Use of Plastic Waste in Bituminous Road

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Abstract – *Use of plastic is rapidly increasing in daily life due to increase in rapid rate of urbanization and development. As bituminous road is mainly used in India for avoiding scarcity of bitumen for development of road plastic waste is useful raw material. It has been found that plastic waste act as binding material for bitumen, hence it improving the properties of the bitumen. In present study, a comparison is carried is carried out use of plastic waste (5%) in bitumen concrete mixes and use in for road construction.*

Key Words: **Bitumen, Aggregate, Plastic Waste, Marshall Stability, Penetration.**

1.INTRODUCTION

Plastic is manmade polymer which are any of various complex organic compound produced by polymerization is process of small molecules combine to make a large chainlike structure. Polyethylene Terephthalate (PET) plastic is now used for packaging of materials for a whole range of consumer products. Use of plastic is rapidly in daily life due to urbanization. Plastic waste degrade very slow i.e. it takes decades to centuries for its complete degradation. The natural degradation of plastic is harmful for environment which cause of air pollution, water pollution and soil pollution. Disposal of plastic waste is serious issue at global level. The use of plastic waste in bituminous road is better way to disposal of plastic waste. Also replacement of bitumen with plastic waste is more effective which reduces the use of conventical bituminous material.

1.1Problem Statement

- The rapid rate of urbanization and development has lead to increasing plastic waste generation. As plastic is non-biodegradable in nature, it remains in environment for several years and it causes pollution. So disposal of plastic waste is important for avoid bad impact on environment.
- Plastic waste disposal is continue to be major problem for a civic authorities.

1.2Objective

- To reduce plastic waste by using it in bituminous road.
- To evaluate the stability performance on modified hot mix bitumen with plastic.
- To save environment from pollution of plastic waste.

2. LITERATURE REVIEW

I. **DR.R.VASUDEVAN (2011):** Polymer bitumen blend is bettar binder campared to plain bitumen. Blend has increased softening point decreased penetration value with suitable ductility.

II. **APURVA J CHAVAN (2013):** Use of plastic Waste in pavement of roads prevents the moisture adsorption and oxidation of bitumen by entrapped air. The roads can withstand heavy traffic and shows better durability.

III. **K.V.R.PRASAD (2013):** The waste bitumen mix forms better material for pavement constructions the mix shows higher Marshall stability value and suitable Marshall Coefficient. Hence use of the waste plastics for pavement is one of the best methods for easy disposal waste plastic.

IV. **NABIN RANA MAGAR (2014):** The penetration value and softening point of plain bitumen can be improved significantly by modifying with addition of crumb rubber which is major environment pollutant.

V. **NITIN DUTTA SHARMA (2015):** The optimum use plastic can be done up to 10%, based on Marshall Stability Test.

VI. **YASH MENRIA (2015):** The property of bitumen such as penetration, softening point improved with addition of waste fiber.

VII. **ATHIRA R PRASAD (2015):** The use of plastic in 6% by weight of bitumen improves the pavement stability.

VIII. **R MANJU (2017):** The Plastic mixed with bitumen and aggregate gives better performance of the roads.

IX. **A.LOGESHKUMARAN (2018):** Using Lignin and Plastic as a partial replacement of bitumen pavements the results are very effective when compared to usual usage of bitumen in construction of pavements.

X. **ABDULAZEEZ ROTIMI (2022):** Utilizing waste as an additive in road construction pavement have been regarded as a valuable strategy for recycling waste plastics.

3. METHODOLOGY

1. **Collection of Plastic Waste** – Plastic waste is collected from Waste Processing Plant which collects the garbage from city.
2. **Segregation of Plastic Waste** – Plastic Waste is segregated by Low Density Polyethylene and High Density Polyethylene.
3. **Cleaning and Drying Process** – Plastic Waste is cleaned by water. Cleaned plastic waste is dried by kept it in sunlight for a day.
4. **Shredding of Plastic Waste** – It is completed by with the help of shredding machine of Waste Processing Plant. Shredded size of plastic is about 2 to 5 mm.
5. **Mixing with Bitumen** – Shredded plastic waste is mixed with bitumen about 5 percent.
6. **Heating Process** – Polymer modified bitumen is heated for testing.
7. **Testing** – Following Testing are carried out
   i. Penetration Test
   ii. Ductility Test
   iii. Softening Point Test
   iv. Marshall Stability Test

4. RESULT AND DISCUSSION

4.1 Penetration Test – Penetration Test is to determine the hardness of bitumen. The penetration of a bitumen is the distance is the distance in tenths of millimetre, that a standard needle will penetrate into the bitumen under a load of 100gm applied at 5 seconds at 25 degree celcius. Penetration value indicates the softness of bitumen.

