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UTILIZATION OF WASTE PLASTIC IN BITUMINOUS MIX

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ABSTRACT

Solid Waste Management is the threatened area. Of this various waste materials, plastic waste and municipal solid waste are of great concern. On the other side, the load bearing capacities of the road are to be increased due to enormously increasing traffic intensity. This present work helps in taking care of both these aspects. Plastic waste; consisting of carry bags, cups and Thermo-molecules can be used as a coating over aggregates and this coated stone can be used for road construction. By doing this process, a road of 1 Km length and 3.375M width of single lane can consume 10, 00,000 carry bags and even the road strength can be increased by 100% and no pot hole can be found. The mix polymer coated aggregates have shown higher strength. Use of this mix for road construction helps to use plastic waste. Once the plastic waste is separated from municipal solid waste; the organic matter can be converted into manure and used. The main object of paper is to analyse & study how waste plastic will be effectively utilized in construction of flexible pavement as a binder material for replacing the content of bitumen & its successful application.

Keywords: Bitumen, Flexible Pavement, Plastic, Solid Waste Management.

I INTRODUCTION

Generally, for two types of road; materials used are concrete for rigid pavement roads and bitumen for flexible pavement roads. For economical road construction; new techniques and new material must be used. The steady increase in traffic intensity and a significant variation in seasonal temperature made a demand in improvement of road characteristics with the improvement in property of binder. Bitumen is a useful binder for road construction and grades of bitumen available on the basis of their penetration values are 30/40, 60/70, 80/100.

Since, the plastic materials have become part and parcel of daily life, its availability is enormous. They either get mixed with Municipal Solid Waste or thrown over land area, If not recycled; their disposal is either carried out by land filling or by incineration leaving a certain impact on the environment. Under such circumstances, an alternate use for the waste plastics is needed.

Because of rapid urbanisation, the demand of bitumen has increased tremendously due to its use as binder & water proofing material for construction of roads and pavements. The emerging need can be achieved by enhancing the durability of existing road surface resulting in the reduction of maintenance & resurfacing operations. Hence, the modification of bitumen to meet the required performance standards of the pavement appears to be logical & economical approach. As compared to bitumen; crumb-rubber & fly-ash are economical ideal modifiers. So, conventional bituminous materials, if designed & executed properly, perform quite

satisfactory. Though stiffer mixes possess larger fatigue resistance & deformation resistance; it throws out drawbacks as high susceptibility to temperature variations, tendency to crack less, etc. resulting in failure of bituminous pavement under adverse climatic & traffic conditions.

Through the investigations carried out in India and other countries; it has been revealed that properties of bitumen and bituminous mixes can be improved with the incorporation of certain blend additives known as "Bitumen Modifiers" and the bitumen premixed with these modifiers is known as "Modified Bitumen" which gives higher life of surfacing (up to 100%) depending upon degree of modifications and type of additives used and even the time period for next renewal may be extended by 50%. Full scale performance studies carried out under the aegis of Ministry of Road Transport and Highways & Central Road Research Institute, New Delhi; Highway Research Station, Chennai; Rubber Board, Gujarat Engineering Research Institute, Vadodara; and Kerala Public Works Department revealed that when life-cycle cost is taken into consideration, the use of Modified Bitumen in construction and maintenance of bituminous roads is cost effective. Ultimately, the renewals would be using ordinary bitumen and it would be modified bitumen for prevailing traffic and climatic conditions.

II PROCEDURE

2.1 Selecting waste Plastic polythene

Plastic is all pervasive in modern day lifestyle. It is used for packing, protecting, serving, etc. Polythene & polypropylene are more useful than any other kinds of plastics. In India, commonly polyethylene materials are used for packaging of drinking water in small pouches. This pouches costs low and are available generally everywhere. People throw these unwanted pouches in the surroundings that cause environmental pollution to the cities and road side areas. The disposal of this non-decaying and non-biodegradable waste polythene is a menace for the present society.

2.2 Selection of Bitumen Grade

For the study, we shall select bitumen grade as 60/70 (penetration & softening point test) generally used as a Paving Grade Bitumen suitable for construction of bases and wearing courses of flexible pavements with superior properties as thermoplastic property causing the material to soften at high temperatures and to harden at lower temperatures. This unique temperature/ viscosity relationship is important while determining the performance parameters of bitumen.

III SAMPLING PROCESS

3.1 Segregation

Plastic waste must be separated from other waste having maximum thickness of 60 micron.

3.2 Cleaning Process

The separated polythene wastes are washed, cleaned and dried and then shredded into tiny pieces to avoid formation of lumps when mixed with hot bitumen. The smaller the size of the polythene; more proper is mixing done with formation of good blend.

