USE OF WASTE POLYETHYLENE IN BITUMINOUS CONCRETE MIXES

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Abstract: **Bituminous Concrete (BC)** is an integrated material that is widely used in construction projects such as roadblocks, airports, parking lots etc. It consists of asphalt or bitumen (used as a bond) and a mixture of minerals mixed together in layers considering the environment, due to the excessive use of polythenes in daily business, environmental pollution is very high. Since polythenes do not decay easily, the need for the present is to use the garbage dump for certain beneficial purposes. Different percentages of polythene are used to prepare the selected mixing and placement as provided in the IRC Code. The role of polythene in mixing is studied in various engineering structures by preparing Marshall Samples of BC composites containing polymer-free polymer. Marshall's properties such as stability, value flow, unit weight, voids are used to obtain the absolute polythene content in a given range of bitumen (80/100).

Keywords: Bituminous Concrete (BC), Marshall Stability, Flow value, Optimum Polythene Content**.**

I. INTRODUCTION

Bituminous ties are widely used by the housing industry. The paved area has different layers .The main components of bituminous concrete (BC) are composite and bitumen. It is estimated that about ten thousand tons per hour the day (TPD) of plastic waste is made up of 9% of 1.20 TPD lacs for MSW in India. Plastic waste builds up two large plastic sections; (i) Thermoplastics and (ii) Thermoset plastic. Thermoplastics, makes up 80% and thermoset makes up about 20% of the plastic waste produced in India. [11]

Regenerating plastic thermoplastics include;

Polyethylene Terephthalate (PET), Low Poly

Ethylene (LDPE), Poly Vinyl Chloride (PVC), High

Poly Polyyleylene (HDPE), Polypropylene (PP),

Polystyrene (PS) etc.

However, thermoset plastics contain alkyl, epoxy, ester, melamine formaldehyde, phenolic formaldehyde, silicon, urea formaldehyde, and polyurethane, metalized and multilayer plastics etc. is ever increasing. About 50 to 60 percent of the plastics used for packaging. Table 1 provides details on the full utilization of plastic waste in India over the past decade. We need to take certain steps at a lower level in order to control the risk of plastic waste. Studies have shown that plastic waste after proper procedure can be used in the construction of small stones. Such plaques show improved structures and longer lifespan, making road construction more economical and problem-solving at the same time.

II. LITERATURE REVIEW

Plastic waste is used in construction of gemstones in India from ten years now. That is evident the use of plastics improves the rheological properties of it was sent so it was paved. Its questionable research has been done to determine the suitability of plastic debris in the construction of small stones. Dr. R. Vasudevan states in his writings that the use of plastic bitumen improves binding properties for bitch.

Professor C.E.G Justo says 8% increase percent by weight of used plastic is preferable to saves 0.4% bitumen by mixing weight as it improves stability, strength, health and other desirable features of bitch. Crushed macadam recycled plastics, especially polyethylene (LDPE) changing 30% aggregate of 2.36 - 5 mm, reducing mixing 16% congestion and showed a 250% increase in Marshall Stability. Zoorab and Superma claim the use of recycled plastics in bituminous plain concrete mixes increases its intensity and fatigue. Bahia and Anderson, 1984; studied the visco-elastic state of binders and found that, complex modulus and angles of the compound class, require measurement, temperatures and different loading conditions such as weather and loading conditions.

Shukla and Jain (1984) explained that the effect of bitumen wax can be reduced by adding EVA (Ethyl Vinyl ACEtate), fragrant resin and SBS bitumen wax. The addition of 4% EVA or 6% SBS or 8% resin to wax bitumen effectively reduces the tendency to high temperatures, bleeding at high temperatures and stiffness at low ambient temperatures.

The findings of the studies conducted by the Shell Research and Technology Centre in Amsterdam indicated that the rutting rate is greatly reduced as a result of SBS conversion of bond. Button and Little (1998) on the basis of a stress-controlled stress test at 20 and 00C, reported

that the SBS polymer showed higher fatigue properties compared to direct AC-5 bitumen.

Shuler et al. (1987) found that the stiffness of the SBS modified binder was significantly increased compared to the unmodified asphalt mixture at minus 21, 25 and 410C.

