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STRENGTH ENHANCEMENT OF WASTE TYRE RUBBER USING ADMIXTURES – A REVIEW

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ABSTRACT

In our world, products are used and then discarded. Even when materials are recycled, the remaining refuse can create an environmental concern. More production equals more waste, more waste creates environmental concerns of toxic threat. Motivated by the tremendous trend toward green environment and to reduce the effect of scrap tires on the environment, this research is an attempt to find a practical and environmentally sound solution of the problem of scrap tires.

An economical viable solution to this problem should include utilization of waste materials for new products and one that minimizes the heavy burden on the nation's landfills. Partially replacing concrete aggregates with recycled materials could help to combat the decreasing availability of some natural resources (natural sand) and at the same time help to utilize growing quantities of waste material like used tyres. This idea has been put into practice to develop a more sustainable concrete material called rubberized concrete or crumbed rubber concrete (CRC).

LITERATURE REVIEW

This literature review investigates the past uses and effects of recycled waste tires used in concrete mixture design. Environmental concerns are discussed herein only to emphasize its importance in the practice of using waste tire products in an advantageous manner. This review covers the various topics researchers have investigated and the rubberized concrete trends that have been discovered that has facilitated the current utilization of waste rubber tire chips in civil engineering applications.

Toutanji (1996) conducted research on the use of rubber tire particles in concrete to replace mineral aggregates. His results showed a reduction in both compressive and flexural strengths. The **reduction in compressive strength was greater than that for the flexural strength.** He concluded that the reduction in both strengths increased with increasing the rubber aggregate volume content.

Garrick (2004) investigated waste tire modified concrete by replacing 15% (by volume) of coarse aggregate by waste tire. He used waste tire as tire fiber and chips dispersed in the concrete mix. His results showed an **increase in toughness, plastic deformation, impact resistance and cracking resistance** (Garrick, 2004). He also found a **reduction in the strength and stiffness of the rubberized sample**. The control concrete disintegrated at the peaked load; while the rubberized concrete had considerable deformation without disintegration, which was due to the bridging caused by the tires fibers.

Rubberized concrete has many advantages in its use in the construction industry. It is affordable, cost effective, able to withstand more pressure, and more impact and temperature when comparing to conventional concrete. Rubber Modified Concrete (RMC) is weak in compressive and tensile strength, but has good water resistance with low absorption, improved acid resistance, low shrinkage, high impact resistance, and excellent sound and thermal insulation. From a different experiment, Crumb Rubber Concrete (CRC) did not shatter after failure compared to a conventional concrete mix. Such behavior may be beneficial for a structure that requires good impact resistance properties. The impact resistance of rubberized concrete was higher, and it was particularly evident in concrete specimens made with thick rubber (Kaloush, et al., 2005).

Based on the unique qualities of the rubberized concrete, it may find new areas of usage in highway constructions such as shock absorber, sound barriers, and sound absorber, and in buildings as an earthquake shock-wave absorber. It reduces plastic shrinkage cracking, and reduces the vulnerability of concrete to catastrophic failure.

With this new property, it is projected that these concretes can be used in architectural applications such as nailing concrete, where high strength is not necessary, in wall panels that require low unit weight, in construction elements and barriers that are subject to impact, and in railroads to fix rails to the ground (Topçu, 1995)

.It is used in a precast sidewalk panel, non-load bearing walls in buildings, and precast roof for green buildings (Tomosawa,Noguchi, & Tamura, 2005). It can be widely used for development related projects, such as roadways or road intersections, recreational courts and pathways, and skid resistant ramps.

Rubberized concrete can also be used in non-load bearing members such as lightweight concrete walls, building facades, or other light architectural units; thus, the waste tire modified concrete mixes could give a viable alternative to the normal weight concrete (Khatib & Bayomy, 1999).

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Rubberized mixes are alternative uses in places where cement needs stabilized aggregate bases; particularly under flexible pavements. The other viable applications well suited for use in areas where repeated freezing and thawing occur can be poured in larger sheets than conventional concrete. Now, tennis courts can be poured in a single slab, eliminating 'section' lines, which must be smoothed after curing. Roofing tiles and other concrete products can now be made lighter with Rubberized concrete (Allen, 2004). Other possible uses for tire chips in concrete are in runways and taxiways in the airport, industrial floorings, and even as a structural member.

Pierce and Blackwell (2003) studied crumb rubber use as a complete replacement for concrete sand in flowable fill. They found that crumb rubber content in as high as 38% by weight can be mixed in flowable fill without noticeable segregation of the rubber, although there may be measurable bleeding in some cases. Achieving flow ability is reasonable, and satisfying the requirements of mixing speed, mixing time. It should be noted that, addition of fly ash to the mix help control bleeding

S.NO	TITLES	AUTHOR	JOURNAL NAME	RESULTS
1.	The use of rubber tyre particles in concrete to replace mineral aggregate	H.A.Toutanji	Elsevier	1.Reduction in compression & Flexural strength 2. High toughness was revealed by specimens containing rubber tyre chips.
2.	Scrap-tyre –rubber replacement for aggregate & filler in concrete	Eshmaiel Ganjian, Morteza Khorami, Ali Akbar Maghsoudi	Elsevier	Up to 5% replacement in each set, no major changes on concrete occurred. However further increased in replacement ratio considerable changes were observed.
3.	Properties of concrete containing scrap-tire rubber	Rafat Siddique,Tarun R.Naik	Elsevier	1. Workable rubberized concrete mixtures can be made with scrap rubber. 2.Magnesium oxychloride cement as a binder is used in rubberized concrete mixtures

4.	Performance of High Strength rubberized concrete & its potential Structural applications	Danda Li Julie, Tom Benn, Rebecca Gravina	Advances in Civil Engineering Materials	1.Rubberised concrete increases Structural damping ratio 2. Crumb rubber particles should be used than rubber chips or fibres,& the % should be limited to a max of 20% volume replacement of sand.
5.	Influences of different processing techniques on the mechanical properties of used tires in embankement construction	Ayse Edincliler, Gokhan Baykal, Altug Sayghi	Academic	1.Sand used tire mixtures have higher shear than that of sand alone.2.Factors found to affect mechanical properties are Normal Stress, Processing techniques & used tire content
6.	Use of Rubber as aggregate in concrete	Ishtiaq Alam,Umer Amma Md,Nouman Khattak	International Journal of Advanced Structures & Geo technical engineering	1.Less compressive strength when compared to ordinary concrete. 2.Shows ductile behavior before failure. 3.Rubber concrete shows reduction in density 4.Concrete made of crumb rubber as fine aggregate shows much strength than concrete made of chipped rubber as coarse aggregate. 5. Recommended to use silica fumes to increase compressive strength.
7.	Properties of rubberized concrete containing Slica fume	Erhan Guneyisi,Meh,et Gesoglu,Turan Ozturan	Pergamon	1. Large reduction in strength but Addition of silica fumes improved the mechanical properties & diminishes rate of strength loss. 2. Also Rubber content as high as 25% by total aggregate volume might be practically used to produce rubberized concrete with compressive strength of 16-32 MPa.

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