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Application of Asphalt with blending of low density polythen in Road Construction

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ABSTRACT

The research presents a comparative analysis of properties & performance of hot mix asphalt (HMA) with mixing of polymer modified Bitumen (PMB) in terms of LDPE, HDPE & CR. Polymer modified Asphalt improved stiffness and susceptibility to high temperature effects. With CR modified HMA was found to the most cost effective with 0.166 million saving per lane km, compared to LDPE & HDPE modified HMA. The main objective of this study in to investigate the feasibility of using the additives containing from waste PET by the aminolysis process, to improve the performance of bituminous mixture. The environmentally friendly green asphalt was prepared for road construction by mixing with waste polyethylene terephthalate (WPET). The modifier were used in percentage of 4%% and 8% (wt/wt) to obtain modified asphalt binder with desirable physical and engineering properties.

Introduction

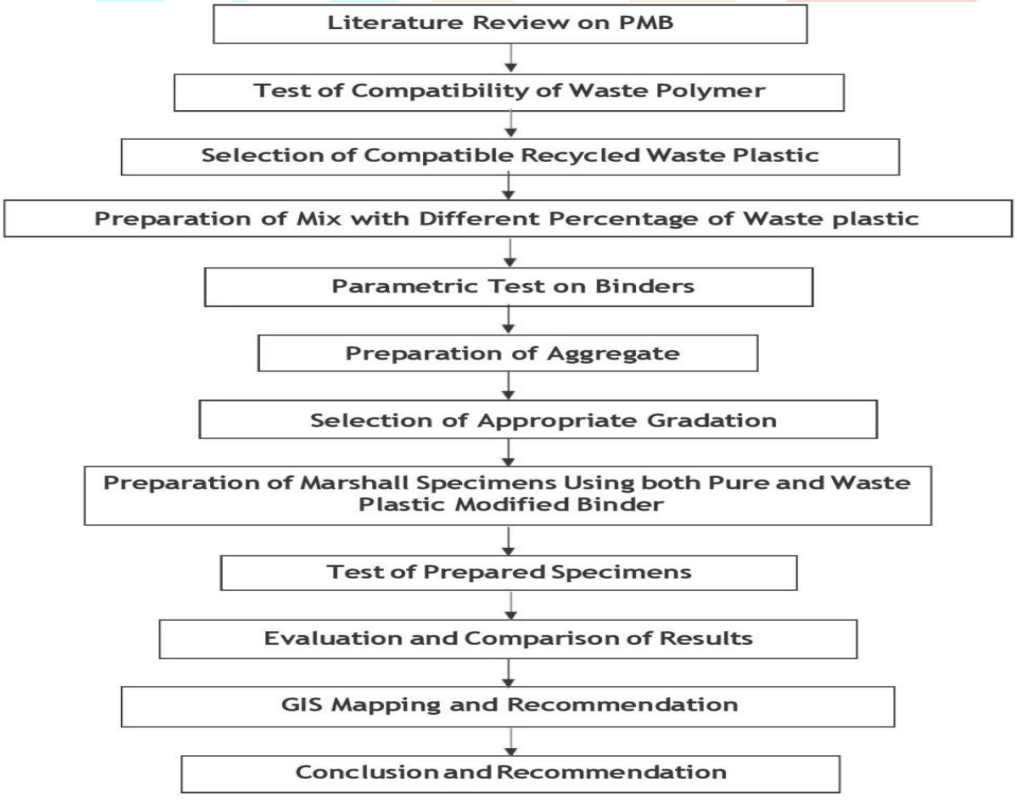
The various worldwide research and research have revealed that India's increase in properties of a pavement of Asphalt and bituminous by incorporating various additives will enhance its performance. This added substance is called Asphalt Modifier and the Asphalt blended in with this modifier is called Modified Asphalt. The performance of surfacing in modified Asphalt is 50 to 90 per cent due to the degree of modification as per additives.

Preliminary trial test contemplates completed under the aegis of Central Road Research Institute, New Delhi, Highway Research Station, Chennai, Rubber Board, Gujarat Engineering Research Institute, Vadhodara and Kerala Public Works Department have indicated that the utilization of enhanced Asphalt in construction and if life cycle cost is considered the bituminous is come to be a cheaper option. The selection of mixed Asphalt with waste plastic on lying road and renewals of maintenance is quite simple and less expensive. It uses the same traditional method by focusing on prevailing traffic and climate compared to a regular Asphalt road. One more important suggestion is to have precaution during construction to raise pavement properties and its life to the desired load.

