

A Review on Use of Crumb Rubber in Flexible Pavement

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Abstract— Today disposal of different wastes produced from different Industries is a great problem. These materials pose environmental pollution in the nearby locality because many of them are non-biodegradable, Crumb rubber is one of them. Soil, stone aggregate, sand, bitumen, cement etc. are used for road construction. Natural material is limited in nature, its quantity is decreasing and cost is increasing. Concerned about this, engineers are looking for alternative materials for highway construction, by which the quality of road is increase with low cost. Keeping in mind the need for bulk use of these solid wastes in India, it was thought expedient to test these materials and to develop specifications to enhance the use of waste tyres in road making in which higher economic returns may be possible. The waste tyres can be used in the form of aggregate which on mixing with various bitumen in suitable size.

Keywords: Rubber Aggregate, Flexible Pavements, Crumb Rubber, Conventional Aggregate, Utilization of Waste

I. INTRODUCTION

Nowadays, the disposing of rubber wastes has become a vast problem. Crumb rubber is a material produced by shredding and commutating used tires. Approximately 60 percent of waste tyres are disposed of via urban and rural areas. This causes various environmental problems including air pollution (due to burning of tyres) and aesthetic pollution which causes severe health related issues. These are a biotic, disposable product due to which these materials pose environmental pollution. In recent years, by-products of rubber wastes are being used in road construction with great interest in many developing countries. The selection of these materials in road construction is based on technical, economic, and ecological criteria and is giving a fruit. Every year millions of tons of rubber waste are produced in India. Utilizing these materials in highway road construction, the pollution and disposal problems can be successfully be reduced. Minding the bulk use of these wastes in India, it was thought necessary to examine these materials and to develop specifications to increase the use of rubber wastes in road making, in which higher economic returns may be possible. These materials should be used in road construction in each and every part of our country. The waste tyres can be used in the form of aggregate which on mixing with various bitumen in suitable size. This reduces the pollution occurred due to waste tyres as well as minimizes the use of natural aggregate, which help in reducing global warming as well as health problems.

II. RELATED WORK

Prof. Justo et al (2002), after the help of Shankar and Mohmad. Imtiyaz, he also uses the crumb rubber in the form of modified bitumen, up to 12% by weight. He preferred crumb rubber modified bitumen (CRMB55) at specific

temperature. For the design of modified bitumen, he preferred conventional bitumen 60/70. In the result modified bitumen shows higher resistance to permanent deformation at higher temperature. Mavroulidou et al. (2010) revealed that the use of rubber 0-10% in concrete gives good results for workability, density, and cube compressive strength after 28-days. G According to his result it improves the strength of pavement as well as protecting environment. He uses rubber aggregates with different different sizes like 20-10 mm, 10-4.75mm and 4.75 mm according to requirement. Nabin Rana Magar (2014) use the crumb rubber aggregate in the form of modified bitumen with the four different different sizes. He replaces crumb rubber with 15% by weight of bitumen. Four different categories of size of crumb rubber will be used, which are coarse (1 mm – 600 µm); medium size (600 µm - 300 µm); fine (300 µm- 150 µm); and superfine (150 µm - 75 µm). Mr.Nirajkumar Gupta, Prof.Dhananjayyadhav (2016) the waste problem considered as one of the most crucial problems facing the world as a source of the environmental pollution. During last recent years, many improvements in India have occurred in all parts of life such as social, industrial, economical etc.; this will lead to generate new ways of living and increase the human requirements and will also increase types and quantities of the waste in India, without any active processes to provide solution to this problem. Waste rubber tires cause serious environmental problems all over the world. And he uses the crumb rubber in pcc. Naveen Sheoran & Ravi Kumar (2017) study on the use of waste tires in the form of coarse aggregate in road construction. The strength and durability characteristics of concrete mixtures have been computed in the present work by replacing 0%, 5%, 10%, 15% and 20% of coarse aggregates with the waste tyre rubber.