3.3 Shredding Process

Different types of plastic wastes are mixed together and shredded or cut into small piece.

3.4 Collection Process

The plastic waste retaining in 2.36 mm is collected.

3.5 Mixing Process

Two processes as under:

3.5.1 Wet Process

Bending of waste plastics by direct mixing of shredded plastics with hot bitumen is done at 160°C with proper cooling while adding stabilizers.Mechanical stirrer is needed as mixing is difficult because of difference in viscosities of molten polymer and bitumen.

3.5.2 Dry Process

The aggregate is heated to 170°C in the Mini hot Mix Plant with addition of shredded plastic in equal proportion coating it uniformly over the aggregates.Immediately, the Bitumen heated at 160°C is added with themixture and is transferred to the road to be laid.

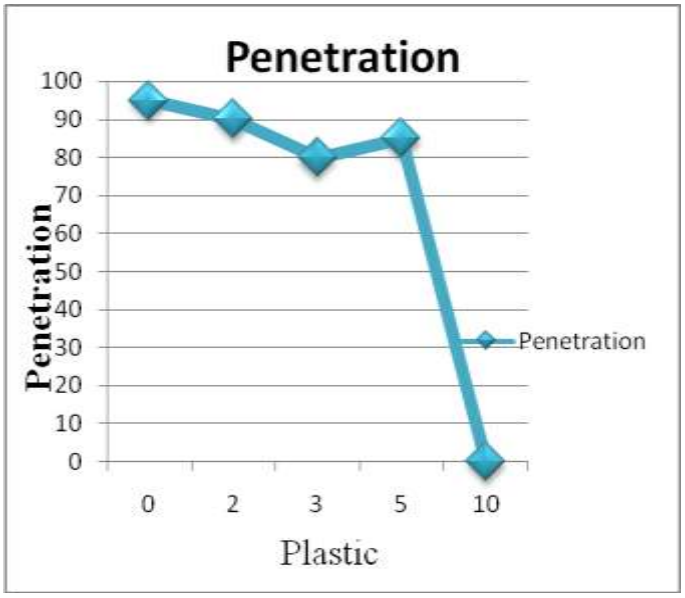
1-PENETRATION TEST:-

AIM- To find out hardness or softness of the bitumen. (IS:1203-1978)

OBSERVATION TABLE:

% of plastics	Penetration mm
0	95
2	90
3	80
5	85
10	NIL

PLOTTING CURVE-



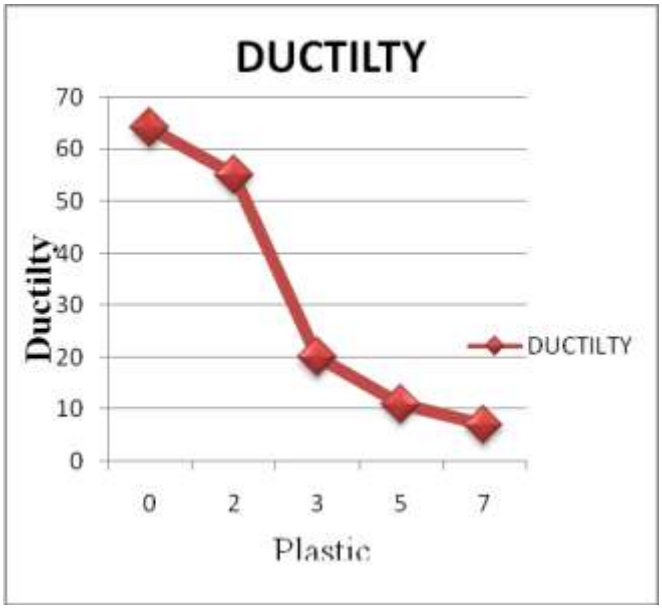
2- DUCTILITY TEST:-

AIM- To measure the ability to stretch of the bitumen. (IS:1208-1978)

