TO STUDY THE IMPACT OF CRUMB RUBBER ON YOUNG'S MODULUS OF CONCRETE

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Abstract - *Large quantities of scrap tires are generated each year globally. This is dangerous not only due to potential environmental threat, but also from fire hazards and provide breeding grounds for rats, mice, vermin's and mosquitoes. Over the years, disposal of tires has become one of the serious problems in environments. Land filling is becoming unacceptable because of the rapid depletion of available sites for waste disposal. In order to prevent the environmental problem from growing, recycling tire is an innovative idea or way in this case. In this, we study the impact of crumb rubber on Young's modulus of concrete. A modified concrete is prepared by replacing fine aggregates in concrete with rubber aggregates by varying the replacement proportion from 0% to 20% with increment of 5%.To manufacture a rubber concrete block by altering the percentage proportion of crumbled rubber aggregates in place of fine aggregates and study its properties and perform the tests. Concrete of grade M30 is prepared.*

Keywords – *Scrap tires, Crumb rubber, strength, cement, concrete (M30*)

1. INTRODUCTION

Concrete is a composite material composed of water, coarse granular material (the fine and coarse aggregate or filler) embedded in a hard matrix of material (the cement or binder) that fills the space among the aggregate particles and glues them together. Concrete is widely used for making architectural structures, foundations, brick or block walls, pavements, bridges or overpasses, highways, runways, parking structures, dams, pools/reservoirs, pipes, footings for gates, fences and poles and even boats. Concrete is used in large quantities almost everywhere mankind has a need for infrastructure

Even if rubber tyre aggregate was used at relatively low percentages in concrete, the amount of waste tyre rubber could be greatly reduced due to the very large market for concrete products worldwide. Therefore the use of discarded tyre rubber aggregates in concrete shows promise for developing an additional route for used tyres.

According to the reports, globally 15 million tonnes of waste tyres are generated annually, out of which India contributes one million tonnes.

Main objective of this project is to determine "**TO STUDY THE IMPACT OF CRUMB RUBBER ON YOUNG'S MODULUS OF CONCRETE"**. In this study we will find the impact of crumb rubber on young's modulus of concrete by replacing fine aggregates with 5%, 10%, 15% and 20% rubber.

2 – MATERIAL AND DESIGN METHODOLGY

2.1. Materials

The properties of material used for making concrete mix are determined in laboratory as per relevant codes of practice. Different materials used in present study were cement, coarse aggregates, and fine aggregates, in addition to plastic bags and iron slag.

Ordinary Portland cement - Ordinary Portland cement of grade 43 was used in concrete. OP cement does not contain any pozzolanic material. Consistency of Cement was found to be 29% and it was well sound with a tensile strength of 3.8 N/mm^2 after 7 days and compressive strength of 48 N/mm^2 after 28 days.

Aggregates -

- Fine aggregate: fine aggregate was used locally available. It was sieved through 2.36mm IS sieve. Fineness modulus was 3.39, and of zone - II

- Coarse aggregate: broken granite rocks of size 10mm and 20mm which were used, of abrasion value of 30%, crushing value of 24.3%

Rubber – Crumb rubber is used in place of fine aggregates with a replacement of 5%, 10%, 15% and 20%.

Water - The potable water from the college was used for mixing and curing the concrete.

2.2. Methodology

In this study we follow the under mentioned model for the design, planning, implementation and achievement of the project:

- The materials to be used will be collected.
- Various tests on the materials will be done to check quality standards.
- Mix design of the concrete will be done (M30). After that fine aggregates will be replaced in different percentages.
- Three cubes will be casted for every percentage of replacement. The dimension of test cube is 0.15m x 0.15m x 0.15m. According to the volume of material required for 3 cubes, materials are gathered and are mixed to prepare the concrete.
- The prepared concrete will then be casted in the form of test cubes. The cube while being filled is tamped by tamping rod to reduce the number of voids in concrete.
- The cube will be left for 24 hours to gain shape.
- After 24 hours, the cubes then will be taken off from the moulds.
- They will be left for curing afterwards.
- Then their compressive strength will be checked from 7, 14 and 28 days from casting.
- Analysis of results will be done then.
- Load Displacement data will be obtained with the help of computerized utm
- The corresponding stress and strain will be determined for each case.

