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# A Review Paper on Experimental Study on use of Waste Rubber Tyre in Bituminous Carpet

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**Abstract:** Nowadays, only a small percentage of waste tyres are being land-filled. The Recycled Tyre Rubber is being used in new tyres, in tyre-derived fuel, in civil engineering applications and products, in moulded rubber products, in agricultural uses, recreational and sports applications and in rubber modified asphalt applications. The benefits of using rubber modified asphalts are being more widely experienced and recognized, and the incorporation of tyres into asphalt is likely to increase. The technology with much different evidence of success demonstrated by roads built in the last 40 years is the rubberized asphalt mixture obtained through the so-called "wet process" which involves the utilization of the Recycled Tyre Rubber Modified Bitumen's (RTR-MBs). Since 1960s, asphalt mixtures produced with RTR-MBs have been used in different parts of the world as solutions for different quality problems and, despite some downsides, in the majority of the cases they have demonstrated to enhance performance of road's pavement. This study reports the results of a literature review upon the existing technologies and specifications related to the production, handling and storage of RTR-MBs and on their current applications within road asphalt mixtures. Furthermore, considering that RTR-MBs technologies are still struggling to be fully adopted worldwide, mainly because of poor information, lack of training of personnel and stakeholders and rare support of local policies, the present work aims to be an up-to-date reference to clarify benefits and issues associated to this family of technologies and to finally provide suggestions for their wide-spread use. Recycled Tyre Rubber.

**Keywords:** Asphalt Rubber, Bitumen Rubber, Crumb Rubber, Terminal blend.

## I. INTRODUCTION

The change in expectations for everyday comforts of the general population the utilization of two wheelers and four wheelers has expanded day by day giving ascent in vehicular density on roads. As vehicles are utilized as often as possible the wear and tear of tyres are more, this results decreases the life of tyres and finally it become useless. The dumping of the tyres has become a major issue, it is non-biodegradable in nature causes environmental issue. Crumb rubber is made by shredding of scrap tyre which is specific material free from fibre and steel the rubber particle is graded and found in numerous size and shapes. Crumb rubber are user friendly not eco-friendly. These wastes are disposed either by landfilling or incineration as shown in the figure (1&2) both the process is certain impact to the environment. The hazardous waste tyre include air contamination associated with open burning of tyres particular smell, visual effect and another unsafe contaminant such as polycyclic hydrocarbon.

It is necessary to find the way for safe disposal of the waste material; recycling is the common solution for the disposal problem. The recent development in technologies and research have been proving there are several successful ways to reuse the waste materials one of the best arrangement being utilization of waste material into the construction of road the utilization of crumb rubber in bituminous mix helps accomplish better execution of wearing courses, lower temperature susceptibility, higher resistance to deformation, better age resistance properties, higher fatigue life, better adhesion between aggregate and bitumen, reducing cracking and reflection cracking[11], reduced traffic noise on the study carried out by united states and India the rubber asphalt road can reduced the noise from 4 decibels to 10 decibels so that it is better to application on roads.

The crumb rubber can be added into bituminous mix using two unique strategies such as wet processing and dry processing. In the wet processing involves mixing of crumb rubber with the hot bitumen during the preparation of mix. In the wet processing crumb rubber/ground rubber acts like a asphalt cement binder where as in dry processing involves mixing of crumb rubber with the hot aggregate prior to bitumen during mixing in both dry and wet process the crumb rubber is some of the time called as CRM. All though dry procedure exhibits some advantage compare to the wet procedure for the most part concerning the cost included and the larger quantity of rubber to be utilized. Researches

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throughout the world have focused mostly on the wet procedure. In this present study an attempt been made to use of waste crumb rubber obtained from worn-out vehicle tyres are replaced into fine aggregate (dry process) in bituminous mix. The aim was to use the crumb rubber waste in the bituminous mix and improving the Engineering properties of the bituminous mix.

