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A Study of Mechanical Properties of Paver Block Concrete by Partially Incorporation of Rubber Waste

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***Abstract*: The purpose of this paper is to report on an experimental study that explores the effect of using recycled rubber powder as an alternate fine aggregate in concrete mixes. Natural sand in the concrete mixes was partially replaced by 5%, 10%, 15%, and 20%. Physical properties such as the density, the compressive strength, the fresh concrete properties, the split-tension, and the impact load capacity are examined. The results revealed a decrease in the compressive strength of concrete cylinders containing rubber. The dynamic performance of the rubber concrete is of high importance because of its high resilient nature, as the rubber particles that are included in the concrete have a positive effect on the dynamic performance. The conclusions that were derived from this research implicate potential applications where rubberized concrete can be efficiently used. Even though rubberized concrete mixture generally has a reduced compressive strength that may limit its use in certain structural applications, it possesses a number of desirable properties, such as lower density, higher toughness, and higher impact resistance compared to conventional concrete.**

***Keywords*: Increasing strength of Concrete using rubber waste**

1. Introduction

In developing countries, utilization of concrete blocks as paving material is widespread. Cement and aggregate, which are the most important constituents used in concrete block making, are also a vital material for the construction industry. This inevitably led to quarry of natural materials used for production of concrete block. Thus, indicate a growing concern for protecting the environment and a need to preserve natural resources (such as aggregate) by using alternative materials (recycled or waste tire materials). On the other hand, disposal of the waste tyres all around the world is increasing every year. This keeps on increasing every year with the number of vehicles, as do the future problems relating to the crucial environment issues. Accumulation of discarded waste tire has been a major concern because waste rubber is not easily biodegradable even after a long period of landfill treatment. Existing or commercial concrete is characterized as a composite material with high compressive strength, moderate tensile strength and with a low toughness. It is anticipated that an ideal concrete block for pavement construction should have high tensile strength and high toughness. Therefore, high strength and high toughness concrete has to be developed for block paving. For concrete, it is found that the higher the strength, the lower the toughness. It is difficult to develop high strength and high toughness concrete without modifications. Owing to the very high toughness of waste tires, it is expected that adding crumb rubber into concrete mixture can increase the toughness of concrete considerably. Laboratory tests have shown that the introduction of waste tire rubber considerably increase toughness, impact resistance, and plastic deformation of concrete, offering a great potential for it to be used in sound/crash barriers, retaining structures and pavement structures. Unfortunately, not much attention has been paid to the use of waste tires in Portland cement concrete mixtures, particularly for highway use. Limited work was done by researchers to investigate the potential conducted on the concrete block mixtures with and without crumb rubber and the basic engineering properties are investigated. Use of rubber tires in concrete paving block mixtures. In this work, an experimental study was the use of rubber product is increasing every year in worldwide. India is also one the largest country in population exceeds 100cr. So the use of vehicles also increased, according to that the tyres for the vehicles also very much used and the amount of waste of tyre rubber is increasing. This creates a major problem for the earth and their livings. For this issue, the easiest and cheapest way of decomposing of the rubber is by burning it. This creates smoke pollution and other toxic emission and it create global warming. Currently 75-80% of scrap tyres are buried in landfills. Only 25% or fewer are utilized as a fuel substitute or as raw material for the manufacture of a number of miscellaneous rubber goods. Burying scrap tyres in landfills is not only wasteful, but also costly. Disposal of whole tyre has been banned in the majority of landfill operations because of the bulkiness of the fires and their tendency to float to the surface with time. Thus, tyres must

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be shredded before they are accepted in most landfills. So many recycling methods for the rubber tyre are carried according to the need. From this one of the processes is to making the tyre rubber in to crumb rubber. It is used in many works such as Road construction, mould making etc.

