

# AMALGAMATION OF BITUMEN WITH POLYTHENE, AN ENVIRONMENTAL MENACE

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## **Abstract-**

Polymer modification of bitumen has been commonly performed since the 1980s in order to decrease bitumen (and pavement) susceptibility to high and low temperatures, allowing reduction in common failure mechanisms as rutting and cracking. Bitumen modification has been commonly performed by addition of thermoplastic or elastomeric polymers. Polymer modified bitumen is an essential reference for scientists and engineers, from both academia and the civil engineering and transport industries, interested in the properties and characterisation of polymer modified bitumen. The utilization of plastic waste in bituminous mixes enhances its properties and also its Strength. The waste plastic is shredded and mixed with hot bitumen and resulted mix is used for pavement construction. This will not only strengthen the pavement but also increases its durability.

**Keyword:** Waste Plastic, bitumen, polythene, Marshall Mix

## **Introduction-**

The threat of disposal of plastic will not solve until the practical steps are not initiated at the ground level. It is possible to improve the performance of bituminous mixed used in the surfacing course of roads. Over 80% of the 100 million tonnes of worldwide annual bitumen consumption is used for paving applications in the construction and maintenance of roads. The remainder is used for various purposes. The use of bitumen in road maintenance can be up to four times its use in road construction. This ensures that neither the ground supporting the road nor the individual layers are permanently deformed by concentrated stresses. Bitumen is a by-product of the fractional distillation of crude petroleum oil, but is also found in natural deposits. The plastic usage in roads can replace some percentage of

natural bitumen that is extracted from petroleum.

The main objectives of the present study to provide an eco-friendly road by mixing polythene and bitumen in different ratios, doing surface modification of the modified bitumen by heating and suitability analysis of the modified bitumen by performing various tests on sample.

## **Materials and Methods-**

### **Materials-**

The two primary materials used in the present study are Bitumen and Polythene.

Bitumen is a very viscous material which is black in colour it is a mixture of hydrocarbons which is extracted from petroleum distillation. The prime use of bitumen is use as a binding material in road.

Polythene is material which is soft in touch and a very ductile in nature. Polythene is manufactured from polymerizing ethylene. Today there are many use of polythene such as plastic bag, packing of items, Water bottles and plastic sheets.

### **Methods-**

The methodology in the present study starts from sampling and ends with the conclusion. Sampling for bitumen was done at SantKabir Nagar. About 15 liters of bitumen was collected while sampling. Sampling for Polythene was done at Ghaila village near Lucknow, Uttar Pradesh, India. About 20 kg of polythene was collected while sampling. Then both the materials were heated parallel and then melted polythene is mixed in bitumen in the ration of 23%, 25% & 27% afterwards the mixture of all three sample are mixed vigorously and left for cooling. The analysis of the prepared sample was done according to the IS 154622004, in Transportation laboratory. Analysis of all three samples were did by performing Ductility test, Penetration test, Specific gravity and Softening point test. Afterwards stability test was also conducted by performing Marshall Mix design on the modified bitumen in order to check the stability of bitumen. Afterwards the results of the above mentioned test were obtained and graphs were plotted on the values of stability test performed on Marshall Mix design and on the basis of the plotted graphs conclusion of the present study were made.

## **Results**

### **Softening Point (R & B) Test-**

Softening point (ring and ball) test is a method for the determination of the softening point of bitumen and bituminous binders, in the range 30 °C to 150 °C.

Softening point of sample 1 is 73°C

Softening point of sample 2 is 77.45°C

Softening point of sample 3 is 69.45°C

### **Penetration Test-**

Penetration value is the measure of hardness or consistency of bitumen sample. This test is used for evaluating consistency of bitumen.

Penetration value of sample 1 is obtained as 58.5 mm

Penetration value of sample 2 is obtained as 88.33 mm

Penetration value of sample 3 is obtained as 101 mm

### **Specific Gravity-**

Specific gravity of bituminous material is defined as ratio of mass of given volume of substance to the equal volume of water, temperature of both being 27°C.

Specific gravity of sample 1 is obtained as 1.094

Specific gravity of sample 2 is obtained as 1.089

Specific gravity of sample 3 is obtained as 1.100

### **Ductility Test-**

The ductility of a bituminous material is measured by the distance in centimetres to which it will elongate before breaking when a briquette specimen of the material are pulled apart at a specified speed and at a specified temperature.

Ductility value of sample 1 is obtained as 65.00 cm.

Ductility value of sample 2 is obtained as 55.75 cm.

Ductility value of sample 3 is obtained as 47.10 cm.

### **Marshall Mix Test-**

The various properties of bituminous mix has been obtained and calculated using

Marshall Test. Marshall stability value is defined as the maximum load at which the Specimen fails under the application of the vertical load.

