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Review on Use of Crumb Rubber in Construction of Bituminous Road

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ABSTRACT: Due to urbanisation, industrialization, and infrastructure development, there is a severe shortage of construction materials, as well as a rise in environmental contamination. Discarded disposal, such as waste rubber tyres and plastic, is a major concern for all countries. The environment, as well as human life, are threatened by some non-biodegradable materials. To alleviate these issues, waste materials must be used as an alternate source in various construction components. It has a wide range of applications in civil engineering due to its unique qualities such as lightweight, superior insulation, water resistance, durability, and compressibility. Stone aggregate, sand, bitumen, cement, and other materials required in road building are scarce in nature. As a result, an alternate material for road building that also helps to decrease pollution and disposal issues is necessary. The goal of the research is to develop bitumen with crumb rubber as an addition that will assist reduce bitumen costs while providing better outcomes than regular bitumen.

KEYWORDS: Bitumen, Crumb rubber.

I. INTRODUCTION

In India, around 15 million trash tyres are produced each year. Disposal issues are occurring as a result of these tyres on a daily basis. They are also harmful to one's health. Tyre fire, which releases massive amounts of carbon into the atmosphere, is hazardous to human and animal health. Some jurisdictions unlawfully burn discarded tyres; however, this is simply a short-term solution. The use of powdered rubber derived from scrap tyres as a modifier is the subject of this research.

II. PROBLEM STATEMENT

Tire garbage is a solid waste that raises environmental issues in a number of countries. Stabilizers, additives, and the elastomeric polymer material's cross-linked structure all contribute to its non-biodegradability. To put it another way, disposing of discarded tyres is tough since it requires a lot of space, which causes environmental, aesthetic, and health problems in the surrounding area. Waste tyres will be stacked if thrown in the environment, generating landfilling concerns and fast depleting accessible solid waste disposal locations, as well as offering several environmental and health risks, including a high danger of fire and giving refuge to hazardous insects, rats, and animals.

III. OBJECTIVES

- To investigate crumb rubber management options and provide an effective method for reducing it and putting it to good use.
- The primary goal of a crumb rubber road is to eliminate rubber pollution in the environment while also improving communication in rural and urban regions.
- The basic requirement for a country's development is a road.
- Increase the road's strength and performance.
- By recycling waste resources, crumb rubber in road building is a sensible answer for sustainable development.

IV. SCOPE

The load of disposal garbage may be successfully decreased by employing rubber in bituminous road building. This reduces the amount of natural aggregate used. Crumb rubber and polymers will be used in the future research. Crumb rubber will be used for a variety of novel applications in the future, including highway pavement construction, sound absorption, and ductile building structures.

5.Literature review

The notion of employing scrap rubber tyres as well-sized aggregate in various bituminous mixes was offered in the article. Rubber aggregate is made from tyre rubber that is commonly treated in a bituminous mix in the form of rubber particles that are exposed to a dual cycle of magnetic separation, then screened and recovered in various sizes. It was cleaned after preparation by de-dusting or washing if necessary [1].The performance of flexible pavement on expansive soil subgrades with gravel/fly ash as a subbase course and waste tyre rubber as a reinforcing material is demonstrated in this article. According to direct shear and CBR laboratory test findings, gravel subbase outperforms flyashsubbase when different percentages of waste tyre rubber are used as reinforcing material. Cyclic load testing is also performed in the laboratory. During the test, it was discovered that gravel reinforced subbase has the highest load bearing capability and has a lower rebound deflection than fly ash reinforced subbase [2]. An experimental investigation on the usage of scrap rubber tyres in road pavement is presented in this publication. According to the report, adding scrap tyres as rubber aggregate changes the top layer's elasticity. It should be mentioned that rubber tyres should be utilised in the range of 5% to 20% for best performance. In hot climates, problems like thermal cracking and permanent deformation are addressed by employing tyres [3]. The purpose of this research is to examine the viability of using scrap tyre rubber as a blending ingredient in bitumen and its mix for building purposes. The study in the article is divided into two parts. They researched the fundamental properties of bitumen in the first stage, and then changed it by adding 1-4 percent crumb rubber. In the second step, the strength of the bituminous mix is determined by mixing crumb rubber with bitumen up to 1-4 percent and substituting aggregate with waste rubber aggregate from 5-15 percent. The stability and flow of the bitumen mix were found to be within the limits of 1 percent crumb rubber [4].

