



Marshall Method of Mix Design by using Waste Plastic in Bituminous Concrete Mix Design

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ABSTRACT

Disposal of lot of waste like plastic, poly bags, bottles etc, which are produced in enormous amount and causes ecological hazards after disposal. Disposal of waste is a main problem as they are non biodegradable, present study attempts to make use of these wastes to improve performance of bituminous. Test results shows that the strength increases up to 16% due to partial substitution of bitumen with plastic waste. The laboratory test results shows that bituminous concrete of the required density and strength can be obtained by using plastic wastes and also with lower material cost ecofriendly green pavement can be prepared.

Keywords —Plastic waste, Optimum binder content, Optimum plastic content, Bitumen.

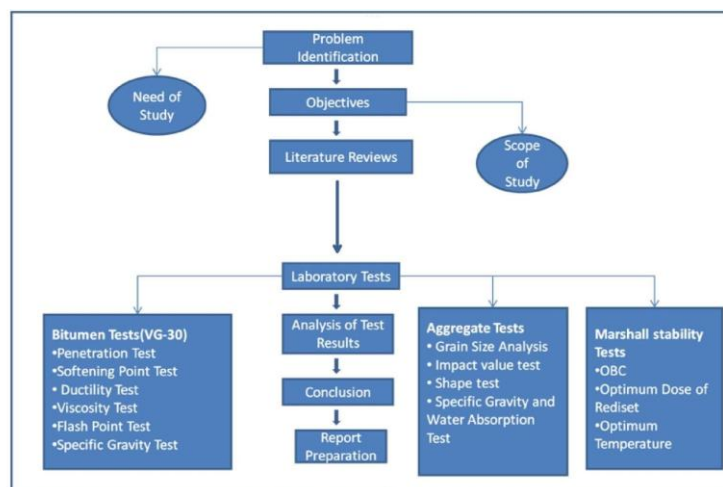
I. INTRODUCTION

Plastics become a problem for the environment after their use. Disposing of a variety of plastic and rubber waste in an eco-friendly manner is the focus of current research. In view of the current lifestyle, the use of plastic waste cannot be completely prohibited, although plastic waste taking the face of a devil for the present and future generation. Plastic roads perform better than ordinary roads because plastic roads have better wear resistance than ordinary roads and Plastic roads are more durable. In hot and extremely humid climates, durable and environmentally friendly plastic roads are the biggest advantages. It will also help relieving the earth from all kinds of plastic waste.

II. METHODOLOGY

The procured materials for the project work are:

- Coarse aggregates
- Waste plastic
- Asphalt binder.



III. LITERATURE REVIEW

3.1 Evaluation of modified bituminous concrete mix developed using rubber and plastic waste materials.

Shubham Bansal, Anil Kumar Misra, Purnima Bajpai.

- Various materials that become waste after their useful life, such as plastic bottles, can be used as a partial replacement in the bituminous concrete mixture, which can help in the increasing demand for bitumen in road construction.
- Using waste materials such as plastic bottles in the bituminous concrete mix lowers the cost of road construction.

3.2 Utilization of Plastic waste in Bitumen Mixes for Flexible Pavement.

Dr. S. L. Hake, Dr. R. M. Damgir, P. R. Awsarmal.

- The optimum bitumen content of pure semi-dense bituminous concrete mixes was found to be 10% higher than that of semi-dense bituminous concrete mixes modified with plastic waste
- The Marshall stability of pure semi-dense bituminous concrete mixes at optimum bitumen content showed 1.6% less when compared to semi-dense bituminous concrete mixes modified with plastic waste.

3.3 Effect of waste polymer modifier on the properties of bituminous concrete mixes.

Sangita, Tabrez Alam Khan, Sabina, D.K. Sharma.

- The effect of waste polymer modifier on bituminous concrete mixes shows that the waste polymer modifier is thermally stable up to 230°C, so it will not degrade when mixed with hot aggregates.

3.4 Sustainable use of waste plastic modifiers to strengthen the adhesion properties of asphalt mixtures.

Safeer Haider, Imran Hafeez, Jamal, Rafi Ullah.

