

Waste Plastic usage to Improve Properties of Bitumen in Road Construction

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Abstract— The usage of sustainable development is the present need worldwide. The need of utilisation of waste material in the construction industry is necessary so as to reduce environmental impact. Since plastic material is non-biodegradable the use of plastic material can help us to reduce the present environment effect to some extent. The use of plastic in bitumen to improve the property of bitumen is a right step towards sustainable development of roads in roads construction. Low density polymer helps in increasing the life of flexible pavement and it also helps in proper utilisation of plastic waste.

Key words: Waste Plastic, Bitumen

I. INTRODUCTION

Plastics waste situation on the planet, of the different waste materials, plastics and metropolitan strong waste are incredible concern. Finding legitimate use for the arranged plastics waste is the need of great importance. On the other side, the street activity is expanding, thus the need to build the heap bearing limits of the streets. The littered plastics, a non-biodegradable material, get blended with local waste and make the transfer of city strong waste troublesome. The city strong waste is either burned or land filled. Both transfer strategies are not the most ideal approaches to arrange the waste and it causes both land and air contamination. In addition, if city strong waste, contains PVC waste, when smoldered, it produces poisonous gasses like dioxins. Transfer of plastic squanders in an eco amicable way is the central purpose territory of today's examination works. The creator has created imaginative procedure to utilize the waste plastics for the development of black-top asphalt. This procedure is eco agreeable and can elevate esteem expansion to the waste plastics.

II. OBJECTIVE

To determine the optimum percentage of the plastic which can be added in the bitumen sample so as to enhance its property and adequate use of waste plastic and easier disposal this can help in sustainable growth. To determine softening point, flash and fire point, penetration point, ductility and Marshall Stability of bitumen sample when mixed with percentage of plastic (low density polythene) by weight of the bitumen sample and to determine optimum percentage of plastic (low density polythene) by which the desired performance of bitumen sample can be achieved.

III. TYPES OF BITUMINOUS MIXTURE

Bituminous mixtures which are used in road applications can be classified on the bases of their composition and characteristics or by their methods of production. Hot mix asphalt (HMA), Cold laid pant mix, Penetration type macadam, Road mix or mixed in place. Bituminous mixtures

on the bases of characteristics and composition are Open graded hot asphaltic mix, Stone matrix asphalt, Dense graded hot mix asphalt. Polymer customized bitumen is up-and-coming as one of the significant construction materials for flexible road works. Utilize of plastic waste in the manufacture of flexible roads is getting hold of meaning because of the numerous reasons. The polymer customized bitumen show superior properties for road making & plastics waste, otherwise consider being a pollution hazard, can find its use in this method and this can help solve the problem of pollution since most of the plastic waste are generally polymers.

IV. EXPERIMENT INVESTIGATION

A. Determination of Softening Point Test of Bitumen:

The Grade of Bitumen On Which Test Are Performed Is VG-30. Bitumen Is First Heated to A Temperature Between 75to 100 Degree Celsius Which Is Approx Above the Softening Point of Bitumen Until It Becomes Fluid. Then The Shredded Plastic, Here We Are Using Low Density Polythene Having Thickness Greater Than Equal to 30 Micron Is Added to The Hot Bitumen Sample in Certain Percentage with Respect the Weight To Bitumen Used And Stirring Is Done Until Plastic Is Homogenously Mixed With The Bitumen Sample And Then It Is Poured Into The Rings Which Are Placed On The Metal Plate. *Method of Test According to IS 1205-1978.*

Temperature at which sample touches the bottom plate	% of plastic with respect to weight of bitumen sample.	Mean Temperature
	0 %	51 °c
	1 %	52.5°c
	3 %	54.5°c
	6 %	53.5°c
	9 %	56.5°c

Table 1: Determination of Softening Point Test of Bitumen

B. Modified Flash and Fire Point of Bitumen of Bitumen:

Relax the bitumen somewhere around 75 degrees Celsius and 100 degree Celsius. Blend it completely to evacuate air bubbles and water and add the shredded plastic in the bitumen sample and mix thoroughly until a homogenous mixture is obtained. Fill the cup with the material to be tested up to the filling mark. Place it on the bath. Fix the open clip. Embed the thermometer of high or low range according to prerequisite furthermore the stirrer, to blend it. Light the test flame, conform it. Contribute heat at such a rate, to the point that the temperature augmentation, documentation by the thermometer is neither below 5 degrees Celsius nor further than 6 degree Celsius each instant Method of testing is then according to IS 1209-1978. Bitumen sample used VG-30.

% of plastic added with respect to the weight of bitumen sample	Flash point	Fire point
0 %	246.66°C	261.66°C
1 %	266.66°C	286.66°C
3 %	283.33°C	316.66°C
6 %	291.66°C	330°C
9 %	303.33°C	336.66°C

Table 2: Flash and Fire Point of Bitumen of Bitumen

C. Penetration Test of Bitumen:

Heat the bitumen over the softening point (somewhere around 70 and 100 degree Celsius). Blend it completely to evacuate air bubbles and water. And then in the next following trials add certain percentage of plastics in the heated bitumen and mix them until a homogenous mixture is obtain. Pour it into a compartment to a profundity of no less than 15mm in abundance of the normal penetration. Method according to IS- 1203-1978. Grade of bitumen used vg-30.