The investigation of crumb rubber tyres used in subgrade reinforcement is proposed in this work. It has been proposed that waste crumbed tyres may be safely used as a soil binder in the subgrade to efficiently retain the soil with higher strength values. The test was carried out as a standard Proctor test on black cotton soil, with moisture content and dry density readings of 18 percent and 43, respectively. The CBR test results revealed a value range of 1.16 to 1.54 [5].The use of waste plastic and waste rubber in flexible pavement is proposed in this research. Materials such as scrap plastic and crumb rubber can be utilised to partially replace the traditional material, bitumen, in order to improve the mechanical properties of a certain road mix. The proposed study compares the usage of waste plastics such as LDPE and Crumb Rubber (1 percent, 1.5 percent, 2%, and 2.5 percent by weight of bitumen) in bitumen concrete mixes to see which has the best potential to convert bitumen so that it may be used for building [6].The addition of crumb rubber produced from various recycled tyres to bitumen characteristics is investigated in this research. Because of its smaller size, crumb rubber collected from waste tyres by shedding and other traditional techniques can enrich the many key features of bitumen. A thorough investigation was done on various scrap tyres obtained from various autos (heavy, medium, and light) and its impact on bitumen qualities [7]. The study focuses on using powdered rubber as a substitute for total bitumen weight. Highways and concrete roads are designed to last 10–20 years, yet they frequently collapse due to tremendous weight and strain before their anticipated lifespan. Powdered rubber created by shredding scrap rubber can be utilised as a modifier to solve this problem. It's frequently utilised as a low-cost, ecologically friendly alteration method. Based on the experiments completed, the study's goal is to build bitumen with powdered-rubber that will reduce the value of bitumen while providing greater physical attributes than standard bitumen [8].

VI. METHODOLOGY

Rubber tyres were gathered from road sides, dumpsites, and garbage purchasers. It is then pulverised once it has been collected. Bitumen was sourced from local producers and combined with powdered rubber at a high temperature (about 1600 C) to make modified bitumen. The penetration test, softening point test, ductility test, viscosity test, and Marshall Stability test were all used to assess the different qualities of this blend. The results of this bituminous mix's tests are compared to those of standard bitumen.



Table no. 1:

PROPERTY	ORDINARY ROAD	CRUMB RUBBERROAD
TENSILE STRENGTH	LESS	HIGH
SOFTENING POINT	MORE	LESS
SEEPAGE WATER	YES	NO
DURABILITY OF ROAD	GOOD	BETTER
COST OF PAVEMENT	NORMAL	LESS
MAINTAINCE COST	MORE	ALMOST NIL
ECO-FRIENDLY	NO	YES