Temperature and viscosity should be maintained in mountain road surfacing from plastic deformation from high temperature and brittle cracking from the low temperature. The commercially available Asphalt in various part of the country does not meet the requirement as it doesn't hold the temperature viscosity lead to follow "premature failure of Asphalt surfacing". If a bituminous blend - utilized in a surfacing will be made it some degree stiffer, it can have a longer fatigue life and endurance to traffic load for a longer span. The enhancement in the strength of a bituminous surfacing will bring about an economy in the utilization of Asphalt and ot To study various test performance as Penetration Test, Softening Test, and Ductility Test of Asphalt help modify it. The test desired to have a higher softening point, better ductility, and lower penetration values. The test performs on the Asphalt and plastic doped Asphalt such as retained Marshall Test, Fatigue and Marshall Stability is done. It shows that Fatigue and Marshall Stability is enhanced by times in plastic mixed Asphalt than Asphalt.

METHDOLOGY

This work was conducted to reduce the amount of waste plastics from the dumping . The blending of Asphalt with waste plastics and were tested different property strength. The flow diagram given below.



1 -Selection of materials

The selection of raw material and in this research helps to study characteristics of a Asphalt mix by reducing a substantial amount of the Asphalt by adding plastic. The adaptability of plastic in road construction is studied in Asphalt Macadam and Semi Dense Asphalt concrete (SDBC). The MORTH (2001) is used to

gradation of fine and coarse aggregate (Adnan *et al.*, 2018). The result of waste plastic is analyzed using various tests like the Fatigue test, Indirect Tensile Test and Marshall Test etc.

1. 1 Asphalt

To prepare our sample 80/100- grade Asphalt used with a specific gravity of 1.025.

Table 1: "Physical properties of Asphalt."

S No.	Test	Test Result
1	Penetration	87
2	Softening Point (Ring and Ball Method) °C	51
3	Ductility	96

1.2 Waste Plastic

The waste plastic is collected from the Saharsa district of Bihar. This is due to reduce the plastic waste in our society and one step forward in reducing already dumped waste. The collected sample has a specific gravity of 0.48.

1. 3 Aggregate

Coarse and fine aggregates were collected from the nearby river of "Sone-River".

Table 2 : Properties of Coarse Aggregates

Properties	Values	Recommendation Value (As per MOST)
Aggregate Impact Value (%)	20	<30
Flakiness (%)	15	<25
Aggregate Crushing Value (%)	19	<30

2. Blend Preparation

In blend preparation, using a polymer as a modifier like scrub tiers using a mechanical blender are very much helpful as drawn in a literature review. It is also clear that time, temperature and shear force of blending are affecting factor of blending. For our research blending time of 40 minutes and higher shear stress to mix evenly in the waste plastic sample with a shorter blending time, no change in the rheology occurs(Leng *et al.*, 2018). The mechanical blending is used to have uniform missing as higher shear stress is required for HDPE.

Table 2: Modified Asphalt-Penetration values

S No.	Waste Plastic + Asphalt	Penetration, 0.01 mm (100 gm, 5 sec, 25 °C)	Softening Point (Ring and Ball Method) °C	Ductility (cm)	Specific Gravity	Heat Loss
1	Pure Asphalt	95	50	106	1.025	0.02
2	4 % Plastic + Asphalt	79	58	66	1.019	0.03
3	6 % Plastic + Asphalt	70	62	53	1.017	0.04
4	8 % Plastic + Asphalt	65	66	46	1.015	0.03
5	10 % Plastic + Asphalt	58	71	39	1.012	0.02

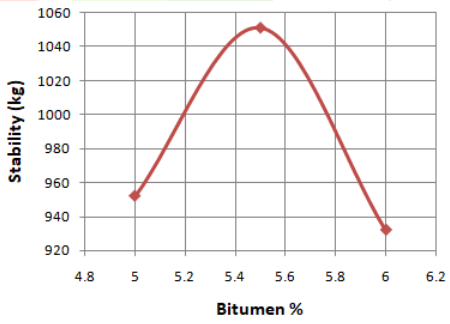
The results out comes analyzed as per their property and nature of materials physical durability and strength

