

A STUDY ON PERFORMANCE OF CRUMB RUBBER MODIFIED BITUMEN BY VARYING THE VISCOSITY GRADE OF BITUMEN

Deepesh Kankariya¹, Deepak Patil², Darshan Gundecha³, Pratik Pund⁴,

Prof.Pooja Sonawane⁵

^{1,2,3,4}Student, Dept. of Civil Engineering, RMD SSO, Warje, Pune-411038, Maharashtra, India

⁵Professor, Dept. of Civil Engineering, RMD SSOE, Warje, Pune-411038, Maharashtra, India

Abstract – Nowadays waste-tyre disposal is a very serious problem which leads to environmental pollution. Minimization of waste material is important aspect and one of its way is to use crumb rubber in the road construction. Crumb is a high performanve modified bitumen manufactured by used scrap tyres and processed in a sophisticated reactor at high temperatures. Use of CRMB leads to excellent pavement life, driving comfort and low maintenance. Highway engineers around the world are trying their best for capturing the flexible nature of rubber in a long paving surface. The use this material is spread rapidly throughout the world. The present study aims at investigating performance of crumb rubber by varying the viscosity grade of the bitumen and to determine the optimum binder content for each grade by Softening point test and Penetration test.

Key Words: *Crumb Rubber Modified Bitumen(CRMB), Viscosity Grade (VG), Softening Point Test, Crumb Rubber (CR), Modifies Bitumen, Pavement.*

1. INTRODUCTION

In the present scenario disposal of rubber wastes produced from different Industries is a great problem. These materials lead to environmental pollution in the atmosphere nearby locality due non-biodegradable property. Cost of extracting good quality of natural material is increasing. To overcome this problem, it is recommended to use alternative materials for highway construction, by which the pollution and disposal problems may be reduced. The need for these solid wastes in India, it was in need to test these materials and to develop specifications for usage of waste tyres in road construction in which it may leads to higher economic returns. The possibility of using these materials should be developed for low volume roads construction in various parts of our country. The necessary specifications should be formulated to maximize the use of solid wastes in different layers of the road pavement

The conventional bituminous mix consists of aggregate and 5 to 6 percent bitumen by weight of the aggregate. The tyre rubber scrap can be incorporated into bitumen, which is known as modified bitumen and granulated, or ground rubber or crumb rubber are used as a portion of the fine stone aggregate. The use of waste tyres in hot bituminous

mixes enhances the performance of pavement, protect environment and provide economic and long-lasting roads.

1.1 Objective

- To study the different viscosity grades VG10, VG-20 of bitumen & its properties.
- To determine the optimum binder content of each grade.
- To compare test results of Conventional and Modified Bitumen.

2. MATERIALS AND METHODOLOGY

2.1 Materials

Crumb rubber (Used Tyres/Tubes) cut in varying size and shape, Bitumen of Viscosity Grade-10, Viscosity Grade -20, Softening Point apparatus, Bitumen mixing apparatus, burner, Penetration test apparatus.

2.2 Methodology

The small pieces of used tyres are cut and of different shape and size so that it mixes and uniformly fills the void when pored with the bitumen. The hot bitumen while constructing the road is burnt and this crumb rubber is used with the aggregate. The bitumen was heated till 170°C and the crumb rubber is added. The blend is mixed for 2-3 minutes. The mixture is then heated to 160 °C and the whole mass was stirred using a mechanical stirrer for about 50 minutes. Care is taken to maintain the temperature between 160 °C to 170 °C. The contents are gradually stirred for about 55 minutes. The modified bitumen is cooled to room temperature and suitably stored for testing.

Following Tests are to be performed for the determination of the properties of CRMB values

A. Softening Point Test

B. Penetration Test

A. Softening Point Test

Softening point denotes the temperature of the bitumen at which it attains a particular degree of softening under the specifications of test. The test is conducted by using Ring and Ball apparatus. A brass ring containing test sample of bitumen is suspended in liquid like water at a specific temperature. A steel ball is placed on the bitumen sample and the liquid is heated at a rate of 5°C /minute. Temperature is noted when the softened bitumen touches the metal plate bottom. Generally, higher softening point indicates lower temperature susceptibility and is preferred in hot climates.



Image 1- Ring and ball (Softening Point) apparatus.

B. Penetration Test

Penetration test is the measure of hardness or softness of bitumen by measuring the depth in tenths of a millimeter to which a standard needle will penetrate vertically in 5 seconds. The penetrometer consists of a needle assembly with a total weight of 100g and a device for releasing and locking in any position. The bitumen is softened to a pouring consistency, stirred thoroughly and poured into containers at a depth at least 15 mm in excess of the expected penetration. The test should be conducted at a specified temperature of 25°C. It may be noted that penetration value is largely influenced by any inaccuracy with regards to pouring temperature, the size of the needle, weight placed on the needle and the test temperature. A grade of 40/50 bitumen means the penetration value is in the range 40 to 50 at standard test

conditions. In hot climates, a lower penetration grade is preferred.