Collins et al. (1991) and Baker (1998) found that SBSs converted to asphalt mixtures have a longer lifespan than untreated asphalt mixtures. The addition of SBS polymer to unpolished bitumen also increases its resistance to low temperatures. Denning and Carswell (1981) reported that asphalt concrete using polyethylene-based binders was highly resistant to permanent fluctuations at high temperatures.

Sibaletal. (2000) assessed the life of the flexible fatigue of the asphalt concrete fixed with 3% crumbly rubber as part of the composite.

Goodrich (1998) reported that the fatigue and creepy areas of modified polymer mixtures were significantly higher compared to untreated asphalt mixtures. Special Issues of the Indian Roads Congress: 53 (2002) show that the next renewal period can be extended by 50% in the event of reconstituted bitumen compared to unconventional bitumen.

A 25-kilometer concrete concrete road has been laid in Bangalore. This plastic road has shown a high smoothness, uniformity and a slight reduction compared to the unpaved plastic road at the same time, which began to form "crocodile cracks" very recently. This procedure was also adopted, in 2003 by CRRI (Central Road Research Institute Delhi).

Justo et al (2002), at the Center for Transportation Engineering, Bangalore University used recycled plastic bags as an additive to asphalt concrete mixtures. The characteristics of this modified bitumen were compared with those of standard bitumen. It was noted that the penetration and ductility values, modified we bitumen decreased with the increase in the value of the plastic additive, by up to 12% by weight.

Mohammad T. Awwadet al (2007), polyethylene as a single type of polymers is used to investigate potential opportunities for the development of asphalt composite structures. Objectives include determining the best type of polyethylene to use and its value. Two types of polyethylene are added to cover the aggregate High Density Polyethylene (HDPE) and Low Density Polyethylene (LDPE).

The results show that the HDPE polyethylene modifier grinding offers better engineering properties. The recommended component of the converter is 12% by weight of bitumen content. It has been found to increase stability, reduce congestion and slightly increase the voids in the air and the associated mineral gaps.

Shankar et al (2009), modified rubber crumbs (CRMB 55) were incorporated at set temperatures. Marshall's composite formulation was performed by modifying the converted bitumen content into a non-permanent rubber content and subsequent experiments were obtained to obtain distinctive features of the composite and standard bitumen design (60/70) as well. (5.67%). This resulted in very improved features.

Imtiyaz khan and Dr. P.J. Gandaliya, "The use of polyethylene waste in bituminous concrete mix to improve the performance of flexible corridors." International journal of scientific research, September - 2012 Vol-1 Pg no. 57, 58

Bitumen prepared with 4% polythene waste showed better performance compared to other marshal hardness which is a power parameter showed an increasing trend of a sharp increase of 34.26% compared to conventional mixing when converted by 4% Polythene Waste.

Afroz Sultana.SK, K.S.B. Prasad, “The use of plastic waste as a surface strength regulator is a course of flexible and durable paving stone.” International Journal of Research and Engineering, July-August 2012 Vol-2 PgNo.1185to1191. In this study they are investigating the potential use of plastic waste such as repairing asphalt concrete and cement concrete blocks.

III. THE FOLLOWING POINTS ARE AVAILABLE BY USING WATSE POLYTHENE IN BITUMINOUS MONCRETE MIX

• Improvement of marshalles features such as the value of durability and flow rate.

• Resistance to paralysis under heavy loads increases.

• Ventilation closes gaps in the mixture.

• Unmeasured paved system found to have better working health.

• Increase bond bonding between aggregate and binder which can improve many small stone structures.

• Reduction of rutting and hot cracks in the pavement.

• Use of non-perishable plastic waste that causes environmental pollution.

• Reduction in the amount of plastic waste that is unsuitable for wildlife, aquatic life and is subject to soil pollution.

Materials used to conduct current research are:
1.Aggregates
2.Bitumen
3.Plastic_waste
Various laboratory tests were performed on this building materials and results were calculated.

1. Aggregates

Aggregates form a large part of the pavement structure and they form the finest materials used in stone masonry construction. Aggregates should bear the resulting pressures due to the loading of the wheels on the pavement and above

Yes. They should also resist wearing because of a bad act of vehicles. This is used for the construction of the pavement in cement concrete, bituminous concrete and other bituminous structures and as a granular base course the upper layers paved with stones.

The properties of aggregates are therefore very important to highway engineer. Some of the desirable features of these combined are strength, durability, weight, stiffness, etc.