% of plastic added with respect to the weight of bitumen sample.	Penetration 1/10 th mm
0 %	128.33 mm
1 %	129.66 mm
3 %	117.33 mm
6 %	59.66 mm
9 %	52 mm

Table 4: Penetration Test of Bitumen:

D. Ductility Test of Bitumen:

Totally dissolve the bituminous material to be tried by warming it to a temperature of 75 to 100 degree Celsius over the surmised softening point until it changes into to be altogether liquid. Add shredded plastic (low density polythene) to the bitumen sample. Method of testing according to IS 1208-1978. Bitumen sample used vg-30.

% of plastic added with respect to the weight of bitumen sample.	Ductility in cm
0 %	93.33 cm
1%	89 cm
3 %	47.5 cm
6 %	22.66 cm
9 %	15.66 cm

Table 5: Ductility Test of Bitumen

E. Marshall Stability Test of Bitumen:

The bitumen is heated to 140°C - 1650°C. The shredded plastic (plastic covers, milk covers) is added to the bitumen. The aggregate (6mm, 10mm, 20mm and stone dust and cement) are weighed to all total of 1200 gm and then heated to 150°C. The heated aggregate & the plastic added bitumen is mixed & transferred to the compaction mould. The specimen is given 75 number of blow on the topside of the Sample mix with standard hammer (450mm, 4.86kg). reverse the specimen & 75 blows is given on the other side. The mould is kept undisturbed for 24hours. The specimen from the mould is gently removed. A sequence of sample is prepare by a similar Method with varying quantities of bitumen content with percentage of plastics. The mould is immersed in hot water bath at 60°C for 30min. The mould is tested for its stability & flow.

% of plastic added with respect to the weight of bitumen mix sample.	Stability in kN	Flow in mm
1 %	16.87 kN	5.63 mm
3 %	16.93 kN	2.83 mm
6 %	17.32 kN	1.1 mm
9 %	20.86 kN	1.23 mm

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Table 6: Marshall Stability Test of Bitumen

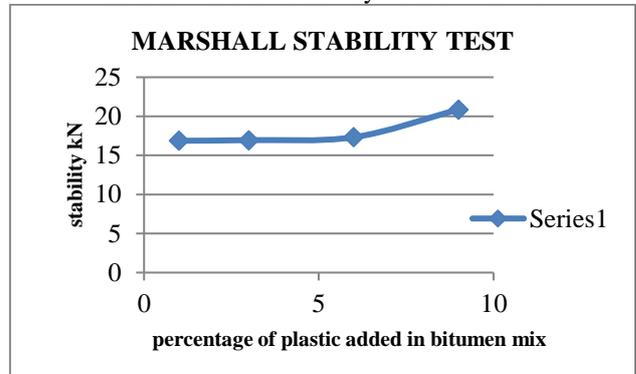


Fig. 1:

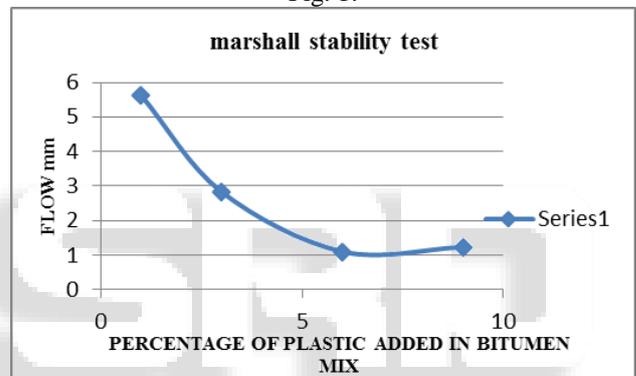


Fig. 2:

V. FINAL RESULT

- 1) VG-30 bitumen which are generally used in Madhya Pradesh in flexible road construction, when the experiment was conduction on the softening point of bitumen on vg-30 grade bitumen by using different percentage of plastic, it was observed that the softening point of the bitumen sample increases with the increase in the percentage of plastic which is added with respect to the weight of bitumen.
- 2) When the experiment was conducted on the flash and fire point of bitumen on VG-30 grade, it was observed that the flash point of the bitumen and the fire pint of the bitumen of VG-30 here we used increases with increase in the percentage of low density polythene or plastic having size greater than equal to 30 micron.
- 3) When the experiment was conducted on the penetration point of the bitumen on the bitumen sample of VG-30 grade, it was observed that the penetration value of the bitumen sample decreases with increase with the percentage of plastic with respect to the weight of bitumen used.
- 4) When the experiment was performed for the ductility test of bitumen then it was observed that the ductility of the sample is decreased the percentage of plastic with respect to the weight of bitumen increased.

When the experiment was performed for the marshal stability test on the bitumen sample it was observed that as the percentage of plastic added in bitumen is increased the flow value of the sample reduces and the value of stability increases.

VI. CONCLUSION

Since now a days as the garbage and waste material is increasing day by day there efficient disposal has become difficult. The reuse of the waste plastic material in the road construction has given us a new ray of hope and getting new innovative method so we can go towards the sustainable development and thus by reducing man made hazardous impacts on the environment.

The following result concluded that for the optimum performance of the flexible road and to give us improved properties of material we can use low density polythene or plastic in the proportion between 1% to 3% to give the desired results.

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