OBSERVATION TABLE-

% of plastics	Ductility cm
0	65
2	55
3	20
5	11
10	07

PLOTTING CURVE-



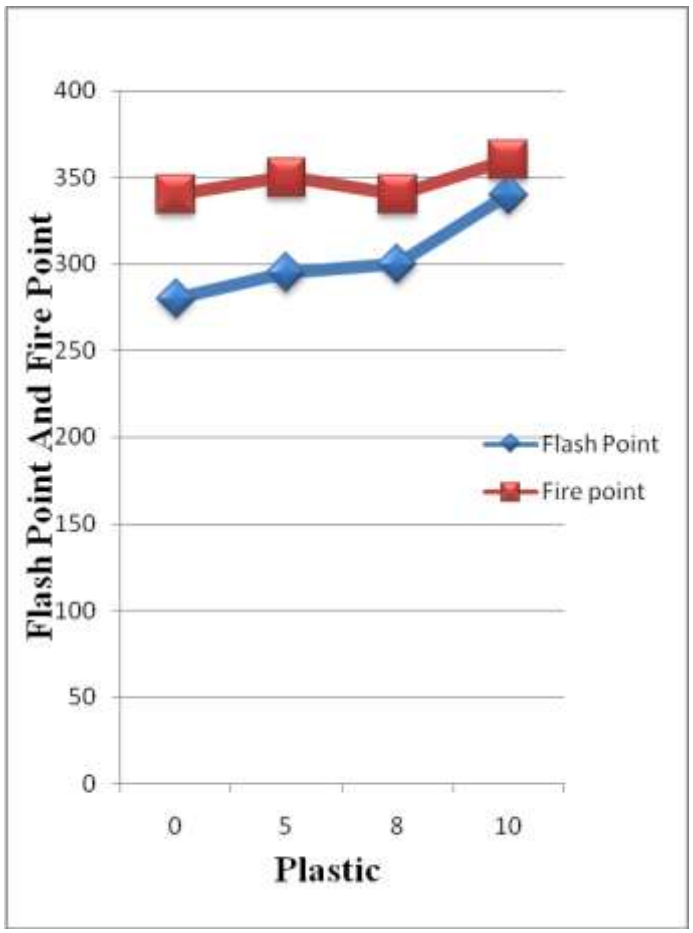
3- FLASH AND FIRE POINT TEST

AIM- To find out flash and fire point of bitumen.(1209-1978)

OBSERVATION TABLE :

% of plastic	Flash point	Fire point
0	280	340
5	295	350
8	300	340
10	340	360

PLOTTING CURVE :



4- MARSHAL STABILITY TEST

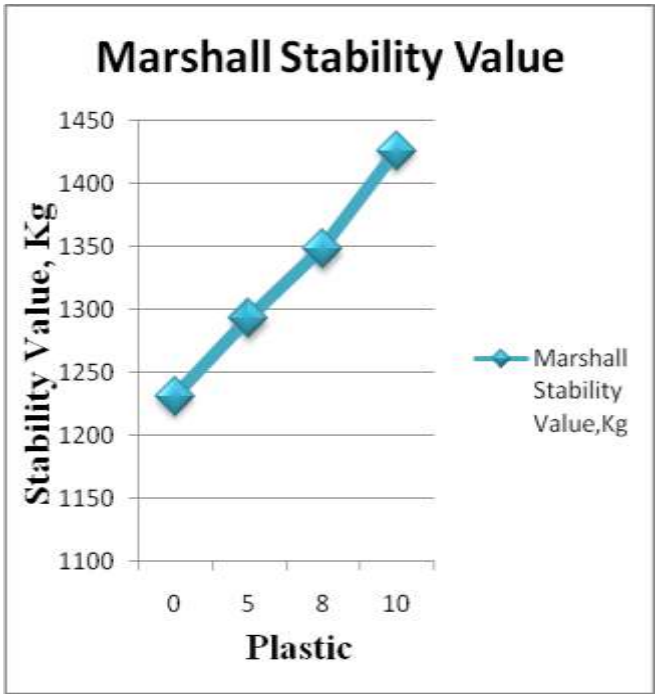
AIM : a) To determine the density-voids analysis for given bituminous mix.

b) To determine the strength and flexibility for given bituminous mix.

OBSERVATION TABLE :

Parameters				
Plastic content,%	**0**	**5**	**8**	**10**
Stability value ,kg	1231	1293	1348	1426
Flow value in 0.25 unit	8.22	8.59	8.93	9.41
Unit Wt. gm/cm3	2.28	2.28	2.36	2.51
Vv%	7.70	6.34	5.58	5.02
Vfb%	76.46	78.93	80.82	81.93

PLOTTING CURVES :



IV CONCLUSION

- Improved property of the mixtures with increase in Marshall Stability Value for the mix with 10% of waste plastics.

- The Marshall Stability; a strength parameter shows increasing trend with a maximum increase of 17.63%.
- The use of higher percentage of waste plastic is not preferable.
- The formation of pot holes at early stages which will be heated by waste plastic bitumen blend due to its higher binding property and better resistance against stripping.

Sr. No.	Properties	Modified Mix	Conventional Mix
1.	Marshall Stability Value	More	Less
2.	Blinding Property	Better	Good
3.	Softening Point	Increase	Low
4.	Penetration value	Decrease	High
5.	Flash & Fire Point	Increase	Low
6.	Stripping	No	Yes
7.	Durability of the Roads	Better	Good
8.	Bleeding	Less	More
9.	Rutting	Less	More

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