III. METHODOLOGY

Waste rubber tyres were collected from roads sides, dumpsites and waste-buyers. The collected waste tyres were sorted as per the required sizes for the aggregate. The waste tyres were cut in the form of aggregate of sizes ranging from 22.4 mm to 6.00 mm (as per IRC-SP20) in the tyre cutting machine. The waste rubber tyres can be managed as a whole tyre, as slit tyre, as shredded or chopped tyre, as ground rubber or as a crumb rubber product. The rubber of tyre usually employed in bituminous mix, in the form of rubber particles are subjected to a dual cycle of magnetic separation, then screened and recovered in various sizes and can be called as Rubber aggregate. It was cleaned by de-dusting or washing if required. The rubber pieces (rubber aggregate) were sieved through 22.4 mm sieve and retained at 5.6 mm sieve as per the specification of mix design and these were added in bituminous mix, 10 to 20 percent by weight of the stone aggregate. These rubber aggregates were mixed with stone aggregate and bitumen at temperature between 1600c to 1700c for proper mixing of bituminous mix. As the waste

rubber tyres are thermodynamically set, they are not supposed to melt in the bitumen, at the time of mixing of rubber aggregate, stone aggregate and bitumen in hot mix plant.

IV. EXPERIMENTAL SETUP

Experimental setup is an approach of considering the essential set of experiments suitable and useful for the testing of the materials. There are some certain tests for aggregate, bitumen, rubber waste, etc. By the test, strength, durability and lots of factors will be justified. Before the testing of material, there should be proper selection of appropriate material for the research so that proper experiment should be carried out. In this research methodology, deals with the explanation of all the experiments required for our research. The testing methodology will consist of the following step:

- 1) Selection of material
- 2) Material Processing
- 3) Material Testing
- 4) Observations & Calculations
- 5) Result & Discussion

V. HISTORY

Rubberized Bitumen is being used in USA from 1960 Currently Arizona, Florida, Texas and California using 2 million tons of Rubberized Bitumen. Use of Rubberized Bitumen being increase in developing countries of Latin America. In 1960s scrap tyres were processed and used as a secondary material in the pavement industry. One application was introduced by two Swedish companies which produced a surface asphalt mixture with the addition of a small quantity of ground rubber from discarded tyres as a substitute for a part of the mineral aggregate in the mixture, in order to obtain asphalt mixture with improved resistance to studded tyres as well as to snow chains, via a process known as “dry process” By 1975, Crumb Rubber was successfully incorporated into asphalt mixtures and in 1988 a definition for rubberised bitumen was included in the American Society for Testing and Materials (ASTM) D8 and later specified in ASTM D6114- 97. Furthermore, in 1991, the United States federal law named “Intermodal Surface Transportation Efficiency Act” (then rescinded), mandated its widespread use, the Asphalt-Rubber 10 technology concept started to make a “quiet come back” Nowadays, these rubberised bitumen materials, obtained through the wet process, have spread worldwide as solutions for different quality problems (asphalt binders, pavements, stress absorbing lays and inlayers, roofing materials, etc.) with much different evidence of success demonstrated by roads built in the last 30 years

VI. CONCLUSIONS

In the present study, the importance was to add the shredded waste crumb rubber to aggregate and to evaluate the various mix properties like Impact value, abrasion value, crushing value, etc. And also, to check the property of Crumb rubber aggregate. To check the coating property of rubber aggregate with adhesive materials. To check crumb rubber material properties through both laboratory and field evaluation. Develop test data for specification for non-structural / low loading usage. To evaluate the properties of rubber resistance

against cracking, fatigue and rutting. Making environment less harm from rubber waste.

So in the end of this we get outcomes which are satisfying all the objectives, like: It modifies the flexibility of surface layer. Waste rubber tyres to be used are between the ranges of 5% to 20%. Problem like thermal cracking (Fatigue) and permanent deformation (Rutting) are reduce in hot temperature region. Rubber has property of sound absorption, which also helps in reducing the sound pollution of heavy traffic roads. The use of rubber can improve the quality and performance of road. We can be save a certain quantity of natural stone aggregate.

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