

EXPERIMENTAL STUDY ON RUBBERISED CONCRETE

Neel gajera¹, payal patel², Hardik patel³

¹Post Graduation Student, Department of Civil Engineering, CGPIT, Uka Tarsadia University, Bardoli, Gujarat, India.

²Assistant Professor, Department of Civil Engineering, CGPIT, Uka Tarsadia University, Bardoli, Gujarat, India.

³Assistant Professor, Department of Civil Engineering, CGPIT, Uka Tarsadia University, Bardoli, Gujarat, India.

ABSTRACT: *Solid waste management is one most important environmental concern worldwide. Concrete is third most important resource used by humans after air and water. The most commonly used coarse aggregate is crushed rock ballast. The manufacture of coarse aggregate by crushing rock ballast causes environmental pollution. Now a day there is a scarcity of coarse aggregate due to increase in cost and infrastructural growth. This mainly directed towards exploring the possibilities of making effective use of alternative materials. In many research tyre rubber is used to replace coarse aggregate. The present study is to produce rubberized concrete by partial replacement of coarse 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 scrap rubber on different proportion of coarse aggregate and, compressive strength for 7days, 14days, 28days and other mechanical properties measured. It has been observed from the previous research data that the overall strength concrete decreases as per the rubber particles increases when compared to ordinary concrete. Rubberized concrete mixes may be suitable for structural and nonstructural purposes such as lightweight concrete walls, building facades and architectural units. The crumb rubber with concrete will find new areas of usage in highway construction as a shock absorber, in sound barriers as a sound absorber, and also in buildings as an earthquake shock-wave absorber.*

Keywords— waste tire, crumb rubber, concrete, coarse aggregate, strength properties, waste disposal

I. INTRODUCTION

Concrete is one of the most popular construction materials. Due to this fact, the construction industry is always trying to increase its uses and applications and improving its properties, while reducing cost. In general, concrete has low tensile strength, low ductility, and low energy absorption. Concrete also tends to shrink and crack during the hardening and curing process. These limitations are constantly being tested with hopes of improvement by the introduction of new admixtures and aggregates used in the mix. One such method may be the introduction of rubber to the concrete mix. The use of recycled rubber as partial aggregate in concrete has great potential to positively affect the properties of concrete in a wide spectrum. It is a perfect way to modify the properties of concrete and recycle rubber tires flaps at the same time. The best way to overcome this is to find alternate aggregates for construction. The generation of such waste tyres far exceeds than that which are now being recycled. Waste rubber tyres cause serious environment problems all around the globe. Thus, this accumulated waste material can be used for the civil engineering construction.

II. PROPERTIES OF RUBBER

Crumb rubber is being used in concrete as a partial replacement to fine aggregate to produce rubbercrete. In comparison to fine aggregate it has lower specific gravity ranging from 0.51 to 1.2, bulk density ranging from 524 kg/m³ to 1273 kg/m³, lower water adsorption, strength and stiffness. Crumb rubber is hydrophobic and non-polar material which repels water and entraps air into its surface. It also has a different gradation compared to fine aggregate which falls below the lower limit of the curve in particle size analysis. Therefore when it partially replaced fine aggregate in rubbercrete, it changes the grading to a non-continuous aggregate gradation. Partial replacement of fine aggregate with crumb rubber in rubbercrete is normally done by volume of the materials due to the lower specific gravity of crumb rubber compared to fine aggregate.

III. LITERATURE REVIEW

A. K. Paul Sibiyone*, M Lenin Sundar, “Experimental Study on Replacing Waste Rubber as Coarse Aggregate”, International Journal of ChemTech Research, Department of Civil Engineering, Sri Krishna College of Technology, Coimbatore, India.

This research evaluated the reuse potential of recycled tire flap chips as coarse aggregate in concrete mixes. An extensive literature review was performed on the rubberized concrete focusing on the tire chips as coarse aggregate replacement. The test results of this study indicate that there is great potential for the utilization of waste tyres in concrete mixes in several percentages, ranging from 10 to 40 percent. From this present study it has been concluded that

maximum strength is obtained by 10% replacement of coarse aggregate even 40 percent of replacement of coarse aggregate give more strength than the nominal concrete. Concrete with higher percentage of flap rubber possess high toughness From the present experimental study, Rubberized concrete strength may be improved by improving the bond properties of rubber aggregates

Table 1. Compressive strength results

Compressive strength (N/mm²)		
% of rubber	7th day	28th day
Nominal	15.1	24.9
10	19.06	29.33
20	18.77	28.89
30	18.20	28.00
40	17.04	26.22

Table 2. Tensile strength results

Tensile strength (N/mm²)		
% of rubber	7th day	28th day
Nominal	1.27	2.40
10	1.93	2.97
20	1.83	2.68
30	1.55	2.546
40	1.41	2.26

Table 3. Flextural strength results

Tensile strength (N/mm²)		
% of rubber	7th day	28th day
Nominal	2.01	3.1
10	2.47	3.8
20	2.27	3.5
30	2.21	3.4
40	2.08	3.2

B. Er. Yogender Antil , “An Experimental Study on Rubberized Concrete” , International Journal of Emerging Technology and Advanced Engineering (IJETA), S.E, I.G.C.E Mohali .