Table 1 - Comparative Study of Plain Bitumen and Polymer Modified Bitumen

Sr.No	Comparative Study of Plain Bitumen And Polymer Modified Bitumen		
	Material	Name of The Test	Result
1	Plain Bitumen	Penetration Test	98.5
2	Polymer Modified Bitumen	Penetration Test	92.5

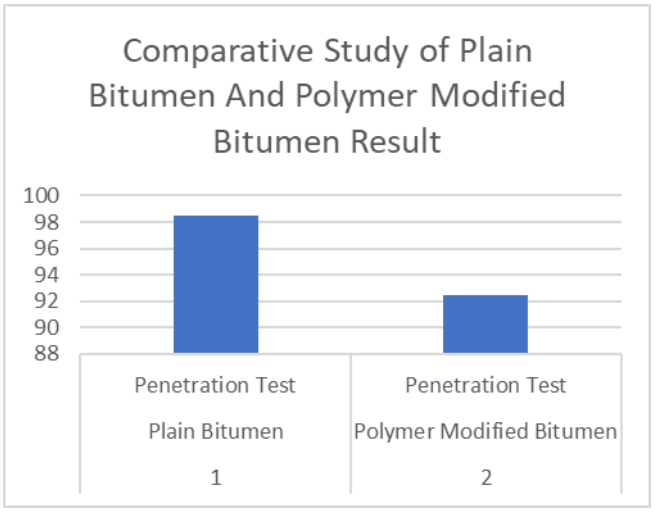

Chart 1 - Comparative Study of Plain Bitumen and Polymer Modified Bitumen

4.2 Ductility Test – The ductility of 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 described under mould are pulled apart of specified speed and at specified temperature.

Table 2 - Comparative Study of Plain Bitumen and Polymer Modified Bitumen

Sr.No	Comparative Study of Plain Bitumen And Polymer Modified Bitumen		
	Material	Name of The Test	Result
1	Plain Bitumen	Ductility Test	46
2	Polymer Modified Bitumen	Ductility Test	45

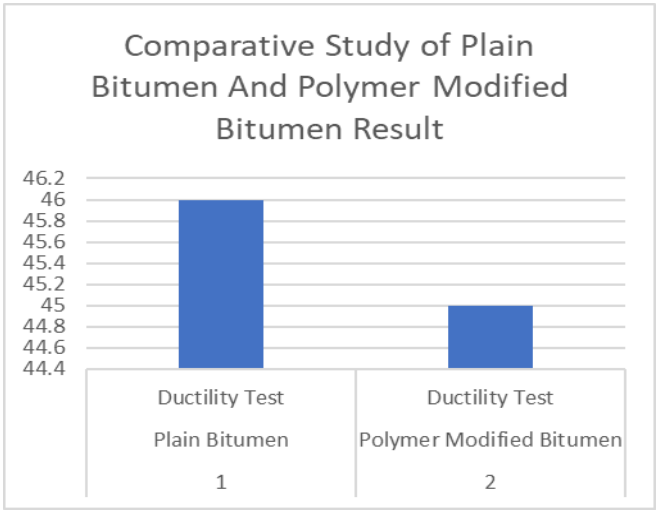

Chart 2 - Comparative Study of Plain Bitumen and Polymer Modified Bitumen

4.3 Softening Point Test - The temperature at which a substance attains a particular degree of softening under specified condition of test.

Table 3 - Comparative Study of Plain Bitumen and Polymer Modified Bitumen

Sr.No	Comparative Study of Plain Bitumen And Polymer Modified Bitumen		
	Material	Name of The Test	Result
1	Plain Bitumen	Softening point	49
2	Polymer Modified Bitumen	Softening point	46

