

# Testing of Strength Parameters When Coarse Aggregate is replaced with Scrap Tyre Rubber in Concrete

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**ABSTRACT:** Concrete is a composite mixture of heterogeneous material which is used in construction, because of its high structural strength and stability. Scrap rubber the waste material which is obtained from useless vehicles .the replacement of coarse aggregate as a major ingredient of concrete by scrap tyre rubber will be a economic as well as environmental protective solution to the above problem. The present research work was carried out to study the strength and stability of concrete containing scrap tyre rubber as a partial replacement of coarse aggregate at various percentages. In this research the experimental investigations carried out in the M25 mix grade concrete is used with scrap tyre rubber in proportions of 0%,3%,6%,9%,12%.from this research this results are much better as compare to conventional concrete.

**KEYWORDS:** Scrap tyre rubber, Compressive strength, Split tensile strength

## I. INTRODUCTION

Tyre rubber wastes represent a serious environmental issue that needs to be addressed with urgency by the scientific community. investigations carried out so far reveal that tyre waste. Concrete is specially recommended for concrete structures located in areas of severe earthquake risk and also for applications submitted to severe dynamic actions like railway sleepers. This material can also be used for non load-bearing purposes such as noise reduction barriers. Investigations about rubber waste concrete show that concrete performance is very dependent on the waste aggregates. further investigations are needed to clarify for instance which are the characteristics that maximize concrete performance. Nevertheless, future investigations should clarify which treatments can maximize concrete performance being responsible for the lowest environmental impact. Mechanical trifurcation can be done to rubber scraps of post-used tyres from motor vehicles and trucks. They have long been investigated for resource reutilization as an aggregate in concrete resulting in the rubcrete mix, which can be conveniently used in various applications with promising effects. rubcrete provides a final product with good mechanical properties and also represents an effective and inexpensive way of recycling the discarded tyres, replacing partially or totally natural aggregates. Experimental investigation to study the structural characteristics of concrete using various combinations of rubber tyres for the partial replacements for coarse aggregates . when the rubber tyre pieces are replaced up to definite percentage of coarse aggregates, there is no decrease in strength. this thesis will investigate suitability of rubber tyre aggregate as a construction material. in this waste tyre rubber added concrete is termed as rubberized concrete. My present study aims to investigate the optimal use of waste tyre rubber aggregates as coarse aggregate in concrete composite.

## II. LITERATURE REVIEW

**K.C.Panda,P.S.Parthi and T.Jena** has investigated on Scrap tyre rubber replacement for aggregate in cement concrete Solid waste management has gained a lot of attention to the research community now a days. Out of the

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various solid waste, accumulated waste tyres, has become a problem of interest because of its non-biodegradable nature. Most of the waste tyre rubbers are used as a fuel in many of the industries such as thermal power plant, cement kilns and bricks kilns etc. This kind of usage is not environment friendly and requires high cost. Thus, the use of scrap tyre rubber in the preparation of concrete has been thought as an alternative disposal of such waste to protect the environment. In this study an attempt has been made to identify the various properties necessary for the design of concrete mix with the coarse tyre rubber chips as aggregate in a systematic manner. In the present experimental investigation, the M20 grade concrete has been chosen as the reference concrete specimen. Scrap tyre rubber chips has been used as coarse aggregate with replacement of conventional coarse aggregate

**Pravin A. Shirule, Mujahid Hussain** has investigated on -Reuse of scrap tyre as partial replacement of fine aggregate in concrete and its impact on properties of concrete. This paper suggests a safe and environmentally consistent method of disposal of tyre waste material. The fine rubber particles obtained during remoulding process of tyre at state transport workshop, Jalgoan are used for replacement of fine aggregate (sand) in certain percentage in concrete. The blends are prepared by replacing 0%, 3%, 6%, 9%, 12%, 15% and 18% of fine aggregate (sand) by fine rubber particle by weight. The mechanical property of wet concrete like density, compressive strength, split tensile strength and flexural strength are test for strength of concrete.

**N. Shah, Pradip D. Jadhao, S. M. Dumne** has investigated on the effect of chipped rubber aggregates on performance of concrete by Sunil. Due to rapid growth in automobile industry, use of tyre increases day to day and there is no reuse of the same to decrease the environmental pollution. The decomposition and disposing of waste tyre rubber is harmful to environment. This research reflects the reuse of waste tyre rubber into concrete after observing their properties. In that experimental work chipped rubber aggregates replaced to the natural coarse aggregates by varying percentage of 3, 6, 9 and 12 with comparison of 0% replacement. Silica fume is replaced in 10% with cement for improving the bond properties between cement paste and rubber. In evaluation test has been carried out to determine the properties of concrete such as workability, unit weight, flexural strength and split tensile strength. The workability of fresh concrete is observed with the help of compaction factor test. From the compaction factor, workability is decrease with increasing percentage of chipped rubber. The specific gravity of chipped rubber aggregates is lower as compared to natural aggregates therefore decrease the unit weight of rubber mix concrete. Increasing chipped rubber aggregates as partial replacement into concrete reduces compressive strength. So these can use in primary structural applications of medium to low strength requirements. The overall results of study that it is possible to use recycled rubber tyre aggregates in concrete construction as partial replacement to natural coarse aggregates.

