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USE OF PLASTIC WASTE WITH PARTIALLY REPLACEMENT OF BITUMEN IN FLEXIBLE PAVEMENTS

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1. ABSTRACT-Disposal of huge amount of various types of waste materials like plastic, polythene bags, bottles and rubber tyres etc, which are generated in huge quantity and causes harmful environmental effect after their disposal has a big challenge for the recent days. This study attempts the utilization of these waste materials as partial replacement of bitumen to develop a modified binder, for making bituminous concrete mix. To simulate with the field conditions, 'Marshall Stability test' was performed on the samples prepared by partially replacing 'Optimum Bitumen Content' with waste plastic (2%, 4%, 6% and 8%). In this Research we focused on scrapping of plastic waste is a significant issue due to its non-bio-degradability. Laboratory testing results specify that by using waste materials, bituminous concrete of required strength and density can be acquired and an environment friendly green pavement can be prepared with less material cost. The use of waste commodity plastics in binder modification carries the advantage of a cheap and effectual means of enhancing conventional bitumen binder performance characteristics and is an alternative way to utilize plastic waste. This waste plastic with modified bitumen mix show better binding property and good stability value.

***KEYWORDS**: Plastic Waste, Bitumen, Aggregates, Marshall Stability test, flow value*

1. INTRODUCTION

The plastic waste when assorted with bitumen, it upgrades the desired mechanical properties in particular road mix. In the erection of flexible pavement the binding material used is bitumen, the water resistivity, capacity, and stability is expended when waste plastic is mixed with it, Plastic waste at different percentage in bitumen is mixed and Marshall stability has to be check at each mix[5]. A material that contains one or additional organic polymers of huge relative molecular mass, solid in its finished state and at some state whereas producing or process into finished articles, may be formed by its flow, is named as 'Plastic'.

According to a GOI report of ''National Highways Development Project", road network of India is increasing at an annual rate of 4% since 1951 while the rate of increasing of vehicles is much more faster as compare to road network as it is around 12% per annum. This higher rate of increment of vehicles on the roads as compared to the rate of construction of roads, has resulted in the formation of various types of cracks, potholes and deformation of various layers in flexible pavement. As a lot of binders are available such as SBS (Styrene Butadiene Styrene), APP (Atactic Polypropylene) etc. but the benefits of modified asphalt should be checked keeping total capital cost and life economically.

Miss Apurva Chavan[1] has studied about the disposal of waste materials such as waste plastic bags and found that it has become a serious problem and waste plastics are burnt for apparent disposal which cause environmental pollution. Utilization of waste plastic bags in bituminous mixes has proved that the properties of bitumen can changes with addition of plastic waste and it is also useful to solving disposal problems. Mrs Kalpana et. all [2] has studied about the use of waste plastic and concluded that 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. Shivraj Sarojero Patil[3] has studied about replacement of bitumen with synthetic fiber and found that the use of synthetic fiber enhance the properties of mix and also helps in disposal problems. Bansal S. and Mishra A. K.[4] has studied about the plastic waste which is cleaned is cut into various small sizes such that it passes through 1-2 mm sieve. Then the mix is heated and the plastic is effectively coated over the aggregate. The use such innovative technology will not only strengthen the road construction but also increase the road life as well as will help to improve the environment and make the construction economically. Plastic waste which is cleaned is cut into a size such that it passes through 2-3mm sieve using shredding machine. The aggregate mix is heated and the plastic is effectively coated over the aggregate. This plastic waste coated aggregate is mixed with hot bitumen and the resulted mix is used for road construction. Bindu et al.[6] investigates the benefits of stabilizing the stone mastic asphalt (SMA) mixture in flexible pavement with waste plastic. virgin and the stabilized SMA mixtures were subjected to various tests including Marshall Stability, tensile strength and compressive

strength tests with varying percentage of bitumen by weight of mineral aggregate (6% to 8%) and by varying percentage of plastic by weight of mix (6% to 12% with an increment of 1%). And they found that plastic waste at 10% by weight of bitumen is recommended for the improvement the properties of Stone Mastic Asphalt mixtures.

2. MATERIAL DETAILS

The various types of plastic waste is collect in the locality area of Jagatpura, Jaipur. Shredded plastic waste, having particle size around 650 mm with specific gravity 1.18 was used in the binder mix and the bitumen has VG 20 viscosity grade and a penetration value of 40/50. The ductility test were also carried out and found the ductility value 80 cm.

3. EXPERIMENTAL INVESTIGATION

The various proportions (0%, 2%, 4%, 6% and 8%) of waste plastic material is mixed with replacement of bitumen and Marshall stability and flow value test were carried out. As the test results are shown above in table shows that the maximum stability values are achieved when 8% plastic waste is replaced with bitumen content
The tests results are shown as under:

Material specification	Marshall stability at 60^0C(KN)	Marshall flow values (60^0C) mm	Bulk Density g/cc	Air voids %	Voids in mineral aggregates
100% B	8.78	3.08	2.145	3.45	11.89
98% B + 2% P	9.29	2.59	2.119	3.89	12.20
96% B + 4% P	9.45	2.89	2.124	4.15	12.33
94% B + 6% P	9.60	3.40	2.129	4.25	12.68
92% B + 8% P	**10.21**	**3.51**	**2.134**	**4.32**	**12.98**
90% B + 10% P	10.03	3.56	2.130	4.28	13.10

Table 1 various test results

4. CONCOLUSION

we can conclude that, using plastic waste with bitumen mix will help reduction in need of bitumen by around 10%, increase the strength and performance of road, avoid use of anti stripping agent, avoid disposal of plastic waste by incineration and land filling and ultimately develop a technology, which is eco-friendly and cost effective. It will save millions of dollars in future and reduce the amount of resources used for construction.
The use of modified bitumen with the addition of waste plastic of about 8-10% by weight of bitumen helps in substantially improving the Marshall stability, strength, fatigue life and other desirable properties of bituminous concrete mix, resulting which improves the life and pavement performance. The process is environment friendly. The use of waste plastics in the construction of roads and laminated roofing also help to consume large quantity of waste plastics. Thus, these processes are socially highly relevant, giving better infrastructure and eco-friendly environment.

5. REFERENCES

[1] Chavan Apurva J,"Use of Plastic Waste in Flexible Pavements", International Journal of Application or Innovation in Engineering & Management (IJAIEM), Volume 2, Issue 4, April 2013 PP 540-551
[2] Mrs. Kalpana, Surendaran D., "Utilisation of Waste Plastic in Bituminous Roads – A Review", International Journal of Pure and Applied Mathematics, Volume 119 No. 17, 2018, pp 1143-1156
[3] Patil S S, "Experimental Study on Bitumen With Synthetic Fiber", Journal of Information, Knowledge and Research in Civil Engineering, ISSN: 0975 – 6744 Volume 3, Issue 2, pp213-216
[4] Bansal S, Misra A K et. all, "Evaluation of Modified Bituminous Concrete Mix Developed Using Rubber and Plastic Waste Materials", International Journal of Sustainable Built Environment, (2017) 6, pp 442–448
[5] ASTM code : D6927 standard test procedure for marshall stability test.
[6] Bindu C.S & Dr. K.S.Beena., "Waste Plastic as A Stabilizing Additive in Stone Mastic Asphalt", International Journal of Engineering and Technology, Vol.2 (6), 2010, pp 379-387