International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395 -0056
Volume: 04 Issue: 06 | June -2017 www.irjet.net p-ISSN: 2395-0072

Waste Management By Utilization Of Tire Rubber Aggregate In Concrete

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Abstract - Concrete is one of the most important parts of civil engineering application. The utilization of concrete is growing day by day in the industry of construction. On the others sides non- biodegrade waste things like water bottles and various types of plastic, crumb or shredded rubber etc. are accommodation of this types of waste materials creates a serious environmental problem and pollute waste air and soil. The motto for this investigation to find out the percentage comparison for the replacement of normal aggregate to rubber aggregate on which it acts as standard normal concrete. The test is made by varying percentage of rubber aggregate from 10%, 15%, and 20% with normal aggregate.

***Key Words*: Rubber Aggregate, Compressive Strength, Flexural Strength, Workability and Unit Weight.**

1. INTRODUCTION

Day by day automobile industry is increasing and also increase subsequent in tire manufacturing, tire waste has created big problems. A substance like rubber which originates from waste tires as not ways to degraded & fall apart within the environment that indicates it is a non-biodegradable so they are considered as a major problem in our environment. The United States of America, there show that in every year more than 2700 hundred thousand vehicle & other automobile is being tagged as used which finally goes to scrap. Approximately 49 of 50 states in [USEPA, 1999] was made a legal guideline or rules for scrap-tire control applications and were beneficially applied in lots of states. As well as India also a proficient road system & it is essential reuse, it help in connecting other area and city for socio-economic development. Last few years the usage of vehicles has increased for the development of living standards, on increasing vehicle during on the road when regularly then its degradation is obvious along with their tires & by the accumulation of the waste tires to be useless. Tires disposed of without problems by means of both burnings or by using dumping. Disposal with the aid of burning result air pollution, wasting of useful land. Many progressive solutions had been proposed to solve this trouble. Therefore, the use of waste tire rubber has been thought to utilize as an aggregate in partial replacement in course aggregate to save the nature. Hence it can be said that rubberize concrete can be used in serval places where the durability or deformation has importance over this strength like it can be used in bridges pole foundation. Due to its remarkable property of dumping it can be used to rashes it the along structural vibration which beneath effect consequences. In petroleum industry and Portland cement concrete rubber elements is used as last circulating particles and in the asphaltic pavement. Experiments permed show that unused tire can be used as a partial replacement with normal aggregate without affecting the physical properties, weight %. This study has given the idea to the contractor & investors to deal with the waste material tire rubber to their used which ultimately save the nature, resources & economically.

1.1 Recycling rubber aggregate

The process of creating a new product by using the used material is known as recycling. Recycling rubber aggregate can be used as a replacement material for the reduction of uses natural aggregate as the recycling rubber aggregate consists of the crushed waste tire, graded inorganic material and its come from vehicle's old tire.

Fig -1: Rubber aggregate

1.2 Procedure of recycling tires as a various sizes aggregate

The various methods and machinery available for processing waste tires are recycling below.

Scrap tires rubber: They can be managed as a scrap rubber, slit rubber, shredded rubber, chipped rubber, ground rubber and crumb rubber product.
Slit Tires rubber: This waste tire generated by cutting machine. The tire is broken down into two component.
Shredded Tires rubber: This includes two faces primary & secondary, in primary larger box cutter down into smaller once in secondary shredding the smaller pieces are again into little one.

Chipped rubber: The rubber has a measurement of about 25-30 mm. It became used to the normal aggregates in concrete.

Ground Rubber: In this process, the small pieces are further chipped down to their minimum size. It can be down to their processes of the dual circle & magnetic process which separate the desired pieces.

Crumb Rubber: It is similar to the ground rubber which size vary from 4.75 to 0.1 mm which generally can be three processes. These processes are the granular process, micro mill process, & cracker mill process.

2. OBJECTIVE:

- Investigate the utilization of rubber aggregate as some replacement in normal aggregate by workability test, compressive strength, flexural strength and unit weight.
- The main motto of the research is to find a substitute for Coarse aggregate in concrete. If rubber tires can successfully replace the coarse aggregate in concrete mixes, that will create concrete economical and save the environment as well and reduces the landfill problems.

