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Investigation of Long Term Compressive Strength and Splitting Tensile Strength of Rubber Concrete by Replacement of Fine Aggregate

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Abstract*: The increase of about three crumb tyres scrapping. This is very dangerous to environment. Hence; we have to solve this problem by the alternate aggregate method for construction. This work represents the fine aggregate by replacing crumb rubber. In concrete there may be volume variation of crumb rubber generally crumb rubber consist of particle size. Which is ranging in size from 4.75mm to lesser than 0. 075mm. Most process include crumb rubber asphalt modifier. Which increase the aggregation ranges particle size from 0.6mm to 0.15mm for the acceptable properties of particle application 60% replacement of fine aggregate and 10 % of the total mixture indicate The main objective of this project is to provide the effectiveness the rubber as a replacement for fine aggregate and put to use crumb rubber as in concrete to minimize global warming. The objective of this study is to analyze the effect of addition of crumb rubber on the various properties of concrete. The crumb rubber is used as alternate over aggregates in the concrete mix. Crumb rubber is prepared from the scraps of tyres. In this study aggregates are replaced by 10%, 25% 33% and 60% crumb rubber. The rubberized concrete is tested for slump and compression strength. It is found that the slump of rubberized concrete increases first but at certain place amount of rubber increases slump start decreases. It is observed that initial compression strength of rubberized concrete reduced significantly but the final strength is found to be more than that of ordinary concrete. In recent days availability of natural resources are not fully available and scrapping of the used materials becomes a large in amount challenge. As a result of industrialization and urbanization the usage of rubber tyre has increased radically. The scrapping of such used rubbers designs lot of environmental issues. So an attempt was made in this paper to replace fine aggregates by used tyre rubber particles in concrete. This is better advantage of saving in natural aggregates as well as it effectively uses the waste materials.

***Keywords*: Compressive strength, Splitting tensile strength, Rubber Concrete, Fine aggregate.**

1. Introduction

Rubber is most commonly used in automobile. The use of vehicle are increases day to day, so there is large wastage of rubber The rubber produce got large demand in day to day life across the world. The tyre in recent days, due to increase in scrapping of rubber by consume and land filling that create environmental problem like are air pollution , soil exhausted and massive stoke piles of used tyre .A very large amount of used rubber tyre increased in world every year out of which 275 million in the India. However, this rubber waste higher amount can be utilize of fuel, pig mate soot, in bitumen roof and floor cover etc. One of such application that world use old rubber tyre effectively is rubberized concrete, concrete can be made less economic by replacing fix percentage of fine aggregate with granular crumb rubber waste. Scrapping of waste tyre is a challenging task because tyre have a long life and are non-biodegradable. The traditional method of waste tyre management have been stockpiling or illegality dumping land filling all of which are short term solution. The environmental problem for growing, recycle tyre is an innovative idea of way in this case. Tyres are no longer suitable for use of vehicles due to wear or miserable damage such as punctures.

2. Experimental program

Experimentation and examination have been carried out on the waste rubber specimens to determine the workability, compressive strength, split tensile strength of the designed trial mixes.

A. Materials Used

Natural aggregates are used as per IS 383-1970 and sand is taken as per requirements of IS 383-2007. Portland pozzolona cement of 53 grade is used as per IS 1489-1991 Waste rubber powder as replacement for fine aggregate.

B. Mix Design for concrete

Since there are various methods for mix design suitable for M20, a simplified mix design procedure, is formulated by combining available literatures on normal concrete using Waste rubber powder.

1) Water content

As per the table 5 of IS 456 maximum water-cement ratio 0.32 is adopted. Similarly as per table 2 of IS 10262 water

content for the 20 mm aggregate is adopted as 160 kg (for 25 to 50 slump).

2) Cement content

As per we get water cement ratio 0.5 and water content 160 kg, cement content has been got as 320.1 kg i.e. nearly 321 kg.it is checked as per table 5l of IS 456 clause 8.2.4.2, which says cement content should be less than 450 kg hence it is ok.