3 Semi Dense Asphalt Concrete (without Waste Plastic)

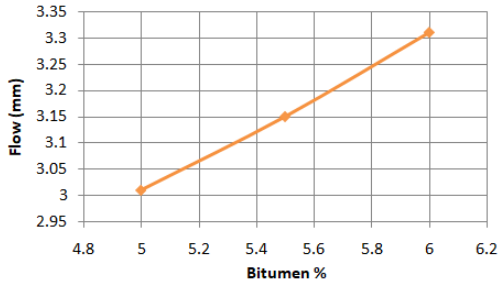
Table 3: Value of different Asphalt % (no plastic) in Semi Dense Asphalt Concrete

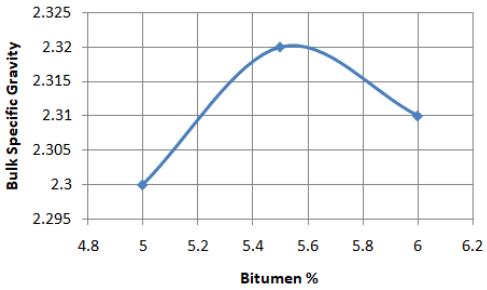
Asphalt %	Waste Plastic %	Stability (kg)	Flow (mm)	BSG of Mix (gm/cm^2)	Air Voids (%)	VMA %	VFB %
5	0	952	3.01	2.30	5.66	16.93	66.56
5.5	0	1051	3.15	2.32	4.51	16.94	73.35
6	0	932	3.31	2.31	3.95	17.42	77.40

The result is drawn in the following Graphs:-



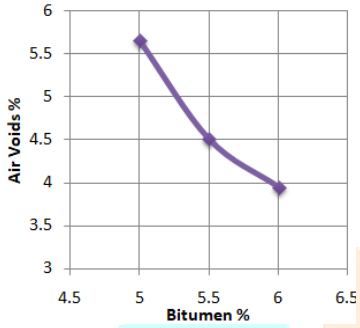
(a) Stability vs Asphalt%

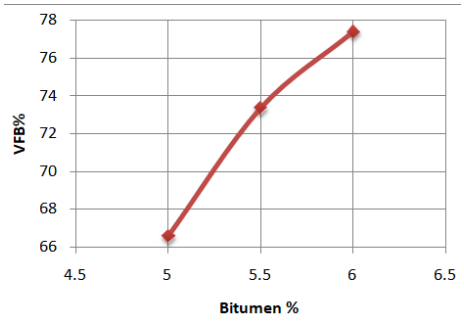


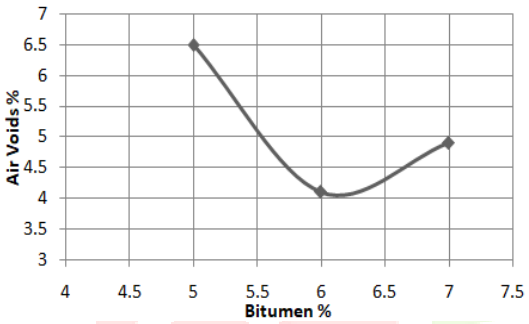


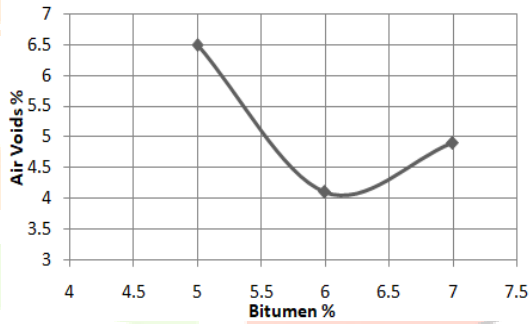
(b) Flow Value vs. Asphalt%

(c) BSG vs. Asphalt%









CONCLUSIONS

The research presents a comparative analysis of properties & performance of hot mix asphalt (HMA). With mixing of polymer modified Asphalt (PMB) in terms of LDPE, HDPE & CR. Polymer modified Asphalt improved stiffness and susceptibility to high temperature effects. With CR modified HMA was found to the most cost effective with 0.166 million saving per lane km, compared to LDPE & HDPE modified HMA. The main objective of this study in to investigate the feasibility of using the additives containing from waste PET bythe aminolysis process, to improve the performance of bituminous mixture. The environmentally friendly green asphalt was prepared for road construction by mixing with waste polyethylene terephthalate (WPET). The modifier were used in percentage of 4%% and 8% (wt/wt) to obtain modified asphalt binder with desirable physical and engineering properties.

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