In India, over 15 million waste tires are generated annually. Not only are these tire mounds eyesores, they are also environmental and health hazards. The little pools of water retained by whole waste tires create an ideal breeding ground for mosquitoes. Aside from the persistent annoyance, mosquitoes have been shown to spread various dangerous diseases. Equally hazardous are tire fires, which pollute the air with large quantities of carbon smoke, hydrocarbons, and residue. These fires are virtually impossible to extinguish once started. Currently, the only large scale methods to use waste tires are through burning for electric power generation, production of cement in cement kilns, energy to run pulp and paper mills, and recycling at tires-to-energy facilities. In 1990, the Environmental Protection Agency (EPA) estimated that out of the 242 million waste tires generated that year, 78% of the tires were either stockpiled, a land filled, or illegally dumped. While some states burn waste tires this is only a temporary solution because of the tires, in many cases, tend to float back up to the surface. Land filling waste tires has also become more and more expensive as landfill space has decreased. Asphalt acting as a binder for aggregates is a very important ingredient affecting the life cycle and travel comfort on roads. It has been an established fact that normal bituminous course cannot cope up with the following problems:

Increasing traffic on road / overloading of vehicles leading to undulations, rutting, cracking, deformations, potholing, and shortening of the life of asphaltic pavements.

ii. High range of temperatures causing pavements to become softer in summer and brittle in winter.

iii. Rains/water causing extensive stripping problems in asphaltic pavements.

To overcome the above problems in the entire world it has become a regular practice to use modifier as additives to strengthen the asphalt for making longer lasting asphalt mixes. This has been a very important development in the last 3 decades and has led not only to huge saving by delaying the maintenance cycles of the road but also its importance has been felt in countries where aggregates and asphalt are in short supply.

Natural asphalt is a naturally occurring hydrocarbon mineral that is high in asphaltense and high in the Nitrogen. When crumb rubber added to asphalt it dramatically increases the asphalt's viscosity, lowering penetration while increasing the softening point. The chemically treated crumb rubber and besides have been designed to rapidly blend into asphalt. The addition of rubber gives the additional binding strength, increasing elasticity and softening point of the asphalt. Carbon present in rubber acts as an anti-oxidant and prevents asphalt from ageing and oxidization.

**Hazards of Tyre Waste**

1) This waste tyres are produced carbon by burning process.
2) This amount of tyres is very large manner so it becomes dangerous as well as uncomfortable to placing, because of Land problems to our country.
3) Potentially harmful substances were found exposed to highly acidic solutions.
4) Aside from the persistent annoyance, mosquitoes have been shown to spread various dangerous diseases.
5) Equally hazardous are tyre fires, which pollute the air with large quantities of carbon smoke, hydrocarbons, and residue.
6) Not only are this tyre mounds eyesores, they are also environmental and health hazards. The little pools of water retained by whole waste tyres create an ideal breeding ground for mosquitoes.
7) These fires are virtually impossible to extinguish once started.

## II. LITERATURE REVIEW

**"Niraj D Baraiya"**

The study was carried out by "Niraj D Baraiya"[1] the incorporation of rubber aggregate in the asphalt mix diminishes the amount of stone aggregate by total volume and improves the flexural quality and flexibility of the carpet layer of highway. In this study the waste rubber tyre were cut into little pieces the rubber pieces were sieved through 22.4mm passing and 5.6mm retains as per mix design specifications. This were included into the bituminous mix of 10 to 20% by weight of stone aggregate

the rubber aggregate were blended with stone aggregate and asphalt at temperature between 1600C to 1700C for proper blending of asphalt mix. As the waste rubber tyre were thermostatically set they shouldn't liquefy in the bitumen at the time of blending the aggregate. The rubber aggregate solves numerous issues like thermal cracking and permanent deformation are diminish in hot temperature area. The rubberized pavement can also resist the effect of water and also the property of absorbing sound which helps to reduce the sound pollution on heavy traffic roads.