3) Proportion volume of aggregate content

As per the table 3 of IS 10262-2009, volume of coarse aggregate corresponding to 20 mm size of fine aggregate (zone) 0.62 is adopted. Then total volume of aggregate investigates as subtracting difference between volume of cement and volume of water from 1 cubic meter volume of concrete. Which results in 0.7312 cubic meter.

4) Mass of coarse and fine aggregates

From the found total volume of aggregate 0.7312 m^3, mass of coarse aggregate got by product of total volume of aggregate, volume of coarse aggregate, specific gravity and 1000. Mass of coarse aggregate get 1206.75 kg per m^3 Mass of fine aggregate get 717.069 kg per m^3.

5) Binder content

To increase the workability there is added the super plasticizer in the 2% of water added to the mix. Because of many assumptions underlying the forgoing theoretical calculations, the trial mix proportions must be checked, if necessary the mix proportion should be modified by adjusting the % replacement of sand by Waste rubber powder, % dosage of super plasticizer to improve the workability and strength of the mix proportion. Fresh concrete should be tested for workability as well as Specimens of hardened concrete should be tested at the specified age.

C. Mixer Proportions and Casting of Specimens

Mix proportions are arrived for M20 grades of concrete based on the above formulated mix design procedure by replacing 0, 10, 25, 33 and 60% of the mass of Sand by Waste rubber powder and the material requirements per m^3 of concrete. Curing was done under water for various desired periods.

3. Tests on fresh and hardened concrete

Workability tests such as slump test, compaction factor test were carried out for fresh concrete as per IS specifications, keeping the dosage of super plasticizer as constant at 2% by weight of water. For hardened concrete cube compression strength test on 150x150x150 mm^3 size cubes at the age of 7 days, 28 days curing were carried out using 3000kN capacity compression testing machine. Also compression strength test and split tensile strength on 150mmx300mm cylinders were carried out on 28 days cured specimens as per BIS specifications.

4. Results and discussions

The results of cube compression strength, split tensile strength are shown Figure 1 & 2 and table 1 and 2 below.

A. Compressive strength of concrete

Table 1
Compressive strength of concrete

S. no.	Percentage replacement	7 days	28 days
1	0%	18.62	25.79
2	10%	15.88	22.71
3	25%	17.92	23.19
4	33%	15.16	22.11
5	60%	14.07	20.09

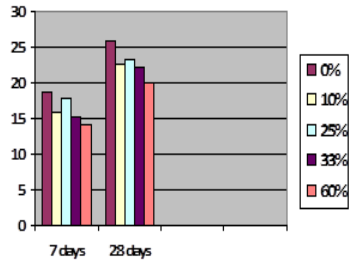

Fig. 1. Bar chart of compressive strength

B. Split tensile strength of concrete

Table 2
Splitting tensile strength of concrete

S. no.	Percentage Replacement	7 Days	28 Days
1	0%	7.17	9.35
2	10%	7.10	9.22
3	25%	7.29	9.78
4	33%	7.11	9.21
5	60%	7.03	8.88

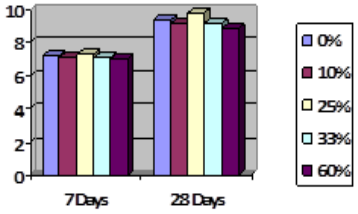

Fig. 2. Bar chart of split tensile strength of concrete

5. Conclusion

Based on the investigation carried out on sand replaced waste rubber mixes the following conclusion are drawn.

1. Sand replaced up to 25% with Waste rubber leads in compressive strength for M20 Grade.
2. Beyond 25 % there is decries in compressive strength for 28 days curing period.
3. The maximum replacement level of waste rubber powder is 25% for M20 grade of concrete.
4. Use of waste rubber powder gives significant result on concrete.
5. The success of the sand Replaced Concrete by waste rubber powder requires more attention on proper mix design, production, placing and curing of concrete. For each of these operation controlling parameter should be achieved by concrete procedure for an environment that a structure has to face.

6. From the test results, it is observed that the sand replaced concrete by waste rubber powder gives less compressive strength than normal concrete so it may be use in temporary structure.

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