### III. MATERIALS USED

#### Cement

An ordinary portland cement with 53 grade conforming to IS:2269-2013 was used. The cement is having a specific gravity of 3.04

#### Fine aggregate

Optimum quality of river sand was used as fine aggregate conforming to grading zone 11 of IS:383-1970 was used. Its specific gravity was 2.3.

#### Coarse aggregate

Coarse aggregate obtained from nearby quarry units has used for this study. Maximum size of aggregate used is 20mm with specific gravity 2.67

#### Scrap tyre rubber

Scrap tyre rubber is a material which is unfit for use by vehicles on road has been proposed as an alternative to coarse aggregate that gives reasonable benefit to concrete. It is used to increase the strength of concrete over concrete

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made with equal quantities of coarse aggregates. Scrap tyre rubber has been used for different activities in the construction industry such as in daily cover in landfills, septic fields and roads bed construction.

In this investigation scrap rubber tyre is collected from mechanic garages. It was observed the specific gravity of scrap tyre rubber is 1.19.

## Water

Throughout the experimental investigation potable water which is free from organic substances is used for mixing and curing.

## IV. EXPERIMENTAL INVESTIGATIONS

In the present study M25 grade concrete were designed as per IS:10262-2009

### A. Workability

Concrete as soon as it is freshly mixed was tested for workability by slump value. In this investigation, M25 mix concrete is considered to perform the test by weight basis by replacing 0%, 3%, 6%, 9%, 12% of coarse aggregate replaced by scrap tyre rubber.



Fig1: Mixing of scrap tyre rubber in concrete

### B. Compressive strength

In this investigation, M25 mix concrete is considered to perform the test by weight basis with 0%, 3%, 6%, 9%, 12% of coarse aggregate replaced by scrap tyre rubber. A concrete cube with mathematical dimensions of 150\*150mm was used as test specimens to determine the compressive strength of concrete cubes. The ingredients of concrete were thoroughly mixed until a uniform consistency was achieved. A proper compaction was given to the cubes all the concrete cubes were de-moulded with 24 hours of their casting. The de-moulded test specimens were properly cured in water available in the laboratory for a duration of 28 days. Compression test was conducted on a 2000KN capacity universal testing machine. The load was uniformly applied until the failure of the specimen occurs. The specimen was horizontally placed between the loading surfaces of the compression testing machine and load was applied without any sudden impact until the failure of the specimen occurred.

### C. Split tensile strength

In the investigation, M25 mix concrete is considered to perform the test by weight basis by replacing 0%, 3%, 6%, 9%, 12% of coarse aggregate by scrap tyre rubber. cylinders having mathematical dimensions of 150mm

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diameter and 300mm length were used as test specimen to determine the split tensile strength of concrete .the various ingredients of concrete were mixed thoroughly until uniform consistency was achieved .the cylinders were compacted properly. All the cylinders were de moulded within 24 hours after casting .the de-moulded test specimens were properly cured in water which is available in the laboratory for an age of 28 days .The split tensile strength was conducted as per IS:5816-1976.the specimen was placed horizontally between the loading surfaces of the compression testing machine and the load was applied without any sudden impact until the failure of the specimen occurred.

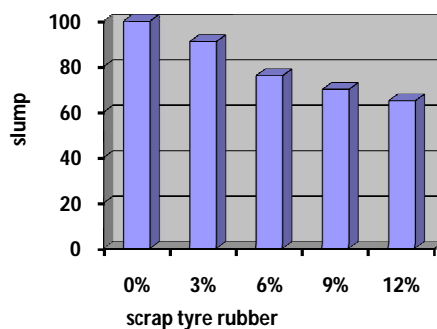
## V. RESULTS AND DISCUSSIONS

### A. Workability:

Slump test of various mix proportions of scrap tyre rubber in concrete are shown below.

**Table1:** Slump values with various proportions of scrap rubber tyre replacing coarse aggregate in M25 grade concrete

S.no	Scrap rubber tyre	Slump
1	0%	100
2	3%	91
3	6%	76
4	9%	70
5	12%	65



**Fig 2:** slump values when replacement of coarse aggregate by scrap tyre rubber

From the above slump results, it is observed that as scrap rubber tyre percentage is increasing the workability decreases

### B. Compressive Strength Test

The compressive strength of concrete was achieved in 28 days of various proportions and presented below The specimens were cast and tested as per IS: 516-1959.