1) Background

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It is anticipated that an ideal concrete block for pavement construction should have high tensile strength and high toughness. Therefore, high strength and high toughness concrete has to be developed for block paving. For concrete, it is found that the higher the strength, the lower the toughness. It is difficult to develop high strength and high toughness concrete without modifications. Owing to the very high toughness of waste tires, it is expected that adding crumb rubber into concrete mixture can increase the toughness of concrete considerably. Laboratory tests have shown that the introduction of waste tire rubber considerably increase toughness, impact resistance, and plastic deformation of concrete, offering a great potential for it to be used in sound/crash barriers, retaining structures and pavement structures. Unfortunately, not much attention has been paid to the use of waste tires in Portland cement concrete mixtures, particularly for highway use. Limited work was done by researchers to investigate the potential conducted on the concrete block mixtures with and without crumb rubber and the basic engineering properties are investigated. Use of rubber tires in concrete paving block mixtures. In this work, an experimental study was The use of rubber product is increasing every year in worldwide. India is also one the largest country in population exceeds 100cr. So the use of vehicles also increased, according to that the tyres for the vehicles also very much used and the amount of waste of tyre rubber is increasing. This creates a major problem for the earth and their livings. For this issue, the easiest and cheapest way of decomposing of the rubber is by burning it. This creates smoke pollution and other toxic emission and it create global warming. Currently 75-80% of scrap tyres are buried in landfills. Only 25% or fewer are utilized as a fuel substitute or as raw material for the manufacture of a number of miscellaneous rubber goods. Burying scrap tyres in landfills is not only wasteful, but also costly. Disposal of whole tyre has been banned in the majority of landfill operations because of the bulkiness of the fires and their tendency to float to the surface with time. Thus, tyres must be shredded before they are accepted in most landfills. So many recycling methods for the rubber tyre are carried according to the need. From this one of the processes is to making the tyre rubber in to crumb rubber. It is used in many works such as Road construction, mould making etc.

2. 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 .It has been well reported that about 1 billion of used automobile tires are generated each year globally. Specifically, 275 million of used rubber tires accumulate in the United States and about 180 million in European Union. In addition to that, the traditional ways of recycling tires in our country like as a shoe making material and other tools is decreasing nowadays. This is considered as one of the major environmental challenges facing municipalities around the world because waste rubber is not easily biodegradable even after a long period of landfill treatment.

3. Methodology

1) Materials

1. Natural aggregate
2. Sand
3. Cement

2) Natural Aggregate

Gravels are obtained by crushing natural basalt stone obtain from quarries nearby Pune. They are hard, strong, tough, clear and free from veins, alkali, vegetable matter and other deleterious substances. Aggregates are free from such material, which will reduce strength or durability of concrete.Natural river sand with a maximum size of 4.75 mm was used as fine aggregate. Crushed stone with a maximum size of 20 mm was used as coarse aggregate. It was tested as per Indian Standard specification IS: 383(1970). The physical properties of aggregate were tested according to IS: 2386(1963).

3) Sand

Natural sand free from silt, alkali, vegetable matter and other deleterious substances, obtained from Mula River, Pune.

4) Cement

Portland pozzolana cement (PPC) fly ash based is the most common type of binder used for concrete production and Grade conforming to Indian Standard IS 1489 was used as a binder. The local brand name of the PPC cement used is Birla A1.

4. Conclusion

After the practical investigation and literature review of the

concrete done by using plastic tyre waste we concluded the following important observation and results,

1. Waste tyre rubbers are used in paver blocks as a construction material replacing coarse aggregate to reduce their impacts on environment as they are not easily decomposable even after landfilling.
2. The compressive strength of the rubberised paver blocks is more than the conventional concrete blocks. The 7-days and 28-days compressive strength of the specimen replacing 15% of coarse aggregate by rubber is more than 5%, 10% and 20%.

Table 1
Specific Gravity of Coarse Aggregate

Observations	**Sample1**	**Sample2**
1) mass of pycnometer (m1)	560gm	560gm
2)mass of pycnometer +aggregates (m2)	1140gm	1152gm
3) mass of aggregates sample+water (m3)	1830gm	1834gm
4) mass of pycnometer + water (m4)	1448gm	1448gm

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