Various tests performed on aggregates in laboratory Los Angeles test, crushing test, impact test, flakiness and elongation index and results obtained listed below in Table 2.

Table 2: Results of the tests conducted on aggregates

S No	Test	Property determined	Results
01	Los Angeles test	Abrasion	26.8%
02	Crushing test	Crushing strength	21.2%
03	Impact test	Toughness	11%
04	Shape test	Flakiness index	13%
05	Shape test	Elongation index	12.3%

2. Bitumen

The bituminous materials used in the construction of the highway are bitumen and tar were added. Bitumen is possible

It is also composed of petroleum asphalt or bitumen as well

Native asphalt. There are many traditional types asphalts are available. These are the ones that happen in the file a pure or almost pure state of nature. The viscosity of bitumen is sometimes reduced by an unconventional dose; this the material is called cutback. When the bitumen is suspended in

A well-separated state in a wet environment as well reinforced with an emulsifier, which is also known as emulsion. Tar is a viscous fluid found there organic matter such as wood and coal is incorporated into carbon or corrupted by the absence of air. Bitumen is available in various grades and types. Judging the merits of these compilers of various physical exercises has been determined by agencies such as ASTM, Asphalt Institute, British Standards Institution and ISI. The set includes entry test, ductility test, softening test, flash and fire point test, viscosity test, etc. The results of the tests performed on our sample are listed below in Table 3:

Table 3: Results of the tests conducted on bitumen

S No.	TEST	RESULT
01	Penetration Test	73 mm
02	Softening point test	43oC
03	Ductility test	63 mm
04	Flash point test	192.33oC
05	Fire point test	201.33Oc

3. Plastic Waste

Plastic waste such as carry bags, cups, disposable items, etc. extracted from the mill and sprayed with different percentages above the hot mixture. Details of the process are provided below.

Figure 1. Collection of Waste Plastic

a. Waste plastic shredding: Distribution is the process of cutting the plastic into small pieces sizes between 2.36mm to 4.75mm with the help of Plastic grinding machine viz. Agglomerater and Scrap Mill. [12]
b. b. Details of Shredding Machine: The use of poly-ethylene "Agglomerator" is used. In this process, plastic debris is cut into small pieces with the help of rotator blades. Process completed by about half an hour. [12]

Figure 2. Collection of waste Plastic

Sprinkled plastic waste was sprinkled over hot condensed compounds when dissolved. The size of the cover varies by using different percentages with plastic. The increase in the percentage of plastic increases the integration properties.

Figure 3. Shredded Plastic

IV. Experimental work

- Tests on aggregates

1. Aggregate impact test
2. Aggregate crushing test
3. Aggregate abrasion value test
4. Specific gravity and water absorption test

Results of Aggregate Testing

Sr. no.	Tests	Method	Test Result	Permissible limit
1.	Impact test	IS 2386 PART IV	19.40 %	Max 30 %
2.	Abrasion Test	IS 2386 PART IV	17.4 %	Max 30 %
3.	Crushing TEST	IS 2386 PART IV	22.8 %	Max 30 %
4.	Specific gravity	IS 2386 PART III	2.7	2.5 to 3
5.	Water absorption	IS 2386 PART III	0.96 %	Max 2 %

- Tests on bitumen

1. Bitumen penetration test
2. Bitumen softening point test
3. Bitumen ductility test

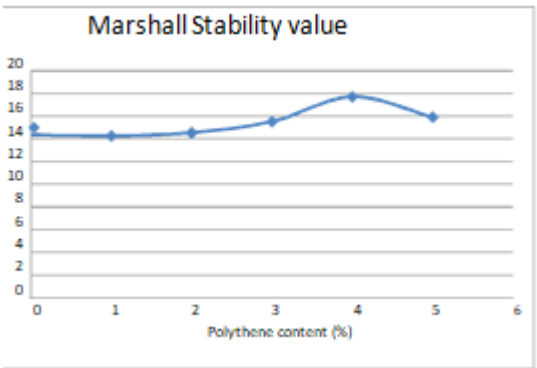
Results of Bitumen Testing

Sr. No.	Type of test	Test Method	Result	Permissible Limit
1.	Penetration test	IS 1203 - 1978	64	60 to 70
2.	Softening point	IS 1203 - 1978	45	40 to 55
3.	Ductility test	IS 1208 - 1978	80	75 (min)

Marshall testing was performed as per the procedure described in ASTM D6927 - 06.