Fig: Computerized Testing Machine Setup

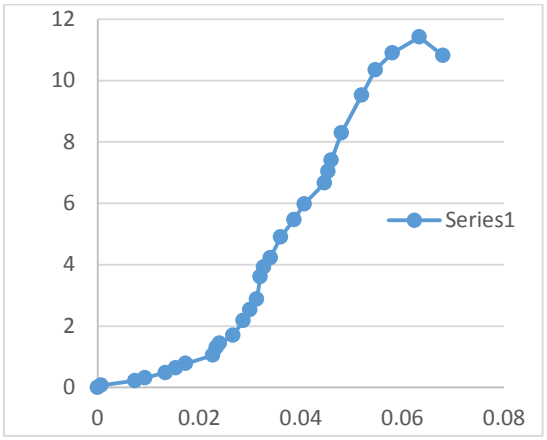
3. TEST RESULTS AND ANALYSIS

A) For tests of raw material

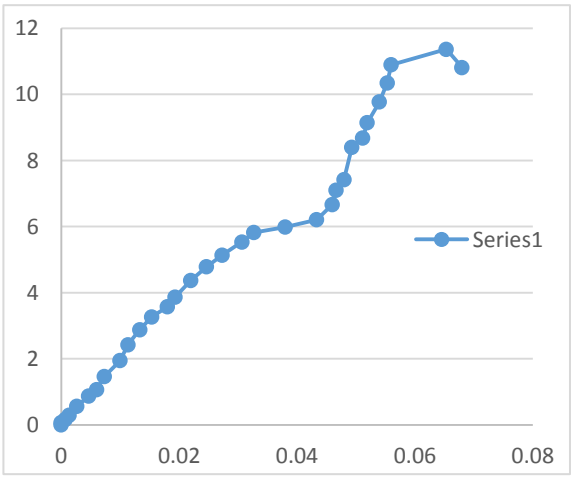
- The consistency of cement 29 %
- The initial and final setting time of cement 30 min and 630 min
- The Soundness of cement 1mm
- The specific gravity of cement 3.18
- The Tensile strength 3.8 N/mm²

- The Bulking of sand 25 %
- The specific gravity of Fine Aggregate 2.67
- The crushing Value 47.4 %
- The Impact Value 17.4 %
- The concrete was made and the slump was recorded as20 mm
- STRESS STRAIN CURVES