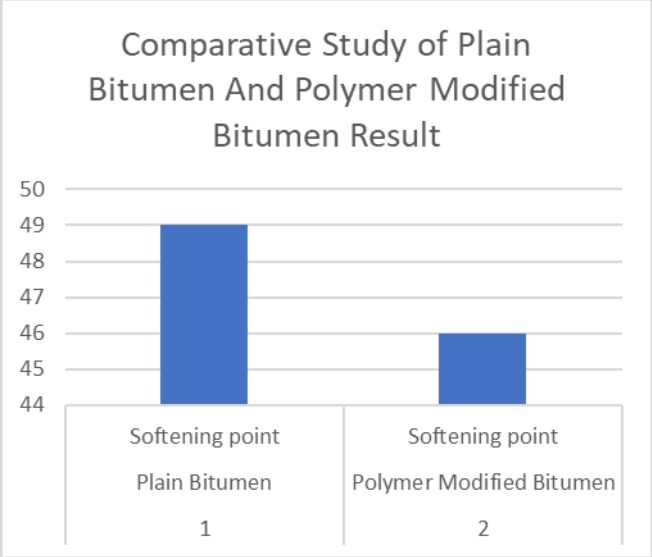

Chart 3 - Comparative Study of Plain Bitumen and Polymer Modified Bitumen

4.4 Marshall Stability Test - Marshall stability and flow values along with density; air voids in the total mix, voids in the mineral aggregate, or voids filled with asphalt, or both, filled with asphalt are used for laboratory mix design and evaluation of asphalt mixtures. In addition, Marshall stability and flow can be used to monitor the plant process of producing asphalt mixture. Marshall stability and flow may also be used to relatively evaluate different mixes and the effects of conditioning such as with water.

Table 4 - Comparative Study of Plain Bitumen and Polymer Modified Bitumen

Sr.No	Comparative Study of Plain Bitumen And Polymer Modified Bitumen		
	Material	Name of The Test	Result
1	Plain Bitumen	Marshall Stability	10.60
2	Polymer Modified Bitumen	Marshall Stability	14.34

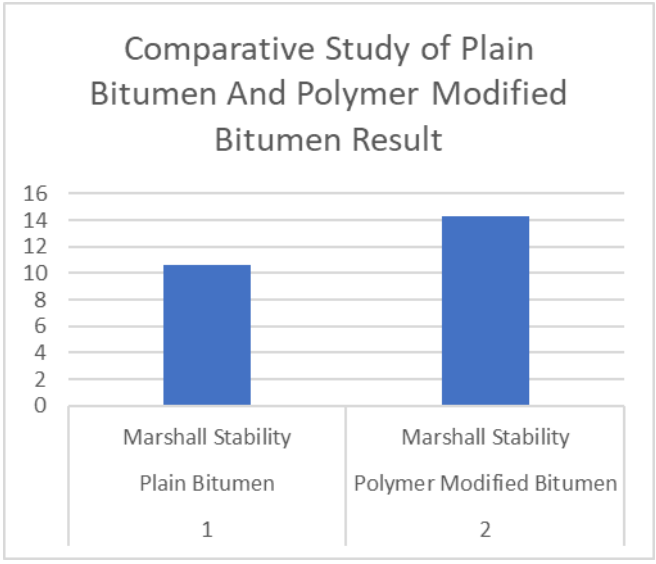

Chart 4 - Comparative Study of Plain Bitumen and Polymer Modified Bitumen

Table 5 - Comparative Study of Plain Bitumen and Polymer Modified Bitumen

Sr.No	Comparative Study of Plain Bitumen And Polymer Modified Bitumen		
	Material	Name of The Test	Result
1	Plain Bitumen	Marshall Flow	7
2	Polymer Modified Bitumen	Marshall Flow	3

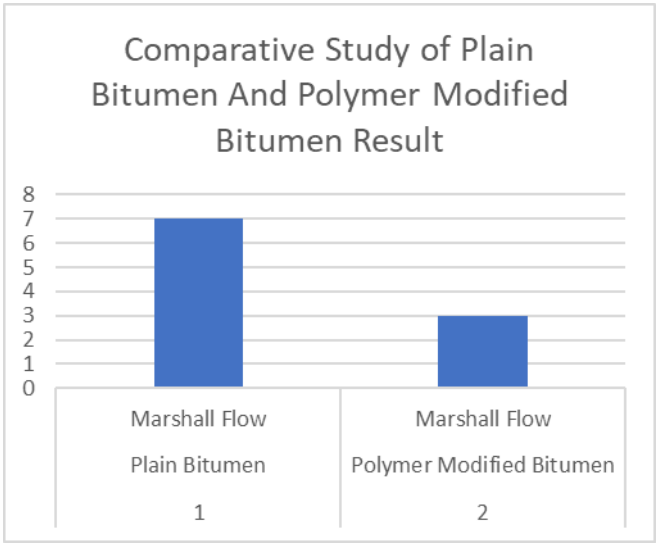

Chart 5 - Comparative Study of Plain Bitumen and Polymer Modified Bitumen

5. CONCLUSION

- It shows the mixing of Plastic waste with bitumen for bituminous road is improving the properties of bitumen.
- It shows the stability increases of polymer modified bitumen compared to plain bitumen.
- Use of plastic waste in bituminous road shows good result compared with conventical bituminous road.
- It is the best way to disposal of plastic waste technique.

6. REFERENCES

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