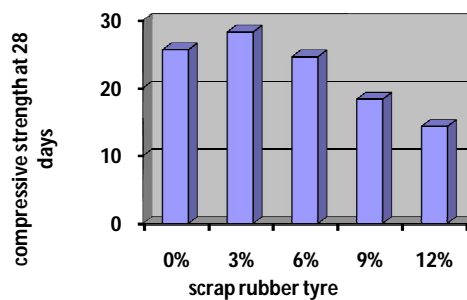
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**Table 2:** Compression test at 28 day with various proportions of scrap rubber tyre replacing coarse aggregate in M25 grade concrete.

S.no	Scrap rubber tyre	Compressive strength N/mm <sup>2</sup>
1	0%	25.61
2	3%	28.23
3	6%	24.59
4	9%	18.33
5	12%	14.33



**Fig3:** compressive strength values when replacement of Coarse aggregate by scrap tyre rubber

From the above compressive strength results, it is observed that scrap rubber tyre based concretes have achieved an increase in strength for 3% replacement of cement for 28 days when compared to conventional concrete

### C. Split Tensile Test

The tensile strength of concrete with 28 days curing period for various proportions and presented below The specimens were cast and tested as per IS: 516-1959.

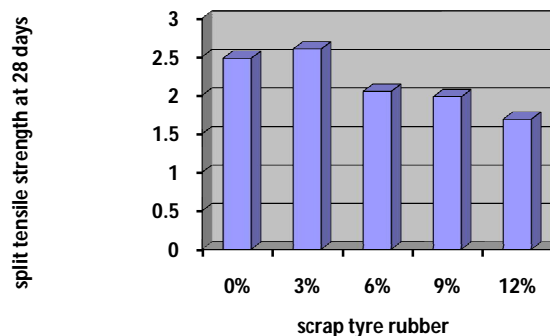
**Table 3:** Split tensile test at 28 day with various proportions of Scrap rubber tyre replacing coarse aggregate in M25 grade concrete

S.No	Scrap rubber tyre	Split tensile strength N/mm <sup>2</sup>
1	0%	2.48
2	3%	2.6
3	6%	2.05
4	9%	1.98
5	12%	1.69

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**Fig4: split tensile strength values when replacement of coarse aggregate by scrap tyre rubber**

From the above split tensile strength results, it is observed that scrap tyre rubber based concretes have achieved an increase in strength for 3% replacement of cement for 28 days when compared to conventional concrete

## VI. CONCLUSION

Based on the experimental investigations the following conclusions are drawn:

- Slump values are decreased as the percentage of replacement of scrap tyre rubber increased. So decrease in workability.
- The compressive strength is decreased as the percentage of replacement increased, but rubber concrete developed slightly higher compressive strength than those of without rubber concrete.
- The split tensile strength is increased with decreased percentage of scrap tyre rubber.
- Decrease in compressive strength, split tensile strength of the specimen due to lack of proper bonding between rubber and cement paste matrix.
- From the above compressive strength results, it is observed that scrap tyre rubber based concretes have achieved an increase in strength for 3% replacement of coarse aggregate for 28 days when compared to conventional concrete.
- From the above split tensile strength results, it is observed that scrap tyre rubber based concretes have achieved an increase in strength for 3% replacement of coarse aggregate for 28 days when compared to conventional concrete.
- From the above experimental investigation scrap rubber tyre can be used as alternate material to coarse aggregate up to 3%.

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## REFERENCES

- [1] Pravin A. Shirule, Mujahid Husain- Reuse of scrap tyre as partial replacement of fine aggregate in concrete and its impact on properties of concrete
- [2] Eldhose C., Dr. Soosan T. G. Studies on Scrap Added Concrete for Rigid Pavements
- [3] Kotresh K.M1, Mesfin Getahun Belachew Study On Waste Tyre Rubber As Concrete Aggregates
- [4] Sunil N. Shah1, Pradip D. Jadhao1, S. M. Dumne2 Effect of Chipped Rubber Aggregates on Performance of Concrete
- [5] IS 2386: Part 3: "Methods of Test for Aggregates for concrete" Part 3, 1963.
- [6] IS 4031: Part 4: "Methods for physical test for hydraulic cements", Bureau of Indian standards, New Delhi, 1988.
- [7] IS 516:1959, "Method of Test for Strength of Concrete", Reaffirmed 2004, Bureau of Indian standards, New Delhi.
- [8] IS 10262 -2009 "IS Method of Mix Design", Bureau of IndianStandards, New Delhi.