strength of concrete.

This decreased strength can be increased by adding steel fiber to the weight of cement in different percentage.

% of rubber in concrete	28 Days strength	Avg. strength
Normal	4.6	4.75
	4.75	
	4.8	
5%+0.5% Steel fiber	4.65	4.71
	4.8	
	4.7	
10%+1% Steel fiber	4.75	4.73
	4.79	
	4.69	
15%+1.5% Steel fiber	4.58	4.65
	4.59	
	4.8	
20%+2% Steel fiber	4.8	4.73
	4.71	
	4.69	

Table- Flexural strength after adding steel fibre

## V. CONCLUSION

1. By adding the rubber chips in concrete the properties of concrete enhances.
2. The concrete becomes crack resistant.
3. It is easy to dispose the waste rubber generated from industries and vehicles.
4. As the quantity and size of rubber increases, the compressive strength of concrete decreases. That decreasing strength we can increase by adding glass fiber to the weight of cement.
5. it helps to produce an eco-friendly material which is not harmful for nature.
6. Waste tire rubber chips filled RC blocks specimens give better ductility than normal RC blocks specimens.
7. It is suitable for the members subjected to seismic forces.

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