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**Rupesh Sahu, Rajesh Joshi(2015)**
The objective of this research is to find a good mix proportion for the rubberized bitumen. Flexible pavements with bituminous surfacing are widely used in India. The high traffic intensity in terms of commercial vehicles, over loading of trucks and significant variations in daily and seasonal temperature of the pavement have been responsible for earlier development of distress symptoms. Investigations in India and abroad have revealed that the properties of bitumen and bituminous mixes can be improved to meet the basic requirements. Use of Crumb Rubber i.e. the rubber obtained from the waste tires of vehicles, is used in the construction of flexible pavement. In the present study, an attempt has been made to use crumb rubber modified bitumen which is blended at specified temperatures. Marshall's mix design was carried out by changing the modified bitumen content at constant optimum rubber content and subsequent tests have been performed to determine the different mix design characteristics and for conventional bitumen (VG-30) also. This has resulted in much improved characteristics when compared with straight run bitumen, due to improved strength of Modified Bitumen it is one of the upcoming important construction materials for flexible pavements. This study will have a positive impact on the environment as it will reduce the volume of rubber waste to be disposed of by burning and land filling. It will not only add value to rubber waste but will develop a technology, which is eco-friendly.

**Pravin shelke (2016) :-**
The waste tyre rubber obtained from the source was cut into the required sizes of aggregates. Cut rubberwas then replaced in the total weight of aggregate with varying percentages. The standard aggregate tests were performed on these aggregates, following tests were conducted,
1) Aggregate impact test
2) Water absorption test
3) Specific gravity test
4) Los-Angeles abrasion test
5) Crushing test
6) Shape test
The present tests are not completely adequate for higher percentages of replacement of rubber.The replacement of coarse aggregate by rubber has shown remarkable improvement in the physical properties, therefore the above method can be used in the actual road construction. and the problem of rubber disposal can be solved up to certain extent.Thus rubber can be a partial substitute for coarse aggregate.The above tests were performed with 5%, 10%,15% replacements and results obtained from these tests were analyzed and the conclusions were made.

**Sulkowski et al. (2004, 2006) and Ranch et al. (2004, 2005)**
The performed of the thermo g ravi metric. It is analysis dynamic mechanical of the polyurethanes. It is highly filled with waste rubber particles. incorporation of the rubber particle is in the thermal stability. The lower temperature is decomposition of an oil fraction in the present of rubber. The author used differential curves on the thermo g ravi metric (DTG).

**Cerny and Jankar(2016)**
The investigated the effect of content (20-Wt 90%) and the size of particle distribution of the WTR structure. The prepared a samples and analysis microscopic revealed that is introduction of the particals. The friction of the small size partical and inflection point the started porosity to rise it was observed for the lower rubber. Such effect was related to a stronger interaction due to higher surface area of particle.

**Gayathri et al. (2013)**
**T**he performance and structure of flexible composites. The material was hardly cellular structure. The unmodified show very similar value of cell size and the cell wall thickness was increased by 100%. The authors decide by the increase led to the enhancement of the tensile strength of material. The materials are typical porous. The thermal stability of the materials especially above 250c and increased the sound absorption coefficient. The frequencies exceeding 150 Hz.

**Cachaco et al. (2013)**
The investigated properties of the flexible pavement. It is applied as compression absorbing buoys. The result increase of the incorporation rubber tyre recycle, and it is modified foams higher modulus and of the compressive. The absorb compressive stress to used commercially buoys.

**Sipahi- Salam et al. (2001)**
The investigation of the toughening mechanisms scanning electron microscope (SEM). After fracture were presented the images of interface between matrix filler. The author analysis and suggested that the main mechanics is crack deflation and slight debonding. The strength of the matrix filler interface such assumption is confirmed further works.

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## III. CONCLUSION

Based upon the above literature following conclusion we're made regarding properties of bitumen in waste rubber tyre. The results also showed that the related between the strength of sand and strength of gravel.

1 Mixing of the waste rubber tyre in aggregate modifies the flexibility of the Surface layer. The optimum waste rubber tyre to use in the range of 5% to 20%.

2. The waste of rubber aggregate solve the problem on permanent deformation and thermal cracking it is reduce in hot temperature.

3. The property of rubber is absorbing sound and the hot temperature region also decrease the sound pollution in heavy traffic road.

4. The physical and chemical properties of the rubber tyre and the performance of the component in the rubber tyre.

5. The rubber aggregate can be better option to convention aggregate for the surface layer of the high, way.

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