

Experimental Investigation of Increase The Strength of Bitumen By Using Plastic

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ABSTRACT

This project can explain that enhancing the strength of bitumen. This can be done by using plastic in bitumen. There is use any type of plastics in bitumen. In now a days to use the plastic bitumen roads. This is prepared by the pavements. The plastic is first mixed with aggregate in the pavement and then the bitumen can used to binder material. This method of mix proportion to give the good result, but there is no homogeneity in load bearing capacity in all over areas. There is the advantage is the construction method is easy, the disadvantage is no homogeneity in load bearing capacity. This waste plastic modified bitumen mix show better binding property, stability, stiffness, density and extra resistant to water. Test in bitumen's such as Penetration test, Ductility test, Softening point test, Viscosity test ect...

INTRODUCTION

Bitumen is manufactured from crude oil. Bitumen is obtained as the last residue in fractional distillation of crude petroleum. Crude petroleum is a mixture of hydrocarbons of different molecular weights. In the petroleum refineries the individual components like LPG, naphtha, Kerosene, Diesel etc. are separated through the process of fractional distillation. The

heaviest material obtained from the fractional distillation process is further treated and blended to make different grades of paving grade bitumen.

Bitumen is defined as "A viscous liquid, or a solid, consisting essentially of hydrocarbons and their derivatives, which is soluble in trichloroethylene and is substantially nonvolatile and softens gradually when heated. It is black or brown in color & possesses waterproofing and

adhesive properties. It is obtained by refinery processes from petroleum, and is also found as a natural deposit or as a component of naturally occurring asphalt, in which it is associated with mineral matter.

OBJECTIVE

Basic intention is to efficiently utilize the waste plastic in constructive way so that it can be beneficial to society

- To evaluate the penetration, ductility, viscosity and softening point values of bitumen without plastic
- To compare the penetration, ductility, viscosity and softening point values of bitumen without plastic and bitumen with plastic.

Different Grades

- Penetration grade
- Industrial grade bitumen
- Cutback
- Bitumen emulsion
- Modified bitumen
- Viscosity grade bitumen

1.1 Uses of different grades

1.1.1 Penetration grade

- **Bitumen 80/100:** The characteristics of this grade confirm to that of S 90 grade of IS-73-1992. This is the softest of all grades available in India. This is suitable for low

however main objectives of current project work are:

- To mix the waste plastic with the bitumen
- To evaluate the penetration, ductility, viscosity and softening point values of bitumen with plastic

We expected that the obtain values of bitumen with plastic is greater than the obtain values of bitumen without plastic.

volume roads and is still widely used in the country.

- **Bitumen 60/70:** This grade is harder than 80/100 and can withstand higher traffic loads. The characteristics of this grade confirm to that of S 65 grade of IS-73-1992. It is presently used mainly in construction of National Highways & State Highways.
- **Bitumen 30/40:** This is the hardest of all the grades and can withstand very heavy traffic loads. The characteristics of this grade confirm

to that of S 35 grade of IS-73-1992. Bitumen 30/40 is used in specialized applications like airport runways and also in very heavy traffic volume roads in coastal cities in the country.

1.2.1 Collection of materials

To collect the materials for to start the project. In this project have the following materials to done the project,

- Bitumen
- Plastic

Bitumen

In this project can use the grade of VG-10. This grade of bitumen have to satisfy the values in table-2. If there is not only this grade of bitumen, can be use all type of grade also.

Plastic

In this project can use the waste plastics like broken plastic stool, broken plastic box, etc... there is use having many properties of plastics. If not only this type of plastics, can be use also same type property of plastics.

1.2 Mixing of materials

1.2.1 Purpose of mix

The purpose of mixing of bitumen and the plastic is that thus the material have should get homogeneity. This homogeneity gives strength of the bitumen.

1.2.2 Mix proportion

We are expect on this project, there is excess adding of plastic in to the bitumen is get loss the strength of bitumen. So that purpose we can dividing the ratios between bitumen and the plastic as follows,

1:0.1

Where '1' is the ratio of bitumen and '0.1' is the ratio of plastic. It can by divided by its weights. It is represent that 10% weight of plastic is mixed with 100% of its weight of bitumen.

1.3 TEST ON BITUMEN WITHOUT PLASTIC AND WITH PLASTIC

Tests can be prepare in bases of its properties. They are,

- Penetration test
- Ductility test
- Viscosity test
- Softening point test

1.3.1 Penetration test without plastic

Penetration of a bituminous material is the distance in tenths of millimeter that standard needle will penetrate vertically into a sample under standard conditions of temperature, load and time. Penetration test procedure can see appendix.

