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Use Rubber as Coarse Aggregate

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Abstract: Rubber is produced in huge amount Worldwide every year. Its decomposition takes much time and also produces environmental Pollution. In such a case the reuse of rubber is a better choice. To reuse rubber wastes, it was added to concrete as coarse aggregate and its different properties such as Compressive strength, Tensile strength etc. Were compared with an ordinary concrete As a result, it was found that Rubberized concrete is durable, great crack resistance but has low compressive strength when compared with ordinary concrete. The compressive strength of rubberized concrete can be increased by adding some amount of Silica to it.

I. INTRODUCTION

The scarcity and availability of sand and aggregate at reasonable rates are now giving anxiety to the construction industry. Over years, deforestation and extraction of natural aggregates from river beds, lakes and other water bodies have resulted in huge environmental problems. Hence, to prevent pollution authorities are imposing more and more stringent restrictions on the extraction of natural aggregates and its crushing. The best way to overcome this problem is to find alternate aggregates for construction in place of conventional natural aggregates. In this research rubber aggregates from discarded tyre rubber in size ranges from 10 to 20 mm is partially replaced with natural aggregates in cement concrete. This attempt of replacing the coarse aggregates with rubber aggregates will save the natural aggregates, reduces weight of structure and also helps achieve sustainability.

Crumbed rubber concrete (CRC) is a promising new material on the construction scene. Created by replacing sand with rubber particles when mixing concrete, the material promises to significantly reduce certain environmental impacts, yet its structural properties are still relatively unexplored. Researchers at the University of South Australia and RMIT University are now assessing the properties of CRC in detail. Their insights could allow us to optimise the properties of CRC for uses in infrastructure, residential buildings and industry.Using rubber aggregate reduces the flexural strength of concretes.Owing to lower strength, the rubberized concrete is recommended for non-load bearing structures and structural members.

II. METHODOLOGY

A. Material

The basic materials for mixing Concrete are required such as

1) Cement
2) Fine aggregate
3) Coarse aggregate
4) Tyre rubber aggregate
5) Water

B. Mix Proportion

In this study four different types of mixes or combination is being considered and designed as per Indian Standard Specification IS: 10262(2009).

Water cement ratio- The water cement ratio must be optimum according to the grade of concrete chosen and mix design has to be done.

Quality aggregates –The quality of aggregates must be high. The other three concrete mixes were made by replacing the coarse aggregates with 0%, 5% 10% and 15% of discarded tyre rubber by weight.

In the present study we are designing a Concrete Mix for M20 Grade concrete is (1:1.5:3) and the water cement ratio is 0.55 below the different percentage of rubber aggregate is replaced by coarse aggregate and cubes were tested for compressive strength for 7 days and 28 days.

Mix proportion of M20 grade concrete

Percentage %	Cement	Fine aggregate IJLRET	Coarse aggregate	Rubber aggregate
	%	%	%	%
0%	100%	100%	100%	0%
5%	100%	100%	95%	5%
10%	100%	100%	90%	10%
15%	100%	100%	85%	15%
Water	W/C Ratio = 0.55			

C. Compressive Strength

Compressive strength test on cubes were carried out using the Universal Testing Machine (UTM). Compressive test were carried out on cubes of dimensions 150 × 150 × 150 mm after 7 days and 28 days. For each test and for each mix three specimens were tested. The compressive strength was computed using the expression Fc= P/A for cubes, Where, Fc is the compressive stress in MPa. P is the maximum load applied in Newton and A is the cross sectional area in 2mm.

The compressive strength is decreased with an increase in the percentage of the tyre rubber chips. The results of compressive strength of cubes for 7 days and 28 days. . The concrete mix was prepared with water-cement ratio of 0.55 then accordingly. The concrete cubes are casted. The same cubes are cured in water curing tank in laboratory at normal room temperature and are tested at 7th and 28th days with the help of Compression Testing Machine.

The test results show that addition of rubber aggregates resulting to significant reduction in compressive strength compared to conventional concrete at 7th and 28th days. Illustrates the trend of strength development in different concrete specimens at 7th and 28th days . The comparison of compressive strength of subsequent concrete mix at 7th and 28th days in comparison to conventional concrete. Further, gain of compressive strength of various prepared concrete mix with respect to the days from the stage of its curing . From the scenario of this graph, one can conclude that rapid in strength gain takes place up to its 7 days of curing later on its gaining rate becomes slower.

