

USE OF WASTE TYRE IN ROAD CONSTRUCTION

Ritika Sharma^{*1}, Shreyansh Yada^{*2}, Utkarsh Dubey^{*3}, Rohit Kumar^{*4},

Ms. Khushboo Tiwari^{*5}

^{*1,2,3,4}B.Tech Student, Department Of Civil Engineering, Bansal Institute Of Engineering And Technology, Lucknow, Uttar Pradesh, India.

^{*5}Assistant Prof. Civil Engineering Department, Bansal Institute Of Engineering And Technology, Lucknow, Uttar Pradesh, India.

ABSTRACT

Rubber tyre are used friendly but not eco-friendly as they are not bio degradable, increasing day by day it is estimated that about 60% of waste tyre are disposed by unknown source. In the urban as well as rural areas. The better binding property in its molten state as help in finding out a method of save disposal of waste tyre. By using them in road laying. The increase of waste tyre disposal is a serious problem that leads to environment pollution, It can be used as a cheap and environmental friendly modification process to minimize the damage of pavement use of crumb rubber help to excellent pavement life. During comfort and low maintainance. The growth rate of vehicle is the backbone economic development of any country . India is a second fast growing automobile industry in the world. As a result amount of waste tyre is also increasing, The increasing of waste tyre has generated many problem suchas increasing landfill space , Environmental Pollution and causing Health hazard. The review include physical test that are use to determine the physical property of bitumen and modified crumb rubber mix, The physical test involve penetration test , softening point test and Durability test. The expectation from this study is to develop between with waste tyre rubber that could minimize the cost of bitumen and providing better physical property compare to the convention bitumen waste on the test that was conduct.

Keywords: Waste Tire Rubber, Bitumen, Crumb Rubber, Wet Process, Flexible Pavement.

I. INTRODUCTION

A country like India an efficient road network is necessary for national integration, industrial development and as well as for socio-economic development and about 0.6 million tonne of scrap tyre are generated annually⁵. Day by day with the increase in number of automobiles in India during recent years. Due to wear and tear of tires the life of tire reduces and at last it becomes useless. The disposal of these tires has become a serious problem. Scrap tyres form a major part of the world's solid waste management problem. Each year the UK alone produces around 30 million waste tyres with 1 billion being produced globally. 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 main constituent of tyre is rubber and the largest single application of rubber is vehicle tyres. Also, the requirement of tyre is directly related to growth of automobile. In Europe, governments are attempting to find alternative uses of scrap tyres as new European Union Landfill Directives have already prohibited the disposal of whole tyres to landfill from 2003 A country like India an efficient road network is necessary for national integration, industrial development and as well as for socio-economic development and about 0.6 million tonne of scrap tyre are generated annually⁵. Day by day with the increase in number of automobiles in India during recent years. Due to wear and tear of tires the life of tire reduces and at last it becomes useless. The disposal of these tires has become a serious problem. Scrap tyres form a major part of the world's solid waste management problem. Each year the UK alone produces around 30 million waste tyres with 1 billion being produced globally. 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 main constituent of tyre is rubber and the largest single application of rubber is vehicle tyres. Also, the requirement of tyre is directly related to growth of automobile. In Europe, governments are attempting to find alternative uses of scrap tyresas new European Union Landfill Directives have already prohibited the disposal of whole tyres to landfill from 2003.

Advantages of using waste tyres :

Waste tyre rubber is used with aggregate in different layer and on the top surface layer mixed with bitumen (5, 10,15). By replacing it with increases its properties of bitumen as well as aggregate. And minimize the pollution occurred due to waste tyre and also used rubber waste is economically as compared to other material.

By replacing the rubber in bitumen the strength will increased.

The main properties of rubber is sound absorbing so reduce the noise pollutions of highway traffic roads.

Addition of waste tyre in rubber aggregate modified the flexibility of surface layer.

II. LITEATURE REVIEW

- **Banglore Process (2002)**, study regarding plastic roads presented. A 25 km plastic road was laid in Bangalore. The plastic road showed superior smoothness, uniformity and less rutting as compared to a plastics-free road laid at the same time, which began developing “crocodile cracks” soon after. The process was also approved in 2003 by the CRRRI (Central Road Research Institute Delhi). Road life improves through improved tackiness and viscosity of the bituminous mix, thereby binding the stones more firmly together and improving the water resistance of the mix to rain etc. Many types of research were carried out by many scholars and professors of civil engineering in this field, to find the ways and crumb rubber mix in conventional bitumen to improve in engineering properties of bitumen.
- **Siddharth Rokade, (2012)** The Crumb Rubber was added to 60/70 grade bitumen in varying percentage. The mix was prepared with 5%bitumen and the varying percentages of Crumb Rubber. The bitumen, when mixed with Crumb Rubber, is termed as Crumb Rubber Modified Bitumen (CRMB). The results observed that the Marshal Stability Value is increased 4% to 12% Crumb Rubber and then it is decreased 15% of Crumb Rubber of the weight of bitumen is the optimum dose for getting enhanced strength characteristics of the mix.
- **Patel Chirag B (2013)**, By using the waste plastic and Crumb Rubber as a modifier the properties of bitumen will be change and this change in physical properties like softening point, penetration value, elastic recovery and Marshall stability was checked by different test. In this study we used modifier in proportion (1%,2%,3% and 4%) by the weight of bitumen.
- **NuhaS. Mashaan, (2012)** In their study presented the application of crumb rubber modifier in the asphalt modification of flexible pavement. From the results of the previous study, it aspires to consider crumb rubber modifier in hot mix asphalt to improve resistance to rutting and produce pavement with better durability by minimizing the distresses caused in hot mix asphalt pavement. Hence, road user would be ensured of safer and smoother road.
- **R. Vasudevan et.al. (2007)**, Has studied that the crumb rubber modified bitumen and they construct different stretches and perform field study with the help of National Transport Planning and Research Centre, Trivandrum. From this field study they concluded that the entire road having a good skid resistance value and from bump instigator study a good surface evenness.