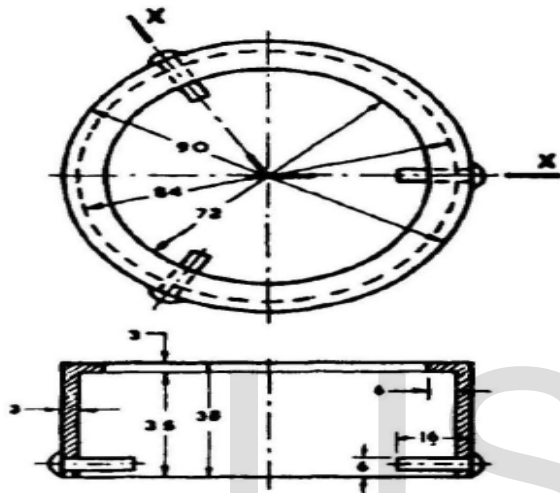


Figure-1.3.1: Penetration container

The values of bitumen is obtain at test as follows,

Table-1.3.1: Penetration test values for bitumen without plastic

Content	Trial-1	Trial-2	Trial-3
Initial reading	200	293	381
Final reading	293	381	465

Mean values	93	88	84
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Mean value of penetration of bitumen is **86.67 mm**. Therefore the grade of bitumen for the above obtain value is **S90**.

1.3.2 Penetration test with plastic

The values of bitumen is obtain at test as follows,

Table-1.3.2: Penetration test values for bitumen with plastic

Content	Trial-1	Trial-2	Trial-3
Initial reading	200	361	463
Final reading	361	463	517
Mean values	161	102	54

Mean value of penetration of bitumen is **105.67 mm**. Therefore the grade of bitumen for the above obtain value is **S90**.

1.3.3 Ductility test for without plastic

The ductility of a bituminous material is measured by the distance in centimeters to which it will elongate before breaking when a briquette specimen of the material of the form pulled apart at a

specified speed and at a specified temperature. Penetration test procedure can see appendix.

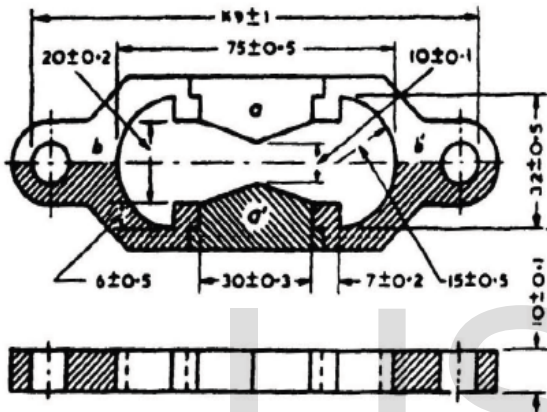


Figure-1.3.3(a): Mould for ductility test



Figure-1.3.3(b): Ductility test equipment

The values of bitumen is obtain at test as follows,

Table-1.3.3: Ductility test values for bitumen without plastic

Content	Trial-1	Trial-2	Trial-3

Initial reading	0	0	0
Final reading	76.8	75.8	76.6
Ductility=FR-IR	76.8	75.8	76.6

The Ductility value of bitumen is **76.4 cm**. This value is **< 75 cm** and is related with given recommended value on **IS-73**.

1.3.4 Ductility test with plastic

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 of the form pulled apart at a specified speed and at a specified temperature. Penetration test procedure can see appendix.

The values of bitumen is obtain at test as follows,

Table-1.3.4: Ductility test values for bitumen with plastic

Content	Trial-1	Trial-2	Trial-3
Initial reading	0	0	0
Final reading	76.2	78.6	82.7
Ductility=FR-IR	76.2	78.6	82.7

The Ductility value of bitumen is **79.17 cm**.
 This value is **< 75 cm** and is related with given recommended value on **IS-73**.

1.3.5 Viscosity test without plastic

The property of a fluid by which it resists flow due to internal friction, and one of the methods by which it is measured, is by determining the time taken by **50 cc** of the material to flow from a cup through a specified orifice under standard conditions of test and at specified temperature. Penetration test procedure can see appendix.

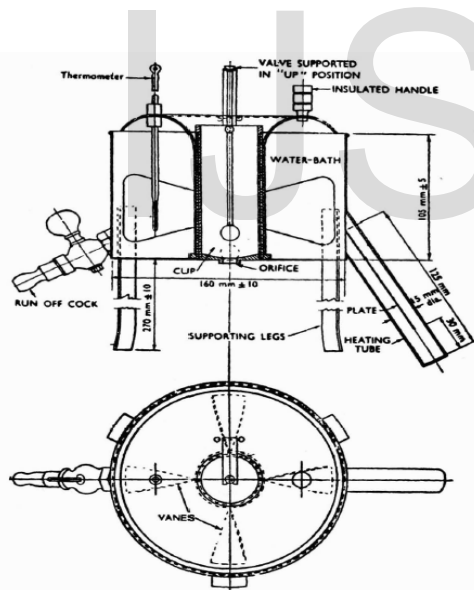


Figure-1.3.5: Tar/Bitumen viscometer

The values of bitumen is obtain at test as follows,

Table-1.3.5: Viscosity test value for bitumen without plastic

Content	Trial-1	Trial-2
Test temperature	60°C	60°C
Time taken to flow 50 cc of the binder	971	1026

The viscosity value of bitumen is **998.5 sec**.
 This obtain value is within the recommended value on **IS-73**.