Image 2- Penetration mould

3. EXPERIMENTAL SECTIONS

Various test were carried out for the determination of the properties of the CRBM and plain Bitumen for comparing the 1. Softening Point 2. Penetration Value 3. Ductility Value and the results were compared by the values of the plain bitumen.

4. RESULTS

Softening point test result compared with VG-10 and CRMB (VG-10) are as below:

SR NO	TEST	PLAIN BITUMEN	8% CR	10% CR	12% CR
1	Softening point (°C)	43	49.8	50.96	52.48

Table 1- Comparing the plain bitumen and % varying Crumb Rubber result of Softening Point.

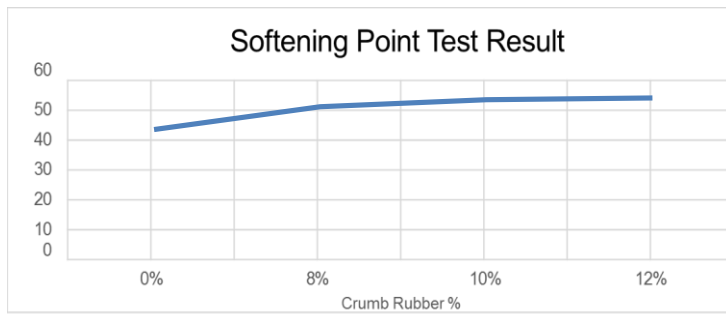


Chart -1 :Softening point test result for CRMB (VG-10)

Common tests result compared with VG-20 and CRMB (VG-20) are as below:

SR NO	TEST	PLAIN BITUMEN	8% CR	10% CR	12% CR
1.	Softening Point (°C)	48	55.67	58.1	58.6

Table 2: Comparing plain Bitumen and % varying Crumb rubber result of softening point test.

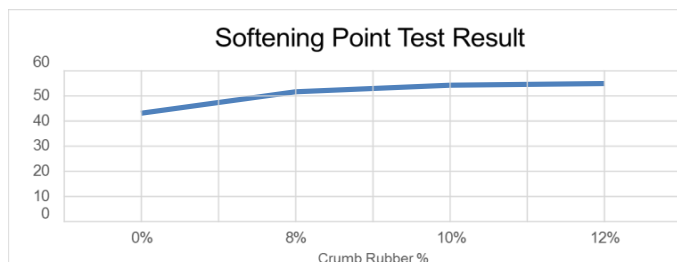


Chart -2: Softening point test result CRMB (VG-20)

5. CONCLUSIONS

1. The use of crumb rubber can reduced the environmental pollution and land dumping problem.
2. The use of crumb rubber will increase the strength and durability of the road as compared in the result.
3. The cost of construction is been reduced.

ACKNOWLEDGEMENT

The support provided by staff of RMD Sinhgad Institute of Technical Campus, Warje and our project guide helped us to get the results and complete our project.

REFERENCES

1. Athira Prasad, Dr Sowmya N J Bituminous Modification with Waste Plastic and Crumb Rubber (IOSR-JMCE) Volume 12, Issue 3 Ver. II (May - Jun. 2015), PP 108-115.
2. Nitu H. Deshmukh, Prof. D. Kshirsagar, Utilization of Rubber Waste in Construction of Flexible Pavement, (Volume 2, Issue7), 2017.
3. Nabin Rana Magar, A Study on the Performance of Crumb Rubber Modified Bitumen by Varying the Sizes of Crumb Rubber , - Volume 14 Number 2 - Aug 2014.
4. Rakesh Nagar Pratiksha Malviya Vikash Kumar Singh, Experimental Investigation of Flexible Pavement by using Crumb Rubber IJSRD - International Journal for Scientific Research & Development Vol. 5 ISSN (online): 2321-0613 Jan, 2018.
5. Nitish Kumar k, Dr. H N Rajakumara Study of Using Waste Rubber Tires in Construction of Bituminous Road International Journal of Scientific & Engineering Research, Volume 7, Issue 5, 23 ISSN 2229-5518 May-2016.
- 6.V. Sukanpriya, S. Omprakash, V. Chandralega. Study of behaviour of bitumen modified crumbed rubber. Published by : International Journal of Engineering Research & Technology (IJERT) ISSN: 2278-0181 May-2016
7. Victor F. Vázquez, Fernando Teran, Urbanos Vihuela, Santiago E. Paje. Study of a road test track with and without crumb rubber. Solutions for noise pollution. October 2014, Vol.13, No. 10, 2487 2495.
8. Prof. S. B. Patil, Prof. A. A. Lole, Prof. N. U. Bavane, Prof. S. S. Shinde. Use of waste tyres in road construction Volume: 03 Issue: 12 Dec-2016
9. Dipak Rathva, Manish Jain, Ashish Talati- A study on performance characteristics of crumb rubber modified bitumen for various blending temperature and blending time Volume: 03 Issue: 12 Dec -2016.
10. Mr. P. Padma Rao, Mr. G. Samba Siva Rao, Mr. Virendra Singh, Mr. A.Suri Babu Performance studies on bituminous mixes using crumb rubber modified bitumen VFSTR Journal of STEM Vol. 03, No. 01 (2017) .