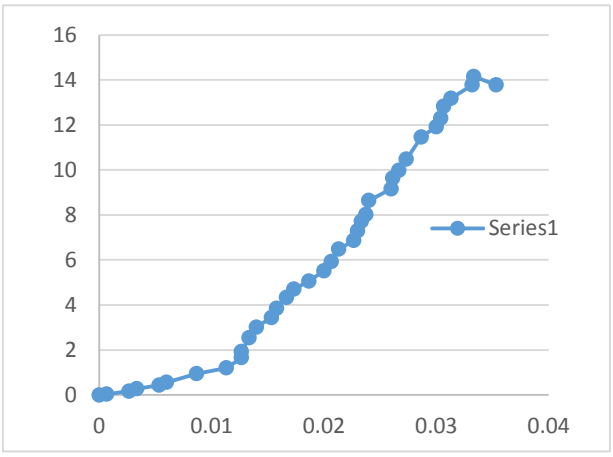
5% RUBBER CURED FOR 7 DAYS



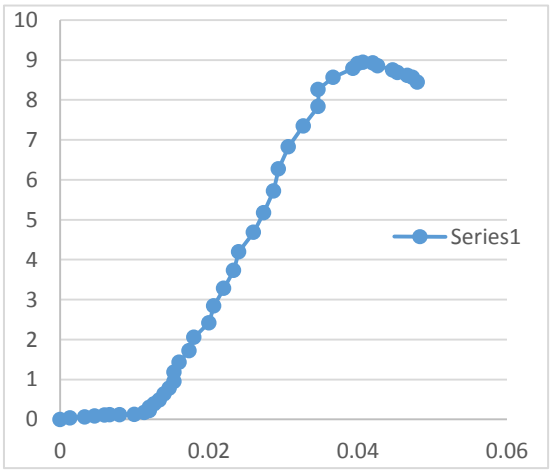
10% RUBBER CURED FOR 7 DAYS



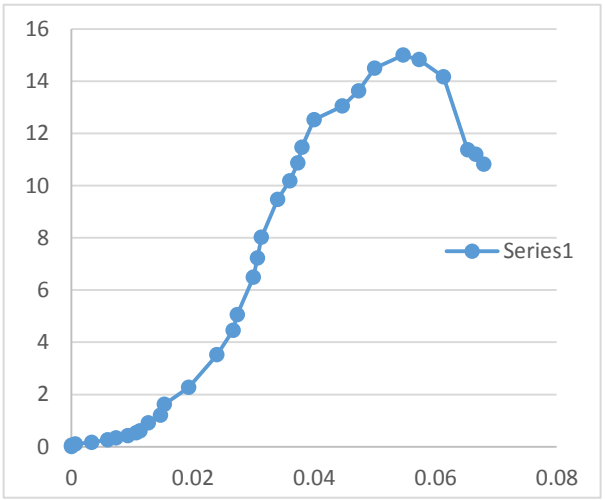
15% RUBBER CURED FOR 7DAY



20% RUBBER CURED FOR 7 DAY



5% RUBBER CURED FOR 14 DAYS



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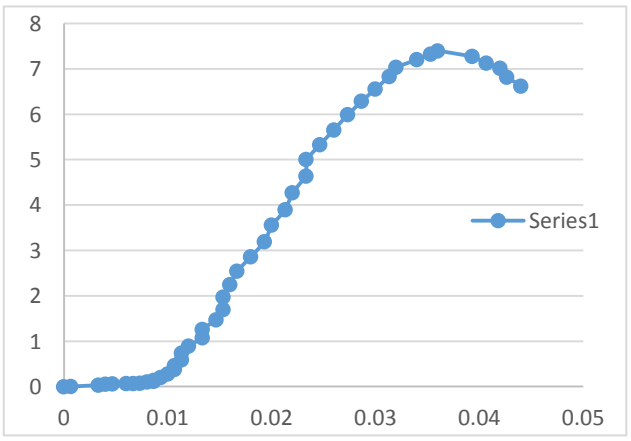
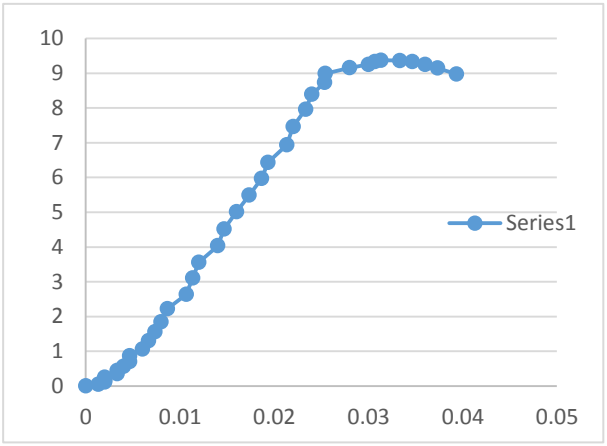
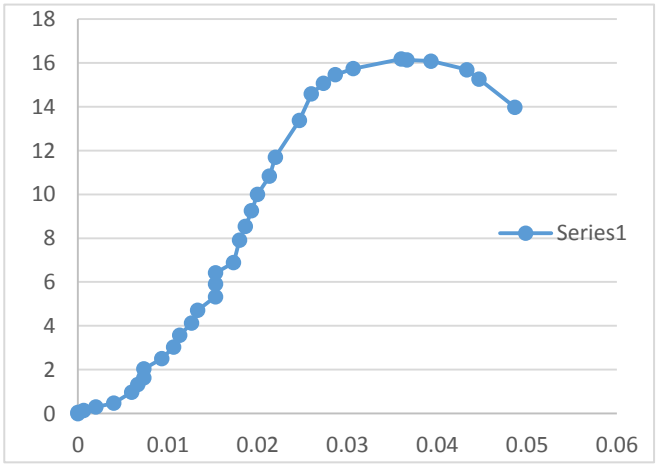


