# A Review on using Crumb Rubber in Concrete

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***Abstract*: Rubber concrete acted as one kinds of building materials came from the traditionalmodification concrete, and it had the excellent thermal insulation properties, such as light, good toughness, good thermal insulation, so it had been initially used in civil engineering, such as railways, highways and so it's like.In an attempt to decrease the magnitudeof this issue, crumb rubbermodifier (CRM) obtained fromwaste tyre rubber has gained interest in asphalt reinforcement. The use of crumb rubber in the reinforcement of asphalt is considered as a smart solution for sustainable development by reusing waste materials, and it is believed that crumb rubber modifier (CRM) could be an alternative polymer material in improving hot mixasphalt performance properties.However, the mixing temperature and duration can cause rubber particles to depolymerize and subsequently cause loss of viscosity. Crumb rubber modification also improves the properties of bitumen by increasing the storage and loss modulus and enhancing the high and low temperature susceptibility. i.e effect of crumb rubber toaging properties of CRMB is also discussed. Finally several techniques of chemical modification to terminal blends of CRMB and the subsequent improvement to the settling property of CRMB are explained.It will also include a review on the effects of CRM on the stiffness, rutting, and fatigue resistanceof road pavement construction.Hence to avoid demand of aggregate to makesustainable concrete rubber crumb can be utilized in manufacturing of concrete. Crumb Rubber was replaced by volume of aggregate in concrete.10% to 30% volume of fine aggregate was replaced by rubber crumb by authors in many of research papers. Mechanical strength of concrete was observed in all research papers and compared with normal concrete. This paper reviews research published on the performance of concrete containing tyre rubber wastes. It discusses the effect of waste treatments, the size of waste particles and the waste replacement volume on the fresh and hardened properties of concrete.**

***Keywords* – Tyre rubber, strength, Literature Survey.**

## I. INTRODUCTION

Rubber concrete was put forward in the last century, and it has been made to carry out a moresubstantial research since the study started and had applied in some projects. The first rubber concrete paving of sidewalks was paved at Arizona State University in the United States in 1999 [1]. According to statistics, about 70% of the reproduction rubber powder was used for construction engineering in the United States.Roadways are an integral aspect of transportation infrastructure. Road construction engineers must consider the primary user's requirements of safety as well as the economy. Toachieve this goal, designers should take into account three fundamental requirements which include environmental factors, traffic flow, and asphalt mixtures materials [1–3]. In asphalt concrete (AC), bitumen as a binder serves two major functions in road pavement, first, to hold the aggregatesfirmly and second to act as a sealant against water. However,due to some distresses like fatigue failure, the performance and durability of bitumen are highly affected by changes with time in terms of its characteristics which can lead to the cracking of pavement. The most studied was the rubber instead of an equal volume of fine aggregate at present. There were also studies on alternative crude rubber replaced aggregate or both coarse and fine aggregate. There was less research on rubber mixed. The research about the rubber concrete was late and the application level was also low in China, so the related experimental research to the rubber concrete and the collation of the results would provide an important basis for the research and development of rubber concrete and effectively improved the level of application of rubber concrete.

Worldwide, there are many additives used as reinforcingmaterial into the asphalt mixes, among these additives used is the CRM [3, 4]. In this paper, asphalt pavement design criteria will be displayed and a considerable review on the use of crumb rubber in asphalt pavement reinforcement will be presented and discussed. It also includes a review on the effects of CRM on the stiffness, rutting, and fatigue resistance of road pavement. In order to understand the asphalt-rubber reinforcement technology, asphalt properties and crumb rubber characteristics will be illustrated.pavements refers to the use of one or more reinforcing layers within the pavement structure. Another application of pavement reinforcement is the use of reinforcement elements in asphalt overlays to provide an adequate tensile strength to the asphalt layer and to prevent failures of the pavement such as reflection cracking. Thus the difference between the two applications is that the first application is used as measure to overcome the distress failure which already occurred in the pavement, while the second application is used as measure to prevent the existence of such failure. Modification/reinforcement of asphalt binder is possible during different stages of its usage, either in between binder productionand mix processes or before paving mix production [4].

## II. FRESH CONCRETE PROPERTIES WORKABILITY

Albano et al. [9] replace fine aggregates by 5% and 10% of scrap rubber waste (particle sizes of0.29mm and 0.59mm) reporting a decreased of 88% in concrete slump. Bignozzi&Sandrolini [10] used scrap-tyre (0.5 to 2mm) and crumb-tyre (0.05 to 0.7mm) to replace 22.2% and 33.3% of

fine aggregates in self-compacting concretes referring that the introduction of the rubber particles does not influence the workability in a significant way if the superplasticizer also increases. Skripkiunaset al. [11] used crumbed rubber to replace 23 kg of fine aggregates in concretes with 0.6% of a policarboxile superplasticizer by cement mass obtaining the same workability of the reference concrete. Other authors [12] used crumb rubber tyres (0.075 to 4.75mm) in the concrete to replace sand in various percentages (20%, 40%, 60% and 100%). These authors stated that increasing rubber waste content decreases the concrete slump.

## III. MIXED RUBBER SOURCES, PHYSICAL PROPERTIES

Currently it used for the preparation of rubber was most from scrap rubber tires for rubber concrete.It was processed into rubber granules or rubber powder, only a few came from factory waste, waste rubber soles and other products. According to their chemical structure, there were about isoprene rubber, styrene-butadiene rubber categories. Isoprene rubber has good tear resistance and abrasion resistance, flexibility and strength was poor. Styrene butadiene rubber has high abrasion resistance, heat resistance and resistance to aging, but the disadvantage was the resilient anti-flex, tear resistance was poor. Butadiene rubber has the better elasticity, aging resistance and low temperature resistance, but its strength and tear resistance was lower. Scrap rubber with a high tensile strength and toughness was usually pulverized rubber particles produced by a machine, so the surface of the rubber particles was not smooth and uniform pulverized.