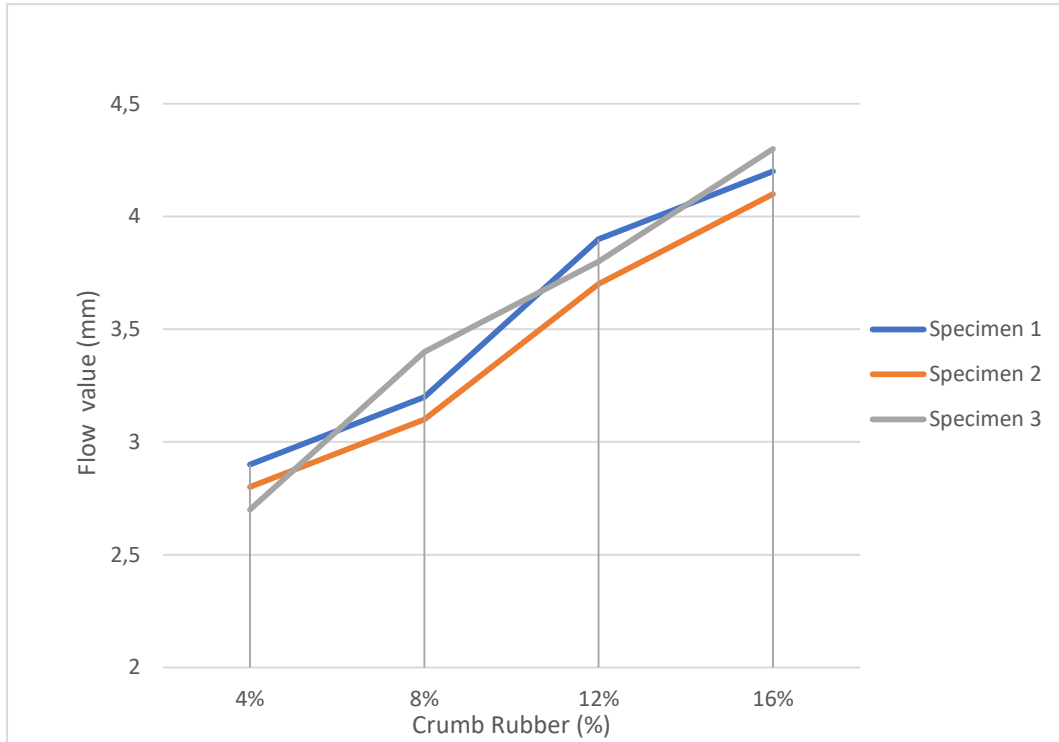
VII. LABORATORY INVESTIGATION

7.1 Marshall stability test:

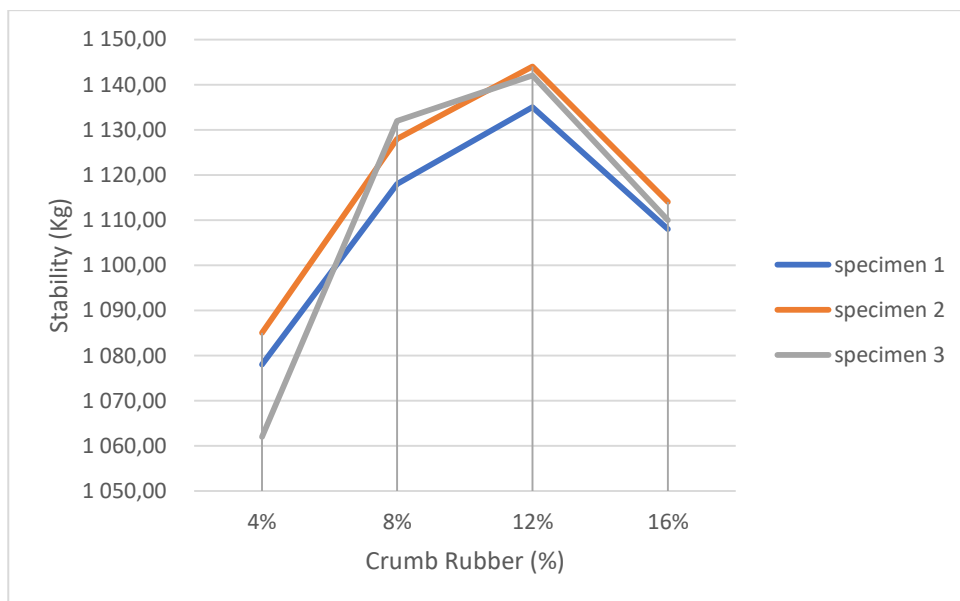
Method is commonly used to design bituminous concrete mix. Resistance to crumb rubber deformation of cylindrical specimens of bituminous mixture is measured. Maximum load carrying capacity in kg at temperature of 60 C when load is applied is known as Marshall Stability of bituminous mix. To conduct a Marshall Stability test 1200gm of aggregate is heated at temperature at 175-190 C and bitumen is heated at temperature 121-138 C. The aggregate and bitumen mix are thoroughly mixed at temperature 154-160C and placed in a Marshall mould. Collar is placed on the specimen and with the help of a hammer 75 blows are given and the specimen is compacted. Specimen is preheated in the oven and prepared and allowed to cool at room temperature for 20-25 minutes. Specimen is extracted from the mould by mechanical sample extractor and dimensions of specimen are measured. By calculating volume of specimen, weight of water is determined. Optimum bitumen content is determined by conventional Marshall Graphs.