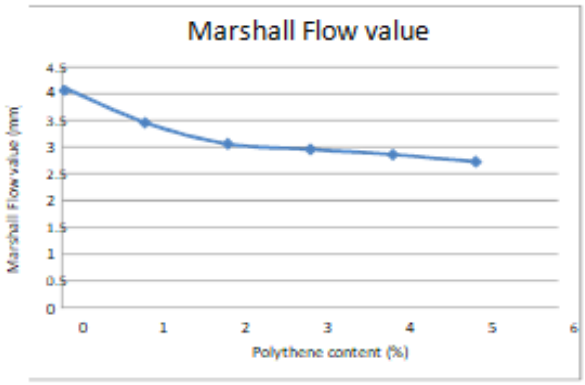
Marshall Stability Value:

It is defined as the maximum load where the specimen fails under the direct load operation. It is a high load supported by a test sample with a load rate of 50.8 mm / min (2 inches / min). Normally, the load was lifted to a maximum, and as soon as the load was lowered, the load was stopped and a large load was recorded by the confirming ring.



Marshall Flow Value:

It is defined as the purity performed by the template at the highest level where failure occurs. During loading, the attached dial gauge measures the plastic flow of the sample as a result of the loading. Flow value was recorded at 0.25 mm (0.01 inch) simultaneous increase when maximum load was recorded.



V. ANALYSIS OF RESULTS

- Plotting Curves
- 5 curves were plotted. i.e.
- Marshall Stability Value vs. Polythene Content
- Marshall Flow Value vs. Polythene Content
- VMA vs. Polythene Content
- VA vs. Polythene Content
- VFB vs. Polythene Content
- Bulk unit weight vs. Polythene Content

Polythene content %	Unit Weight (%)	Mean VMA (%)	Mean VA (%)	Mean VFB (%)	Mean stability value	Mean Flow value
0	2.668241	16.24080719	4.896817	69.86649	14.35667	2.314174
1	2.628602	15.08037044	3.793693	74.86333	14.26	2.302482
2	2.584494	14.21351566	3.020358	78.88036	14.55667	2.283404
3	2.56012	13.87345386	2.837953	79.56232	15.54	2.251242
4	2.52277	13.61238478	2.738914	79.9287	17.72	2.218188
5	2.457956	13.21231979	2.478064	81.2728	15.94	2.189788

Comparison Between normal roads and plastic roads

Roads are lined with cut-out plastic waste is heavily compared to asphalt roads with a general mix. Roads lined with plastic debris are found to be better than conventional ones. Plastic binding material makes the road last longer without providing additional strength to withstand heavy loads. While a typical 'highway' road lasts four to five years, plastic bitumen roads can last up to 10 years. Rainwater will not get in because of the plastic in the tea. Therefore, this technology will lead to minor road repairs. And since each km of road with a medium width requires more than two tons of polyline, using plastic will help reduce non-corrosive waste. The cost of building plastic roads can be slightly higher compared to the conventional method. However, this should not prevent the adoption of technology as the benefits are much higher than the cost. Plastic roads can be a blessing in tropical and humid climates in India, where temperatures often exceed 50 ° C and flooding the rains are causing a lot of damage, leaving many roads with potholes. The government is committed to promoting the construction of small plants to mix plastic waste and bitumen in road construction. It is hoped that we will soon have solid, long-lasting and environmentally friendly roads that will benefit the world from all forms of plastic waste.

VI. CONCLUSIONS

- From a behavioral study of polythene modified BC it has been found that the modified mixture has improved Marshall Properties as mentioned below.
- It is noteworthy that the value of marshalling increases with the content of polyethylene, we see that the flow rate of marshall decreases with the addition of polythene i.e. resistance to deformity under heavy wheel loads increases. Also the parameter values such as VMA, VA, VFB are within the required specifications.
- Looking at these factors we can ensure that we can achieve stable and long-lasting mixing of the parameters by polymer adjustment. This little research not only makes a profit, plastics do not damage waste but also give us a better environment for better energy and longer life.
- This can also reduce the amount of plastic waste that is considered hazardous to the environment.

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