3. EXPERIMENTAL METHODOLOGY:

3.1 Mixing & casting of concrete specimens:

- The objective of mixing is to obtain a uniform and consistent of cement, water, aggregate, sand and any admixtures used in the concrete and also to meet the requirement of the standard. [IS:456-2000]
- Water cement ratio is 0.5
- Which of the present study three compositions are made by 10%, 15% and 20% of rubber aggregate with normal aggregate

3.2 Materials used:

- Natural coarse aggregate (10mm - 20mm)
- Natural fine aggregate (sand)
- Rubber aggregate (10mm - 20mm)
- Cement OPC 43 grade
- Water, curing tanks
- Hand mixing tools, vibrator
- Cube

3.3 EXPERIMENT RESULTS WITH DISCUSSIONS

3.3.1 Workability Test:

There are mixes of M20 grade with w/c ratio .5 respectively. The slump value was used as for indicating of mix workability. The slump values are 110mm, 100mm, 95mm and 80 mm according to 0%, 10%, 15% and 20%. The test result is given below the table.

Table -1: Slump value observation

SL No.	Percentage of concrete	Water cement ratio	Slump Value (mm)
1	0%	0.5	110
2	10%	0.5	100
3	15%	0.5	95
4	20%	0.5	80

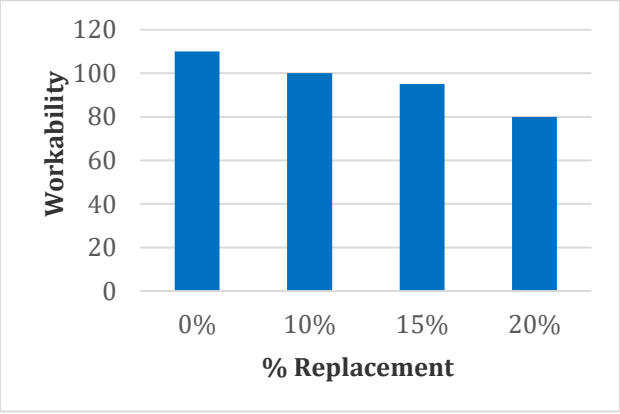

Chart -1: Slump value observation

3.3.2 Compressive strength test:

This test has been made by 24 cubes, the size of Cube 150 x 150 x 150 mm. This cubes had divided into four groups like normal concrete cubes, 10%, 15% and 20% of rubber aggregate and for cubes achieved result since 7days and 28days. For each test and for each mix three samples had tested. The Compressive value in the table is the average of three cubes value. As per below result for 7days & 28days, compressive strength decreases as a percentage of rubber increases. The result is given below the table.

Table -2: Compressive strength of concrete

Compressive Strength (N/mm2)			
SL NO	**Percentage of concrete**	**7 days**	**28 days**
1	0%	22.35	23.56
		21.23	23.47
		21.11	23.31
	Average	**21.56**	**23.44**
2	10%	17.67	19.86
		17.18	19.45
		16.55	18.74
	Average	**17.13**	**19.35**
3	15%	16.78	18.57
		16.23	18.41
		15.52	18.05
	Average	**16.17**	**18.34**
4	20%	15.34	17.73
		14.23	16.30
		14.12	16.21
	Average	**14.56**	**16.74**

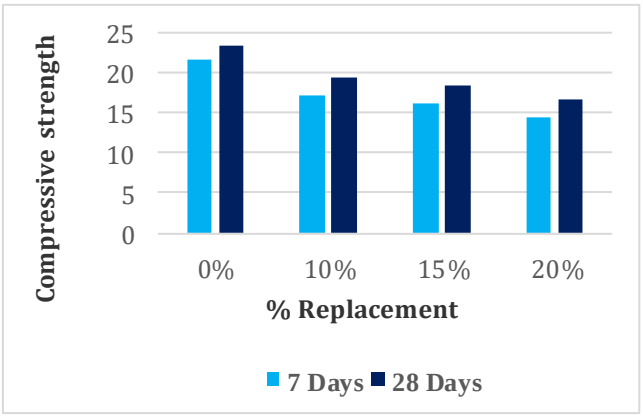

Chart -1 Compressive strength result

3.3.4 Flexural Strength:

This experiment result is given by compressive strength from formula by 0.7√fck according to [IS: 456-2000]. The flexural strength is also reduced with an increase in the percentage of the rubber aggregate.