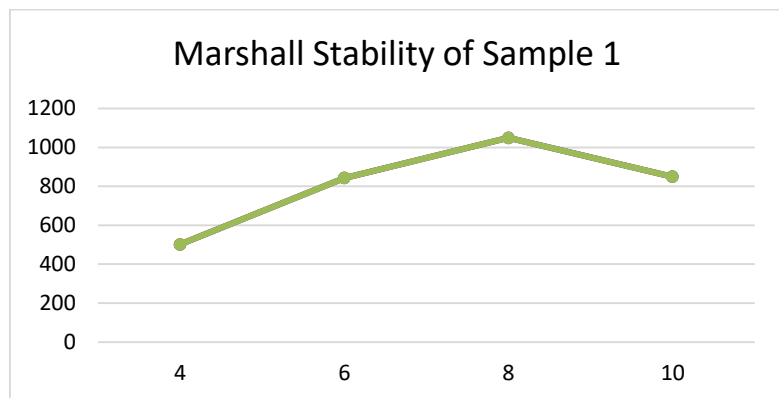


Fig: Marshall Stability for Sample 1

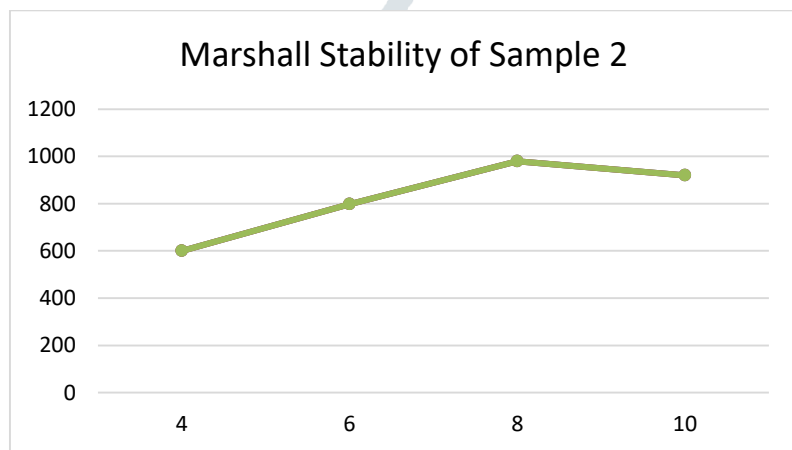


Fig: Marshall Stability for Sample 2

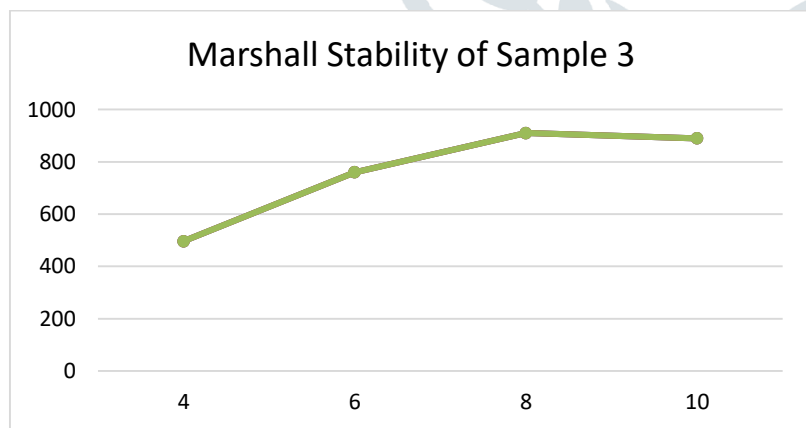


Fig: Marshall Stability for Sample 3

**Conclusion-**

Addition of polythene to bitumen improves the stability value of the mix which results increase in the toughness of the mix. Due to addition of plastic waste the flow value increases resulting the improvement in

the workability. For softening point test Sample 2 is proving better results and after that sample 1 is providing good result. For Penetration test sample 1 is performing very well as compare to other two sample and then sample 2 performance is good. For specific gravity sample 1 and sample 2 lie in the same range i.e. 1.094 & 1.089 but the specific gravity of the sample 3 is increasing a little bit and the value is 1.10. For ductility test Sample 1 is proving better results and after that sample 2 is providing good result. For Marshall Mix Test the test were performed in the laboratory at four different percentage of bitumen and then the graphs are plotted for all three sample now the according to the marshal stability graph sample 1 bears a maximum load of 1050 kg at 8% bitumen whereas sample 2 bears a maximum load of 980 kg at 8% bitumen and sample 3 bears a maximum load of 910 at 8%. So the stability of sample 1 is very good as compare to other two sample.

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