The test results of this research indicate that there is great potential for the utilization of waste tyres in concrete mixes in several percentages, ranging from 5% to 20%. The split tensile strength of the concrete decreases about 30% when 20% sand is replaced by crumb rubber. The split tensile strength of the concrete decreases about 30% when 20% sand is replaced by crumb rubber. The compressive strength of the concrete decreases about 37% when 20% sand is replaced by crumb rubber.

C. Darshan H A, Puru V, Manjunatha R, Naveen Kumar N V, Naveen B M , “An Experimental Study on Rubberized Concrete”, International Journal of Innovative Research in Science, Engineering and Technology , Department of Civil Engineering, Jain Institute of Technology, Davangere, Karnataka, India.

The experimental study investigated the use of recycled tyres for partial replacement of fine aggregates in concrete using fraction of 5%, 10%, 15% and 20%. Based on experiment The compressive strength of the concrete for mix containing 5% crumb rubber shows higher value when compared to the other mix proportions. In split tensile strength, the strength of crumb rubber concrete is lower than the strength of conventional concrete. The use of crumb rubber in concrete mix is very much beneficial to environmental concern and to solve the problem related to disposal of waste tyre rubber throughout the world.

Table 4. compressive strength results

PROPORTIONS	Cube Compressive Strength in MPa	
	7 DAYS	28 DAYS
NC	19.20	29.99
5 % CR	21.26	31.89
10% CR	18.14	27.22
15% CR	15.92	23.89
20 % CR	14.09	21.14

Table 5. Split tensile strength results

PROPORTIONS	Split tensile Strength in MPa	
	7 DAYS	28 DAYS
NC	2.16	3.24
5 % CR	1.79	2.69
10% CR	1.72	2.58
15% CR	1.56	2.35
20 % CR	1.38	2.08

IV. CONCLUSIONS

- From this present study it has been concluded that maximum strength is obtained by 10% replacement of coarse aggregate even 40 percent of replacement of coarse aggregate give more strength than the nominal concrete. Concrete with higher percentage of flap rubber possess high toughness From the present experimental study, Rubberized concrete strength may be improved by improving the bond properties of rubber aggregates.
- Failure of plain and rubberized concrete in compression and split tension shows that rubberized concrete has higher toughness.
- The split tensile strength of the concrete decreases about 30% when 20% sand is replaced by crumb rubber.
- The flexural strength of the concrete decreases about 69% when 20% sand is replaced by crumb rubber.
- The compressive strength of the concrete decreases about 37% when 20% sand is replaced by crumb rubber.
- For large percentage of crumb rubber the compressive strength gain rate is lower than that of plain concrete.

V. SCOPE OF WORK

The waste tire crumb rubber was used as an alternative of river sand and its properties were investigated. So in such cases waste materials are used to modify the mechanical properties of concrete to make it suitable for any situation. This would also additional benefits in terms of reduction in cost, energy savings, promoting ecological balance and conservation of natural resources.

REFERENCES

- [1] K. Paul Sibiyone*, M Lenin Sundar , “Experimental Study on Replacing Waste Rubber as Coarse Aggregate” , International Journal of ChemTech Research, Department of Civil Engineering, Sri Krishna College of Technology, Coimbatore, India. ISSN: 0974-4290, Vol.10 No.14, pp 287-293
- [2] Er. Yogender Antil , “An Experimental Study on Rubberized Concrete” , International Journal of Emerging Technology and Advanced Engineering (IJETA) , S.E, I.G.C.E Mohali . (ISSN 2250-2459, ISO 9001:2008 Certified Journal, Volume 4, Issue 2, February 2014)
- [3] Darshan H A, Puru V, Manjunatha R, Naveen Kumar N V, Naveen B M , “An Experimental Study on Rubberized Concrete”, International Journal of Innovative Research in Science, Engineering and Technology , Department of Civil Engineering, Jain Institute of Technology, Davangere, Karnataka, India. (An ISO 3297: 2007 Certified Organization) Vol. 6, Issue 7, July 2017
- [4] IS 10262:2009, Indian Standard for Concrete Mix Proportioning Guidelines, Bureau of Indian Standard, New Delhi.
- [5] IS 456:2000, Indian Standard for Plain and Reinforced Concrete Code of Practice, Bureau of Indian Standard, New Delhi.