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A Research on use of Waste Tyre in Cement Concrete Pavement by Replacing Coarse Aggregates

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ABSTRACT

One of the primary construction material that is used worldwide is concrete. For the development trading the most important materials that are used are aggregates and cement, these materials makes the primary and significant constituents for the production of concrete. As for concrete production the natural materials are being used in a greater demand. In a similar context that is required for natural resources utilization has been emerged as an increasing issue for protecting the environment as well as requirement for preserving the natural resources like aggregates that are being exploited through several materials that were actually recycled by the area unit. In this analysis, the study focuses on the replacing the coarse aggregate partially with recycled rubber tyre employment in the construction of concrete along with use of waste tyre that were obtained regionally. The initial sections of this particular study has discussed the background of the study along with the matter extent. The literature review section provides the review or discussion of the various relevant literatures that were performed for in the earlier times in this particular subject area. In this study, various tests were applied on the raw materials to investigate their suitableness and properties for this experimentation study. Three concrete grades that is M15, M20 and M25 are combined to prepare the concrete styles area units. To prepare the specimen, the coarse aggregates is used with different proportion replacement of 10, 25, and 50 for exploiting the mixture of rubber. Furthermore, to perform a comparative analysis, a bearing is developed without any coarse mixture replacement. The samples that were prepared includes beams, cylinders and cubes. After that these concrete samples were tested in the laboratory. The various tests that were performed are as: flexural strength, impact resistance, lastingness, compressive strength, unit weight, and slump tests. These laboratory tests that were performed on the specimen were primarily supported by the information assortment. Results of these tests were then compared with the various concrete properties and it was observed that the concrete's compressive strength is decreased due to the presence of rubber aggregates. Although, due to this reason there are chances that it cannot be used in some structural applications. Also, along with the decreased compressive strength it has some important characteristics such as increased flexural strength, increased plasticity, higher impact resistance, and lower density. It is shown from the results that recycled rubber tyres can be used in the construction of concrete as coarse aggregates partial replacement. Due to the fascinating rubber aggregates area unit, the replacement proportion should be kept at normal amount as well as applications should be limited for specific cases where it is required to improve the properties.

INTRODUCTION

The management of worn tyres poses a major problem for all worlds. Also, with the increasing number of vehicles, the industrial development which several countries are currently knowing, and the small percentage of recycled worn tyres (retreaded or used for other purposes) due to the absence of an adequate plan for eliminating this waste, these countries know surely a major environmental problem. The absence of statistics on this subject does not enable us today estimate suitably the mass of worn tyres thrown in nature or burned in public dumpsters. But if we compare these countries with the European Union countries which took this problem in charge, through legislation, recycling companies, research, we can say that many countries are postponing the solution to this problem, and that the mass of worn tyres can only be considerable.

One of the recommended solutions to solve this environmental problem is to incorporate rubber aggregates resulting from cutting worn tyres in the cement concretes. On this subject, several studies concerning the use of rubber aggregates resulting from crushing worn tyres were carried out. These research works showed that the benefits of associating rubber-cement in the development of cementing composites with high deformability and on the durability of these composites.

Tyres are bulky, and 75% of the space a tyre occupies is void, so that the land filling of scrap tyres has several difficulties:

- Whole tyre land filling requires a large amount of space.
- Tyres tend to float or rise in a landfill and come to the surface.
- The void space provides potential sites for the harboring of rodents.
- Shredding the tyre eliminates the above problems but requires high processing costs.

FUTURE SCOPE OF THE STUDY

A. The research aimed on evaluating the characteristics of single graded crumb rubber. The rubber used in the concrete aggregate was collected from waste and recycled tyres available locally and were manually sliced in uniform pieces each of 20mm in size, which is also the maximum size of the aggregate that can be used in the design mix.

B. Various effected of various graded rubber mixtures with the concrete and its properties were not observed in this experiment and can be evaluated in coming experimental studies.

C. The study was done on three grades of concrete (M15, M20, and M25). Where the effect of recycled waste tyres were not observed in this study for any high strength concrete. The amount of replacements were restricted to only three values: 10%, 25%, and 50% with naturally available concrete mixture. Various impacts that can be noted with different replacement percentages were not added in this research.

METHODOLOGY

In this study, rubber is used as the coarse aggregate's partial replacement by different amount of percentage. The coarse aggregate is replaced by 10%, 25%, and 50% by the rubber. The materials used for the preparation of concrete cubesare as under.

A. Water
B. Rubber aggregate
C. Coarse aggregate
D. Fine aggregate
E. Cement

CONCRETE CUBES PREPARATION

By making use of different percentages of rubber aggregate, the concrete cubes were casted in standard moulds sized 150×150×150 mm.The cubes were vibrated for 1-2 minutes. After vibrating, these moulds were left to dry for one whole day. After 24 hours of drying the cubes were submerged in water after removing from the moulds for curing process.

EXPERIMENTAL WORK

This section describes the results of the tests carried out to investigate the various properties of the rubberized concrete mixes prepared in contrast with the control mixes. In the succeeding parts, the results for workability, unit weight, compressive strength, tensile strength, impact resistance and flexural strength tests are presented. Analysis and discussions are also made on the findings.