Table -3: Flexural strength of concrete

Flexural Strength Of Concrete N/mm²			
SL No.	**Percentage of Concrete**	**7 days**	**28 days**
1	0%	3.26	3.39
2	10 %	2.90	3.08
3	15 %	2.82	3.00
4	20 %	2.68	2.87

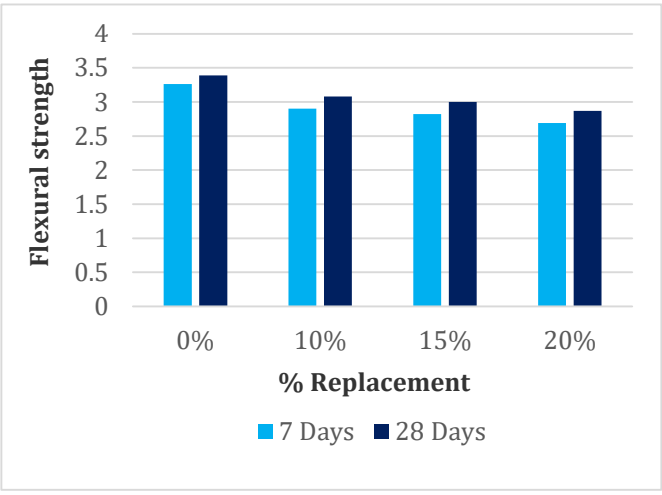

Chart -1 Flexural strength of concrete

3.3.4 Unit weight:

After 28 days of curing of the concrete Cube, the unit weight can find out. Investigation of the study it has to be noticed that decrease in unit weights for increasing rubberized concrete. The reduction of unit weight is 2.56%, 3.36% and 10.28% according to the replacement of 10%, 15% and 20% rubber aggregate into concrete.

Table -4: Unit Weight of Concrete

SL No.	Percentage of Concrete	Unit Weight (Kg)	% Reduction
1	0%	8.259	0
2	10 %	8.073	2.56
3	15 %	7.982	3.36
4	20 %	7.410	10.28

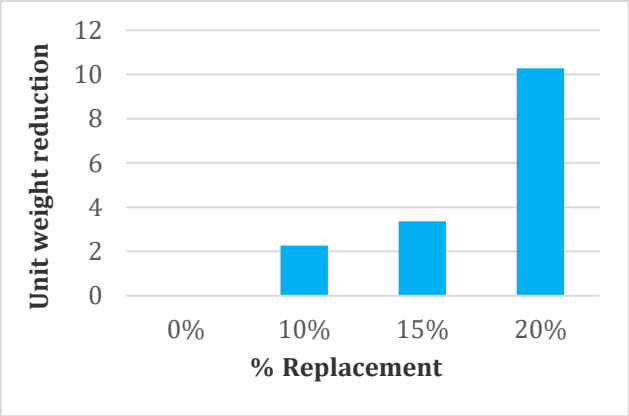

Chart -1 Unit weight of concrete

4. CONCLUSION

- Workability of concrete also decreases as per increasing the rubber, while slump of the mixture in which rubber aggregate was added is slightly low 10 to 25mm which can be considered, this difference is not so big and can be covered with little changes in the testing. So there must be no difficulty in casting, placing & finishing.
- This research observed that compressive strength was reduced 20.54%, 25%, 32.46% in 7days and 17.44%, 21.75%, 28.58% in 28days with increasing the amount of rubber in concrete 10%, 15% and 20% of aggregate volume. As well as flexural strength also decreases with increasing the amount of rubber aggregate in concrete. We can also say that by the increasing the quantity of rubber aggregate, the flexural strength is decreased.
- Unit weight of concrete block decreases with increasing rubber percentage in concrete. This will act as a lightweight concrete.
- If the age of concrete and design consideration take it into the amount of aggregate can be replaced with 10% of rubber aggregate for a major project.
- As per the study, it is concluded that any unused tire rubber can be used as aggregate to a certain amount.

RECOMMENDATION:

- The same study may be done with different materials as aggregate, like glass, steel fiber, plastic timber alloys, metal etc.
- Vast work is essential to growth terms and values so as to make changes for the better usage of recycled aggregate.

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