## IV. HARDENED CONCRETE PROPERTIES COMPRESSIVE STRENGTH

Guneyisi et al. [17] mentioned that the strength of concretes containing silica fume, crumb rubber and tyre chips decreases with rubber content. These authors suggest that it is possible to produce a 40MPa concrete replacing a volume of 15% of aggregates by rubber waste. Ghaly& Cahill [18] studied the use of different percentage of rubber in concrete (5%, 10%, and 15%) by volume also noticing that as rubber content increase leads to a reduction of compressive strength. Valadares[19] studied the performance of concretes with the same volume replacement of rubber wastes confirming the decrease of compressive strength. Ganjian et al. [20] also confirmed the decrease in compressive strength for increase rubber content. However, these authors obtained a slight increase in compressive strength when 5% of chipped rubber replaced the coarse aggregatesprobably due to a better grading of the mixture. This finding had already caught the attention of other authors [21,22]. Snelson et al. [23] used concretes with shredded tyre chips (15 to 20mm) for aggregate replacement in several percentages (2.5%, 5% and 10%) reporting a loss in compressive strength.

The results show that the rubber mixtures also containing pulverised fuel ash as partial cement replacement presented major compressive strength loss. This means that the low adhesion between the cement paste and the rubber waste becomes even lower if admixtures with low pozzolanic activity are used. Aiello &Leuzzi [15] used tyre shreds to replace fine and coarse aggregates concluding that the sizeof the rubber particles have a major influenceon the compressive strength. When coarse aggregates are replaced by the tyre particles the compressive strength loss is much more profound when compared to the compressive strength loss of concretes in which fine aggregates were replaced by rubber particles.

## V. CURRENT RESEARCH EFFORT

1. GintautasSkripkiunas, AudriusGrinys, Benjaminascernius:- The aim of investigation was to study the deformation properties of Portland cement concrete with rubber waste additive. Concrete mixtures with the same compressive strength as concrete without this additive were tested. Used tires rubber wastes were crumbed into fraction 0/1. The rubber additive was used as fine aggregate replacement in concrete mixtures by 3.2 % of aggregates mass. The effect of rubber waste additive on technological properties, air content in fresh concrete, density and deformation properties under the static and dynamic load of concrete was investigated.

2. PitiSukontasukkul, SomyotWiwatpattanapong,'ThammasatInt:- This study provided the test results on themechanical and physical properties of lightweight concreteobtained by replacing portions of the conventional fineaggregate with crumb rubber from recycling waste tires. Themechanical properties were compressive and flexural strength.The physical properties were unit-weight, permeable voids,thermal conductivity and sound absorption. Results indicatedthat the unit-weight of crumb rubber concrete was lower thanthat of plain concrete. The decrease was found to be proportional with the crumb rubber content. In addition to the decrease in unit-weight, the crumb rubber concrete also exhibited better sound and thermal properties. However, due to the low strength and stiffness of rubber, the mechanical properties of crumb rubber concrete appeared to be lower than that of plain concrete

3. Mohammad Reza sohrabi, Mohammad karbalaie: - A lot ofrubber is produced worldwide. For example, 3.6 million tonsrubber is produced annually only in US. It is not possible todischarge the rubbers in the environment because they
decompose very slowly and cause lots of pollution. So, it isnecessary to have a relevant use of these wastages. Thesewaste materials can be used to improve some mechanicalproperties of concrete. Addition of rubber to concrete resultsin the, improvement of some mechanical and dynamicalproperties, such as more energy adsorption, better ductility,and better crack resistance. In this paper, the 7- day and 28-day compressive strength of concretes containing crumbrubber; silica fume and crumb rubber; Nano silica and crumbrubber; and Nano silica, silica fume and crumb rubberisinvestigated. For this purpose, 216 concrete specimens wereprepared and their compressive strength was investigated.

Akinwonmi, AdemolaSamuel,Seckley, Emmanuel, Akinwonmi, Ademola Samuel, Seckley, Emmanuel:- This paper presents a research into the mechanical strength of concrete with shredded tyre and crumb tyre as aggregate replacement. The materials used to make concrete for this experiment are coarse aggregate, cement, sand, shredded tyre, crumb tyre, potable water and Ordinary Portland Cement. A total of fifteen main mixtures were cast as solid bricks with 0% replacement as control then followed by 5%,

7.5%, 10%,12.5%, 15%, 17.5%, 20% separately for both shred and crumb rubber materials. The compressive tests for the concrete cubes were carried out by applying a constant uniform pressure to the cubes of the concrete blocks until failure occurred. The results of the compressive test show that by replacing the aggregate by 2.5 % shreddedtyre, the compressive strength increased by about 8.5% but at 5% replacement and beyond, the compressive strength decreased.

## VI. Conclusion

Rubber concrete with lightweight, noise reduction, high toughness, thermal insulation and other excellent performance undoubtedly has great potential. Since the rubber concrete researches started, in terms of basic mechanics, rubber particle size, rubber content, methods have many theoreticalresults, but in many practical applications have been limited, and many of the problems had to be solved. (1) The nature of the external mixed rubber, size, quality, lack of uniform technical standards. (2) The lack of technical specifications about the process guidance about Rubber concrete. (3) Modifying agent, the dose was still in the exploratory stage, and the reliability for a wide range of applications should to be tested. (4) The impact of the different effects of cementitious materials and additives for rubber concrete performance have not formed a unified theory, and the impact factor was discrete, so the further study was necessary. (5) Lack ofprofessional organizations or associations to promote the exchange of rubber concrete finishing andtheoretical results.

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