- In modifiers, low density polyethylene improves the performance bituminous mixtures.
- In the mixing methods, the wet mixing method was better than the dry mixing method. When the modifiers were wet mixed, there is less loss of asphalt binder coating, along with less rut depth, loss of Marshall stability, and higher TSR values.

3.5 Use of waste high density polyethylene as bitumen modifier in asphalt concrete mix.

Sinan Hinishoglu, Emine Agar.

- It is concluded that the samples prepared with a mixing temperature of 165°C and a mixing time of 30°C for 4% HDPE have the more stability and the less flow, and thus the highest Marshall ratio.

3.6 Experimental investigation on modification of rheological parameters of bitumen by using waste plastic bottles.

Sudheer Ponnada, Vamsi Krishna K.

- The addition of plastic to the bitumen should reach the optimum level, beyond the optimum value, the rheological properties and stability values decrease, which is not recommended for good pavement design.

3.7 An Experimental Study on Plastic Blended Bituminous Concrete Mix Roads.

T. Sarada, G. Sreeja.

- Stripping of the bitumen due to the plastic mixture is reduced.
- The formation of potholes on the roads is considerably reduced with 6% plastic, but from strength point of view, 8% gives better results.

3.8 An experimental study on the properties of extruded Polystyrene waste polymer modified bitumen for flexible pavements.

S.Abinaya, M. Clement , Dr. S. Shanmugam.

- The test results shows that the penetration value of bitumen increases due to use of extruded polystyrene waste polymer.

3.9 Improving the Properties of Asphalt Concrete Using Waste Plastic Bottle as Additive.

Rocksana Akter, Md. Rabiul Islam and Kazi Abu Manjur.

- The results indicate that mixing WPB with an asphalt concrete mix performs better than the conventional mix and improves its properties with increasing amounts of WPB.

3.10 Optimum Use of Plastic Waste to Enhance the Marshall Properties and Moisture Resistance of Hot Mix Asphalt.

Assist. Prof..Dr. Hamed M Jassim, Assist. Lect. Omar T Mahmood , Assist. Lect. Sheelan A Ahmed.

- Plastic wastes are used to increase bituminous performance.
- Marshall stability increases due to addition of plastic waste.

3.11 Evaluation of the effect of recycled waste plastic bags on mechanical properties of hot mix asphalt mixtures for road construction.

Nakachew Assefa.

- The use of plastic waste in bituminous mixes improves the stability of the mix.

3.12 Study the Use of Cement and Plastic bottle Waste as Ingredient Added to the Asphaltic Concrete Wearing Course.

Lilies Widodojoko, P. Eliza Purnamasari.

- The stability of the mixture is maximum for 4% of plastic . Laboratory tests shows that for plastic content more than 4% stability decreases .

3.13 A Study on use of Plastic Waste in Flexible Pavements.

T. Kiran Kumar ,J.Vikranth.

- The construction cost of flexible pavements reduces due to the utilization of waste plastic.
- The properties of bitumen and aggregates increases due to the utilization of waste plastic .

3.14 USE OF WASTE PLASTIC IN BITUMINOUS CONCRETE.

Aman Khimta, Sahil Arora.

- The strength and The life of road increases due to use of plastic mix .
- The use of plastic increases the melting point of bitumen.

3.15 REDUCTION IN CONSUMPTION OF BITUMEN BY USE OF PLASTIC COATED AGGREGATES IN BITUMINOUS MIXES OF FLEXIBLE PAVEMENTS.

Brajesh Mishra, Dr.U.K. Maheshwari, and Dr.M.K.Gupta.

- It concluded that use of plastic reduces porosity, moisture absorption and improves binding property of the mix.

IV.CONCLUSION

- Plastic mixture reduces the bitumen content upto 10%.
- The strength and performance of the pavement increases due to plastic mixes.
- Plastic roads are durable and eco-friendly which will relieve the earth from all type of plastic waste.
- The melting point of bitumen increases due to plastic mixes.
- The use of plastic reduces porosity, absorption of moisture.
- The use plastic bottles in bituminous concrete mix decreases cost of the road construction.

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