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USE OF WASTE POLYTHENE IN MODIFICATION OF BITUMINOUS MIX FOR DBC– A REVIEW

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ABSTRACT
Bituminous mixes are most typically used everywhere the world in flexible pavement construction. It consists of asphalt or bitumen (used as a binder) and mineral combination that is mixed along, set down in layers and so compacted. Under traditional circumstances, standard bituminous pavements if designed and executed properly perform quite satisfactorily; however, the performance of bituminous mixes is extremely poor under varied situations. Today's asphaltic concrete pavements are expected to perform higher as they're experiencing the increased volume of traffic, accrued loads and increased variations in daily or seasonal temperature over what has been experienced within the past. Additionally, the performance of bituminous pavements is found to be terribly poor in wet induced situations. Considering this plenty of labour has been done on the utilization of additives in bituminous mixtures and as well as on modification of bitumen. Plastics are everywhere in today's lifestyle and are growing rapidly throughout particularly in a developing country like India. As these are non-biodegradable there is a major problem posed to the society with regard to the management of these solid wastes. Low density polyethylene (LDPE) has been found to be a good modifier of bitumen. Even, the reclaimed polyethylene originally made of LDPE has been observed to modify bitumen.

KEYWORDS: LDPE, DBC, Bituminous Mixes, Waste Polythene, Flexible Pavement etc.

I. INTRODUCTION
Bituminous binders are widely used by paving industry. A pavement has different layers. The main constituents of bituminous concrete (BC) are aggregate and bitumen. Generally, all the hard surfaced pavement types are categorized into 2 groups, i.e. flexible and rigid.

Flexible Pavement
If the surface course of a pavement is bitumen then it is called "flexible" since the total pavement structure can bend or deflect due to traffic loads.

Rigid Pavement
If the surface course of a pavement is PCC then it is called "rigid" since the total pavement structure can't bend or deflect due to traffic loads. Such pavements are much stiffer than the flexible pavements due to the high modulus of elasticity of the Plain Cement Concrete material. Importantly, we can use reinforcing steel in the rigid pavements, to decrease or eliminate the joints.

Plastics are durable & non-biodegradable; the chemical bonds make plastic very durable & resistant to normal natural processes of degradation. Since 1950s, around 1 billion tons of plastic have been discarded, and they may persist for hundreds or even, thousands of years. The plastic gets mixed with water, doesn't disintegrate, and takes the form of small pallets which causes the death of fishes and many other aquatic animals who mistake them as food materials.

Today the availability of the plastic wastes is enormous, as the plastic materials have become the part and parcel, of our daily life. Either they get mixed with the Municipal

Solid Waste or thrown over a land area. If they are not recycled, their present disposal may be by land filling or it may be by incineration. Both the processes have significant impacts on the environment. If they are incinerated, they pollute the air and if they are dumped into some place, they cause soil & water pollution. Under these circumstances, an alternate use for these plastic wastes is required.

Modification of BC, with the synthetic polymer binder can be considered as a solution to overcome the problems, arising because of the rapid increase in wheel loads and change in climatic conditions. Polymer modification can be considered as one of the solution to improvise the fatigue life, reduce the rutting & thermal cracking in the pavement.

Asphalt, when blended or mixed with the polymer, forms a multiphase system, containing abundant asphaltenes which are not absorbed by the polymer. This increases the viscosity of the mix by the formation of a more internal complex structure.