FRESH CONCRETE PROPERTIES

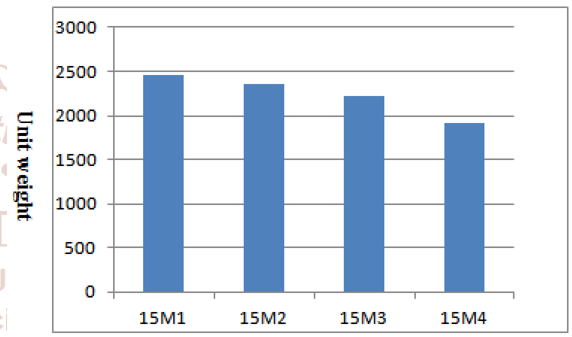
Workability Test

A concrete mix must be made of the right amount of cement, aggregates and water to make the concrete workable enough for easy compaction and placing and strong enough for good performance in resisting stresses after hardening. If the mix is too dry, then its compaction will be too difficult and if it is too wet, then the concrete is likely to be weak

Table Slump Test Results

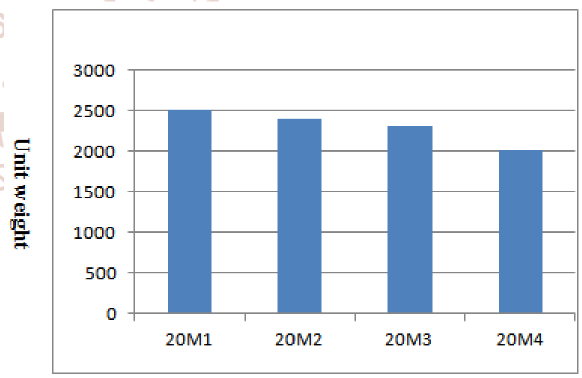
No.	Specimen	Grade	% rubber	Slump (mm)
1	15M1	M15	0	31
2	15M2	M15	10	36
3	15M3	M15	25	41
4	15M4	M15	50	46
5	20M1	M20	0	10
6	20M2	M20	10	20
7	20M3	M20	25	34
8	20M4	M20	50	47
9	25M1	M25	0	7
10	25M2	M25	10	14
11	25M3	M25	25	23
12	25M4	M25	50	45

M15



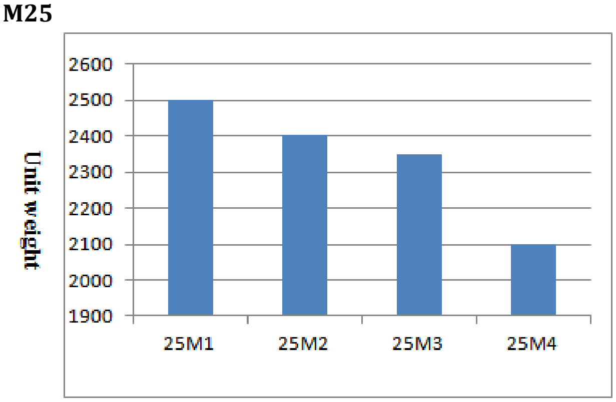
Specimens (a)

M20



Specimens (b)

M25



Specimens (c)

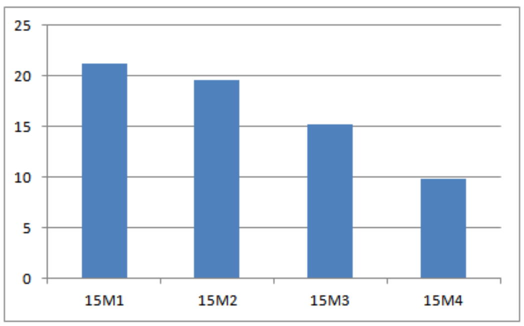
Compressive strength Test

The compressive strengths of concrete specimens were determined after 28 days of standard curing. For rubberized concrete, the results show that the addition of rubber aggregate resulted in a significant reduction in concrete compressive strength compared with the control concrete. This reduction increased with increasing percentage of rubber aggregate.

Table-: Compressive Test Result

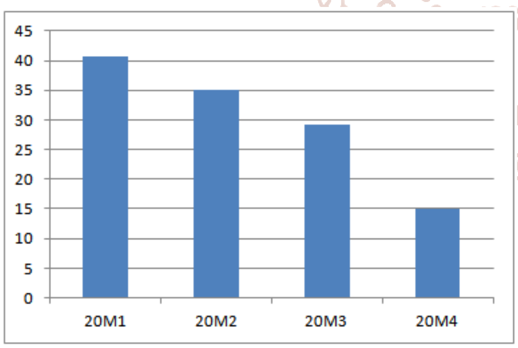
				Compressive Strength (N/mm2)	% Strength loss
No.	**Spec.**	**Grade**	**% Rubber**	**28 Days**	**28 Days**
1	15M1	M15	0	23.23	0
2	15M2	M15	10	18.55	8
3	15M3	M15	25	14.17	28.67
4	15M4	M15	50	9.82	53.79
5	20M1	M20	0	40.60	0
6	20M2	M20	10	35	13.73
7	20M3	M20	25	28.20	28.48
8	20M4	M20	50	15.15	62.84
9	25M1	M25	0	52.15	0
10	25M2	M25	10	40.85	18.64
11	25M3	M25	24	32.52	35.06
12	25M4	M25	52	20.85	58.48

M15



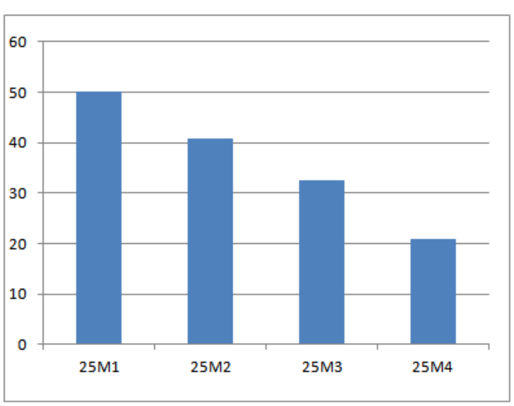
Specimens (a)

M20



Specimens (b)

M25



Specimens (c)

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