III. COMPRESSIVE STRENGTH TEST RESULT

The compressive strength test was performed on the cubes of size 15 cm x 15 cm x 15 cm to check the compressive strength of rubberized concrete and the results obtained are given in Table 4.1.Target mean strength for 28 days for M20 concrete(f'ck) = fck + 1.65*s = 20 + 1.65 x 4=26.6 N/mm

S. No	% of crumb rubber	Compressive Strength(N/mm2)	
		7 Days	28 Days
1	0%	16.03	26.75
2	5%	19.34	28.73
3	10%	18.53	27.46
4	15%	16.67	25.63

IV. CONCLUSIONS

The following conclusions are derived the workability of concrete was not affected by addition of crumb rubber, and this is also attributed to the addition of admixture (i.e.) a super plasticizer named Master Rheobuild 619.There was no problem in binding between the crumb rubber and the cement matrix. This showed that the crumb rubber proved to have a good absorption and binding potential in the concrete. There was a drastic increase in the compressive strength tested on 3rd, 7th and 28th days of testing. Thus the overall compressive strength proved to be greater than the conventional concrete. The flexural strength of the hardened concrete at 28th day testing showed a gradual increase up to 6% partial replacement and showed a sudden decrease at 8% partial replacement. The split tensile strength showed a progressive increase at 28th day testing, reaching a maximum at 8% partial replacement. The slump value of the concrete decreased at the maximum percentage (i.e.) 8% of partial replacement. This showed that the consistency of the concrete is greatly reduced with increase in addition of aggregates in spite of the addition of super plasticizer.

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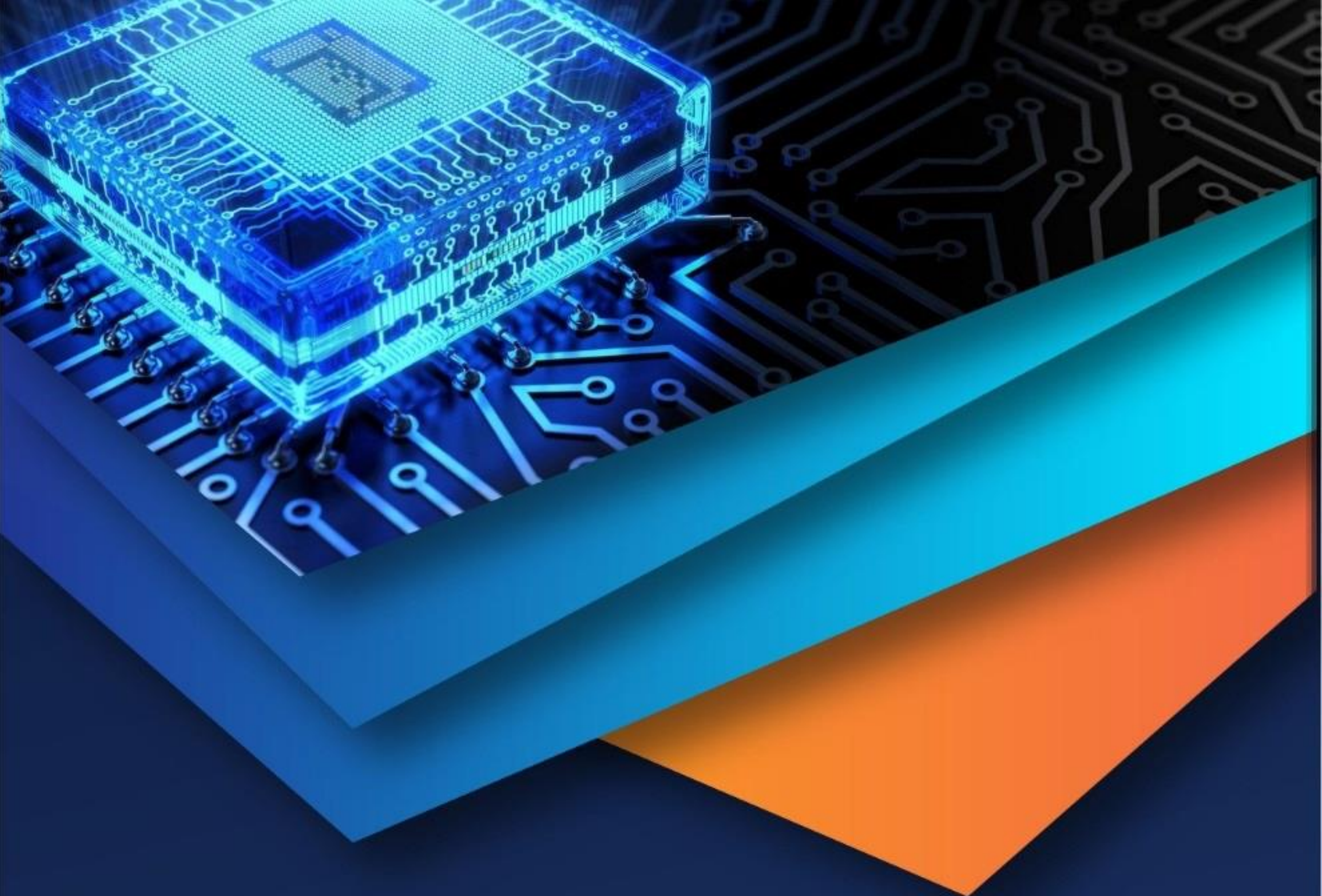

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