II. LITERATURE REVIEW

1. Attaelmanan Moatasim, Pei Feng Cheng and Al-Hadidy AI Were concluded that viability of using high density polyethylene (HDPE) as a modifier for asphalt paving materials. Different ratios of HDPE by weight of asphalt were blended with 80/100 paving grade asphalt. Unmodified and modified asphalt binders were subjected to physicochemical and homogeneity tests. The performance tests including, Marshall Stability, Marshall Quotient (MQ), tensile strength, tensile strength ratio, flexural strength and resilient modulus were carried out on unmodified and modified hot asphalt mixtures. The analyses of test results show that the performance of HDPE-modified asphalt mixtures are better than conventional mixtures. The moisture susceptibility and temperature susceptibility can be reduced by the inclusion of HDPE in the asphalt mixture.
2. Adhikari B and De D was concluded that This poses two major problems: the wastage of valuable rubber and the disposal of waste tires leading to environmental pollution. Two major approaches to solve this problem are the recycle and the reuse of used and waste rubber, and the reclaim of rubber raw materials.
3. Naskar M., Chaki T.K. Chaki, Reddy S. K."*Thermochimica Acta* were concluded that Different modified bituminous binders are used in pavement construction for improved durability and for enhanced performance in resisting cracking and permanent deformation of bituminous layers. Waste plastics, whose disposal is a matter of concern; have been used successfully for modifying bitumen. This paper reports the thermo gravimetric studies conducted on waste plastic modified bituminous binders. Modified bituminous binders prepared using different plastic contents (0–7 wt% by weight of bitumen) were investigated.
4. Sangita, Khan Tabrez Alam, Sabina, Sharma D.K. were concluded that The Marshall tests of the waste polymer modified bituminous concrete (WPMB) mixes, prepared through dry process, indicated the optimum waste polymer modifier content to be 8% (by weight of optimum bitumen content). The waste polymer modified bituminous mix containing 8% WPM showed considerable improvement in various mechanical properties of the mix compared to the conventional bituminous concrete mix.
5. Shukla and Jain (1984) described that the effect of wax in bitumen can be reduced by adding EVA (Ethyl Vinyl Acetate), aromatic resin and SBS in the waxy bitumen. The addition of 4% EVA or 6% SBS or 8% resin in waxy bitumen effectively reduces the Susceptibility to high temperatures, bleeding at high temperature and brittleness at low temperature of the mixes.
6. 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 modification of the binder. Button and Little (1998) on the basis of stress controlled fatigue testing at 20 and 00C, reported that SBS polymer exhibited superior fatigue properties as compared to straight AC-5 bitumen.

III. OBJECTIVES OF THE STUDY

In the present work focus is on flexible roads made of bitumen, as they comprise majority of the roads in India. It has been possible to improve the performance of bituminous mixes used in the surfacing course of road pavements, with the help of various types of additives to bitumen such as polymers, rubber latex, crumb rubber-treated with some chemicals, etc. In this work, use LDPE (Low Density Polyethylene Such as Waste Plastic Bags) as modifiers to improve the physical properties of bitumen. The study is further resulted to utilization of LDPE in higher percentage in DBC.

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The scope of the study includes the following:

1. Determination of optimum binder content of bituminous mix for DBC.
2. Determination of Physical Properties of bituminous mix modified with varying dosage of LDPE modifier.
3. Selection of optimal dosage of LDPE modifier for modification of bitumen.

IV. METHODOLOGY ADOPTED

Laboratory experiments were conducted on the conventional bitumen (80/100) and modified bitumen samples. Individual properties (Penetration, Softening Point, Ductility, Flash and Fire, and Specific Gravity) of the sample were determined. Using the Marshal Mix design characterization of conventional bituminous mix (80/100) for dense bituminous mix (DBC) were carried out and comparison was made for conventional bitumen mix properties with modified bitumen. After determining factors to be considered for modelling modified bitumen in bituminous mix, a detailed plan for the experimental program (sample preparation and lists of tests) was developed.

Following tests were conducted:

1. Penetration test
2. Ductility test
3. Softening point test
4. Specific gravity test
5. Flash and fire point test
6. Marshal stability test

The above listed tests were conducted on the following conventional/modified bituminous samples with LDPE.

Table 4.1 Details of Samples and Modifier

Sample Constitution	**Sample Preparation**	**% Bitumen content + % Modifier (LDPE) by weight of Bitumen**
80/100 Grade bitumen	**Wet Process**	5.0 + nil
		5.25 + nil
		5.5 + nil
		5.75 + nil
		6.0 + nil
Bitumen + LDPE	Dry process	OBC + 1% LDPE
		OBC + 2% LDPE
		OBC + 3% LDPE
		OBC + 4% LDPE
		OBC + 5% LDPE
		OBC + 6% LDPE

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