Table no. 2:

Sr.no.	CRUMB RUBBER (in %)	STABILITY (Kg)	FLOW VALUE (mm.)
1.	4	1078	2.90
		1085	2.80
		1062	2.70
2.	8	1118	3.20
		1128	3.10
		1132	3.40
3.	12	1135	3.90
		1144	3.70
		1142	3.80
4.	16	1108	4.20
		1114	4.10
		1110	4.30



Graph 1: Flow value v/s Crumb rubber (%)



Graph 2: Stability (Kg) v/s Crumb rubber(%)

After adding rubber to more than 12% of the weight of bitumen, the stability value improves at first, then drops. As a result, maximum stability was achieved with a 12 percent modifier.

VI. RESULTS AND DISCUSSION

Adding powdered rubber as a modifier improves the properties of bitumen.

1. As the amount of rubber waste increases, the penetration value drops. The road is strengthened by a lower penetration value.
2. Bitumen becomes less vulnerable to temperature as the softening point rises with the amount of rubber used.
3. Rubber increases the ductility, viscosity, and hardness of bitumen.
4. In compared to regular bitumen, adding rubber to bitumen enhances road longevity.
5. Rubberized bitumen has a higher Marshall Stability value than ordinary bitumen.

VII. CONCLUSION

After investigating the situation, it was discovered that employing discarded tyres in bituminous pavement construction can help to alleviate disposal issues.

Waste tires may be used to minimize carbon emissions, which will assist to reduce air pollution.

Building costs are decreased by using crumb rubber as an addition, making construction more cost effective.

REFERENCES

- [1] Acharya Shrimannarayan, "Use of Waste Rubber Tyres in Construction of Bituminous Road –An Overview", *International Journal of Application or Innovation in Engineering & Management (IJAIEEM)*, Volume 2, Issue 7, July 2013
- [2] D. S. V. Prasad and G. V. R. Prasad Raju, "Performance of Waste Tyre Rubber on Model Flexible Pavement ", *ARPN Journal of Engineering and Applied Sciences*, VOL. 4, NO. 6, AUGUST 2009
- [3] M., R. AmbikaRajasree, R. Vijayalakshmi Pandit, V. Saranya, "Experimental Study on use of Waste Rubber Tyres in Road Pavement", *ISSN XXXX XXXX© 2018 IJESC*, Volume 8 Issue No.4
- [4] Nitish Kumar k, Dr. H N Rajakumara, "Study of Using Waste Rubber Tyres in Construction of Bituminous Road", *International Journal of Scientific & Engineering Research*, Volume 7, Issue 5, May-2016
- [5] Munnoli P M, Suhail Sheikh, Taqudas Mir, Vijay Kesavan, Rohit Jha, "Utilization of Rubber Tyre Waste in Subgrade Soil", *IEEE Global Humanitarian Technology Conference: South Asia Satellite (GHTC-SAS)*, 978-1-4799-1095-3/13/\$31.00 ©2013 IEE
- [6] KarthikChilur, Kamala Battal, MeghaTalawar, Vijayalakshmi M M, Avinash Patel K L, Prof.D.S. Maganur, "Utilization of Waste Plastic and Waste Rubber In Flexible Pavement", *International Research Journal of Engineering and Technology(IRJET)*, volume: 06 Issue: 05 | May 2019
- [7] T. B. Vishnu, Kh. Lakshman Singh, Paul Thomas, Nelson PynadathuRumjit, "Investigating the suitability of used heavy, medium, and light automobile tyres for bituminous mix pavement applications", *Environment, Development and Sustainability*, Received: 8 March 2018 / Accepted: 25 September 2018 © Springer Nature B.V. 2018
- [8] M.ShrekaVanmathi, S.Santosh Kumar, S.K. UdhayaSankar, P. ShanmugaPriya ,J.ArulrajChristadoss, "An Experimental Study Of Waste Tyres In Road Construction", *International Research Journal of Engineering and Technology (IRJET)*, Volume: 06 Issue: 03 | Mar 2019



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