1.3.6 Viscosity test with plastic

The property of a fluid by which it resists flow due to internal friction, and one of the methods by which it is measured, is by determining the time taken by **50 cc** of the material to flow from a cup through a specified orifice under standard conditions of test and at specified temperature. Penetration test procedure can see appendix.

The values of bitumen is obtain at test as follows,

Table-1.3.6: Viscosity test value for bitumen with plastic

Content	Trial-1	Trial-2
Test temperature	60°C	60°C
Time taken to flow 50 cc of the binder	1035	1076

The viscosity value of bitumen is **1055.5 sec**. This obtain value is within the recommended value on **IS-73**.

1.3.7 Softening point test without plastic

The temperature at which the substance attains a particular degree of softening under specified condition of test. Penetration test procedure can see appendix.

guide

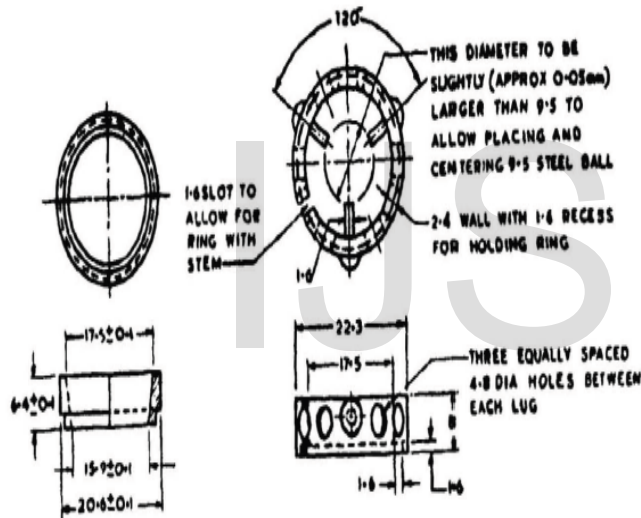


Fig-1.3.7(b)

Figure-1.3.7(b): Softening point test apparatus

Figure-1.3.7(a): Tapered ring and Ball centering

The values of bitumen is obtain at test as follows,

Table-1.3.7: Softening point test value for bitumen without plastic

Content	Trial-1	Trial-2
Temperature when the ball touches	38.6	40.1

bottom, °C		
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Table-1.3.8: Softening point test value for bitumen with plastic

Content	Trial-1	Trial-2
Temperature when the ball touches bottom, °C	45	47.5

The softening point of bitumen is **39.35°C**. This obtain value is within the recommended value on **IS-73**.

1.3.8 Softening point test with plastic

The values of bitumen is obtain at test as follows,

The softening point of bitumen is **46.25°C**. This obtain value is within the recommended value on **IS-73**.

1.4 Results

1.4.1 Comparison of Test Results:

To comparing the result on bitumen without plastic and bitumen with plastic as follows,

Table-1.4.1: Comparison of Test Result

S.No	Tests	Test result for Bitumen without Plastic	Test result for Bitumen with Plastic	Recommended value	Unit
1	Penetration value	86.67	105.67	80-100	Mm
2	Ductility value	76.4	79.17	>75	Cm
3	Viscosity value	998.5	1055.5	800-1200	Sec
4	Softening value	39.35	46.25	40	°C

This comparison of test result can confirm that the strength of bitumen mixed with plastic is greater than the strength of bitumen without mix of plastic.

1.5 Conclusion

Based on the present work the following conclusion can be drawn regarding the

improvement of asphalt mixture that will be used in the local street paving by the use of waste plastics additive displacement:

- Waste plastics (HDPE, PET, and polypropylene) modified bituminous binders provide better resistance against permanent deformations according to their high stability and high Marshall Quotient and it contributes to recirculation of plastic wastes as well as to protection of the environment.
- Waste plastics will increase the melting point of the bitumen. Then use of the innovative technology not only strengthened the road construction but also increased the
- Ductility value for bitumen with plastic is **79.17cm** and is greater than the ductility value for bitumen
- Viscosity value for bitumen with plastic is **1055.5 sec** and is greater than the viscosity value for bitumen without plastic is **998.5 sec** and thus are within the limit of recommended value is **800-1200 sec**.
- Softening value for bitumen with plastic is **46.25 °C** and is greater than the ductility value for bitumen without plastic is **39.35 °C** and thus

road life as well as will help to improve the environment and also creating a source of income.

The results indicated that the consumption of waste plastics in bituminous mixtures shows improved property of the mixtures thus formed. In this project, can done as follow values,

- Penetration value for bitumen with plastic is **105.67 mm** and is greater than the penetration value for bitumen without plastic is **86.67 mm** and thus are within the limit of recommended value is **80-100 mm**.

without plastic is **76.4 mm** and thus are within the limit of recommended value is **>75 cm**.

are within the limit of recommended value is **40 °C**.

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