III. METHODOLOGY

Bitumen

Bitumen is a black, highly viscous and very sticky liquid or semi-solid, found in some natural deposits. It is also the by-product of the fractional distillation of crude petroleum. Generally in India bitumen used in road construction of flexible pavement is of grades 60/70 or 80/100 penetration grade.

PROPERTIES OF BITUMEN

Sr.No.	Characteristics	80/100	60/70	30/40	10/20
1	Specific Gravity at 27 °C min	0.98	0.99	0.99	1.00-1.05
2	Water percent by wt.max	0.2	0.2	0.2	-
3	Flash point, °C	175	175	175	225
4	Softening point °C	35-50	40-55	50-65	65-80
5	Penetration at 25 °C, 100 g 5 sec in 1/100 cm	80-100	60-70	30-40	10-20
6	Ductility at 27 °C, in cm. min	75	75	50	2.5
7	Loss on heating, percentage by wt.Max	1	1	1	0.10
8	Penetration of residue	60	60	60	-
9	Percent by wt. soluble in carbon di- sulphide, min	99	99	99	99

Crumb Rubber

The major component of crumb rubber modifier (CRM) is scrap tire rubber which is primarily natural and synthetic rubbers and carbon black. Automobile tires have more synthetic rubber than truck tires. Truck tires contain a higher percentage of nature rubber than automobile tires. Advances in tire manufacturing technology have decreased the difference in chemical composition between the types of tire rubber. The typical bulk CRM produced in today's market is uniform in composition. The average car tire contains ten types of synthetic rubber, four types of natural rubber, four types of carbon black, steel cord, bead wire, and 40 kinds of chemicals, waxes, oils, pigments, etc. Model and Material which are used is presented in this section. Table and model should be in prescribed format.

Table 1: Physical properties of crumb rubber

Physical properties	Unit
Density	1320 kg/m ³
Young's modulus (E)	2600-2900 MPa
Tensile strength (σ_t)	40-70 MPa
Elongation at break	25-50%
Melting point	200 °C
Price	0.25-0.50 €/kg

TEST FOR BITUMEN:

- Penetration test.
- Softening point test.
- Ductility test.
- Viscosity test.
- Specific gravity test.
- Solubility test.
- Flash and Fire point test.
- Loss on heating test.

Table 1: Tests for Bitumen with IS codes

Type of test	Test Method
Penetration Test	IS: 1203-1978
Ductility test	IS: 1208-1978
Softening Point test	IS: 1205-1978
Specific gravity test	IS: 1202-1978
Viscosity test	IS: 1206-1978
Flash and Fire Point test	IS: 1209-1978
Float Test	IS: 1210-1978
Determination of water content	IS: 1211-1978
Determination of Loss on heating	IS:1212-1978

IV. CONCLUSION

After studying the test results of common laboratory tests on plain bitumen and crumb rubber modified bitumen it is concluded that:

- 1) Penetration value of plain bitumen can be improved significantly by modifying it with addition of crumb rubber which is a major environment pollutant. After careful evaluation of the properties and taking various tests as per standards the results shown by 9% addition of rubber crumbs has best suitability for blending it with bitumen.
- 2) From Ductility test, 10% addition of crumb rubber has best suitability for blending it with bitumen.

V. REFERENCES

- [1] S. K. Khanna and C.G. Justo, "Highway Engineering", 8th edition, Nemchand & Bros., pp. 304.
- [2] P. P. Waychal and P. Sagar, "Construction of Flexible Road Pavement by using Waste Rubber Tyre", International Engineering Research Journal, vol. 2, no. 3, 2016.
- [3] K. N. Kumar and H. N. Rajakumara, "Study of Using Waste Rubber Tyres in Construction of Bituminous Road," International Journal of Scientific & Engineering Research, vol. 7, no. 5, pp. 23-27, May 2016.
- [4] N. R. Magar, "A Study on the Performance of Crumb Rubber Modified Bitumen by Varying the Sizes of Crumb Rubber, International Journal of Engineering Trends and Technology, vol. 14, no. 2, pp. 51-56, August 2014.
- [5] M. Priyanka, P. Deepak and S. M. Bhosale, "Laboratory Evaluation of Usage of Waste Tyre Rubber in Bituminous Concrete," International journal of Scientific and Research Publication, vol. 3, no. 9, pp. 1-7, September 2013.
- [6] R. Mandal, M. Singhal and Y. Yadav, "Use of Modified Bitumen in Highway Construction," International Journal for Innovative Research in Science & Technology, vol. 2, no. 2, pp. 376-382, May 2016.