15% RUBBER CURED FOR 14 DAYS

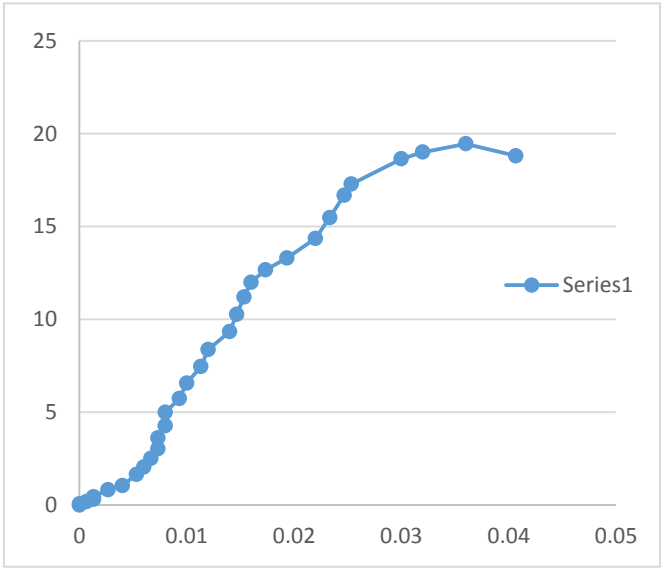


20% RUBBER CURED FOR 14 DAYS

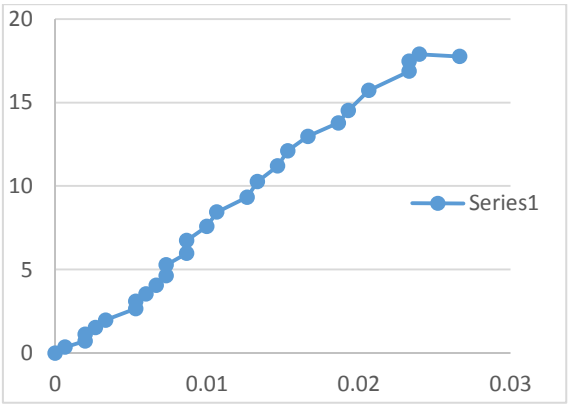


STANDARD BLOCK 21 DAYS

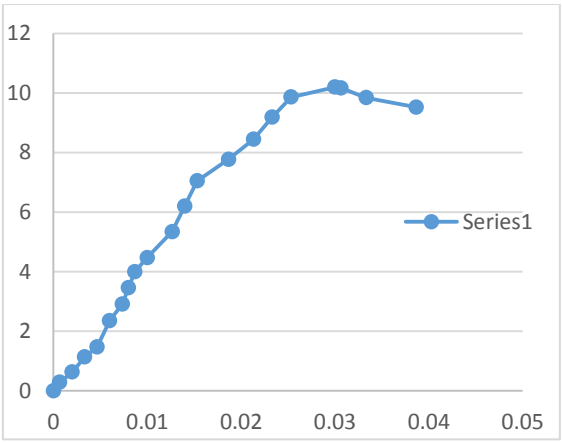
5% RUBBER CURED FOR 28 DAYS



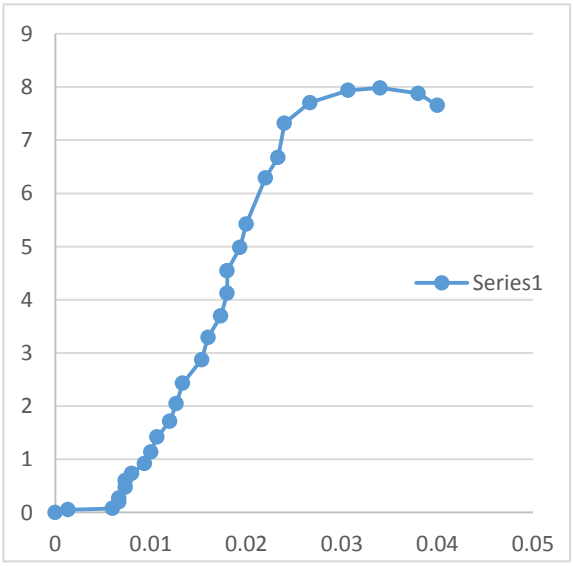
10% RUBBER CURED FOR 28 DAYS



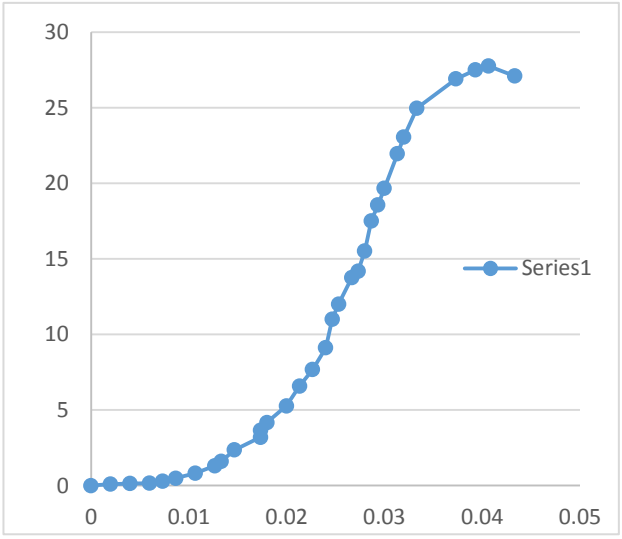
15% RUBBER CURED FOR 28 DAYS



20% RUBBER CURED FOR 28 DAYS



STANDARD 28 DAYS



Compression = 30 N/mm^2

Young's Modulus = $4700(f_{ck})$ ^.5=25742 N/mm^2

DAYS	PERCENTAGE	Compressive Strength (N/mm^2)	Young Modulus (N/mm^2)	% Change in Compression	% Change in Young Modulus
7 DAYS	5	14.52	17912.146	49.1	30
14 DAYS		14.99	18197.62	48.9	29.3
28 DAYS		19.44	20727.42	35	19
7 DAYS	10	11.25	15766.61	62.4	38.7
14 DAYS		14.15	17683.21	52.8	31.3
28 DAYS		17.88	19878.77	40.4	22.77
7 DAYS	15	8.94	14054.66	70	45.4
14 DAYS		9.36	14386.72	68.8	44.1
28 DAYS		10.19	15007.35	66.03	41.7
7 DAYS	20	5.98	11499.80	80	53.38
14 DAYS		7.4	12785.38	75.3	50.66
28 DAYS		7.98	13378.82	73.33	48.5
14 DAYS	Standard	16.17	18901.55	46	26.5
28 DAYS		28	24766.26	3.79	7.48

4 – CONCLUSIONS

Ultimate Load for each Case (KN)

PERCENTAGE	7 Days	14 Days	28 Days
5	326.80	337.30	437.60
10	253.20	318.5	402.5
15	201.20	210.80	229.4
20	134.7	166.5	179.6
Standard	-	363.9	624.5

The Strength of Concrete for Standard Block of 28 days is = 28 N/mm^2 as compared to the 30 N/mm^2 for the design mix prepared.

Thus the load displacement curves of each case were determined with the help of a computerized utm machine and the corresponding values of stress and strain are found and ultimately the modulus of elasticity

Based upon the relative changes in strengths and young modulus the block with 10% rubber cured for 28 days is suitable for imparting toughness in construction.

- Hence, concrete with rubber reduces the compressive and the young modulus of the concrete.
- To reduce the rubber waste and put it into utility the rubber can be added up to 10% of the fine aggregates added.
- The reduction in compressive strength was nearly 40%
- The reduction in young modulus was about 23%.
- These were the results and conclusions for our research.

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