

WASTE RUBBER TYRE AS AN AGGREGATE IN CONCRETE

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Abstract: Huge amount of rubber tyre waste is being generated day by day which creates the disposal problems and environmental issues. This paper presents an overview of the previous researches carried out on the use of waste rubber as partially replacement of natural fine and course aggregate in traditional concrete mixtures. This has the additional advantage of saving in natural aggregates used in the production of concrete which are becoming increasingly scarce. This research investigated a wide range of physical and mechanical properties of concrete containing recycled tyre aggregates, to assess its suitability as a construction material. The study show that despite of losses in strength, these type of concrete is useful for various applications which require medium or low compressive strength. Different properties like compressive strength, tensile strength, Workability were investigated and compared with ordinary concrete. The study also show that compressive strength of rubberized concrete can be increased by adding some amount of silica to it.

Keywords : Solid waste management, used tyre rubber, Rubber Aggregates, Compressive Strength, Silica.

I. INTRODUCTION

Concrete is one the most extensively used construction material all over the world. There is need for developing alternate construction material that are environment friendly and contribute towards sustainable development. Huge amount of rubber tyres waste is being generated day by day which creates the disposal problem and has many environmental issues. An emerging use is the production of concrete, in which tyre rubber particles partially replace natural aggregates. This has the additional advantage of saving in natural aggregates used in the production of concrete which are becoming increasingly scarce. As this scrap rubber waste is an elastic material having less specific gravity, energy absorbent material can be used as a replacement material for obtaining lightweight concrete.



Fig: Dumping of Waste Tyre

II. Problem Statement

Worn out tyres which may be throw on open grounds, then these places may turns to landfills. These tyre wastes slowly raised enormously due to these depletion of land filling occurs.

Accumulation of these stock piles of tyres will not degrade easily but it takes more than 100 years of time because due to presence of cross – links between the rubber polymer chains.

Availability of natural sand conforming to required standards for use in concrete is diminishing day by day and is severely affecting the construction industry.

On the other hand, disposal of used rubber tyres is an environmental, health and aesthetic problem as its recycling is extremely difficult.

III. Objectives

General Objective Most of the time, used tire rubber is not noticed to be applied in a useful way. It is rather becoming a potential waste and pollutant to the environment. Moreover, the collecting process of waste tires is not very costly as compared to the extraction or production of mineral aggregates used in normal concrete. Hence, this study is intended to show the feasibility of using crumb rubber concrete as a partial replacement for coarse aggregate in concrete. The general objective of this research is to evaluate the fresh and hardened properties of the concrete produced by replacing part of the natural coarse aggregate with an aggregate produced from locally available recycled tire rubber.

The specific objectives of the research are listed as follows:

- To introduce an environmental friendly technology, which can benefit the society and the nation.
- To use waste tires as an alternative construction material.
- To find the advantages and disadvantages of using rubber tyre as an aggregate in conventional concrete.

Partial replacement for stone aggregate with rubber as an aggregate in Civil engineering applications.



IV. Scope Of The Project Work

By observing the current scenario we can surely say that in future there will be great expansion of infrastructure.

- Architectural applications such as nailing concrete, false facades, stone backing, and interior construction because of its light unit weight.
- Low-strength-concrete applications such as sidewalks, driveways, and selected road construction applications.
- Crash barriers around bridges and similar structures because of its high toughness (high plastic energy absorption). It is also speculated that the material can be used in sound barriers and vibration-control applications.

There is a potential large market for concrete products in which inclusion of rubber aggregate would be feasible. These can also include non- primary structural applications of medium to low strength requirements, benefiting from other features of this type of concrete. 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.

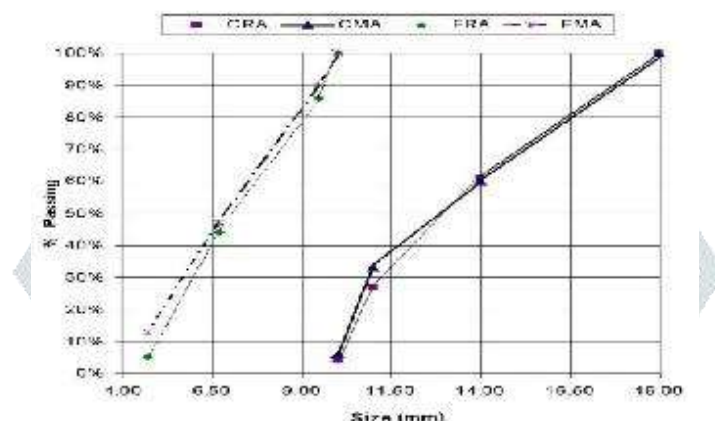
V. Mix proportion

From the studied literature papers we have found that the percentage used was upto maximum of 40%. Hence we have decided to replace conventional aggregate with crumbed rubber as an aggregate by 10% ,20% and 30% of conventional coarse and fine aggregate respectively.

Mix Proportion of M15 was decided as the use of such concrete can only be used where low compressive strength is required. By considering the densities of rubber aggregate and Natural aggregate, replacement of the aggregates was performed with respect to their volumes.

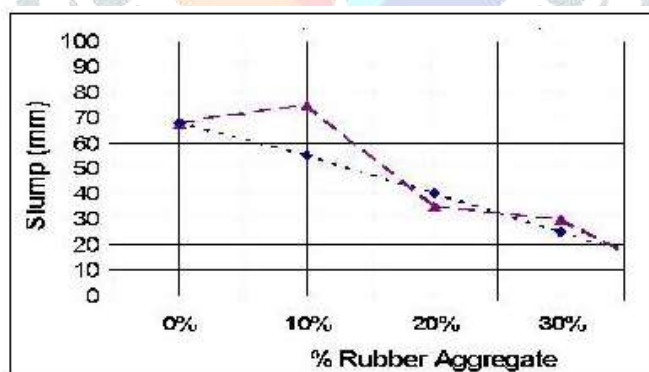
Tests

Sieve analysis was done for the rubber crumbs before the casting of cubes



Particle size distribution of rubber crumbs

Slump cone test was done to study the workability of rubberized concrete



Different tests were conducted such as Compressive strength , tension tests and were compared with conventional concrete, the results of M15 grade rubberized concrete with different percentages of rubber compared with conventional M15 grade concrete are given below.

Compressive strength loss compared with conventional concrete						
Replaced rubber %	Rubberized concrete			Rubberized concrete with silica		
	10%	20%	30%	10%	20%	30%
7 days	10.02%	7.18%	4.32%	8.82%	4.56%	1.75%
14 days	11.31%	7.40%	6.17%	7.36%	4.77%	3.53%
28 days	10.88%	8.9%	5.48%	3.8%	7.2%	20.2%

Conclusion: From the present experimental study and literature review it can be concluded that despite the observed lower values of the mechanical properties of concrete there is a potential large market for concrete products in which inclusion of rubber aggregate would be feasible. Therefore the use of discarded tyre rubber aggregates in concrete shows promise for developing an additional route for used tyres. Decreasing of bond strength was observed with increasing the crumb rubber size and content. It is not recommended to use micro silica in rubberized concrete as compressive strength was not increased. It is recommended to use rubberized concrete small structures like road curbs and non-bearing walls.

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