



TO DETERMINE THE STABILITY OF CONVENTIONAL MIX BY “PLASTIC MODIFIED BITUMEN”

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ABSTRACT

The amount of plastic waste in municipal solid waste (MSW) increases day by day due to increment in development activities, urbanization, and changes in lifestyle. Hence removal of waste plastic is a hazard and becomes a significant issue universally due to their non-biodegradability. Plastics give out destructive gases after warming or burning which causes air contamination and many medical issues. The usage of plastic waste in bituminous mix upgrades or increases its properties and quality. In the present paper developed methods to utilize plastic waste for construction purposes road and adaptable flexible pavement have explored. In conventional road making process bitumen is utilized as a binder. Such bitumen can be altered with waste plastic pieces by varying percentage of total bitumen contain and then bitumen blend is made, which can be utilized as a top layer of adaptable asphalt. This waste plastic adjusted bitumen mix shows better binding property, predictable quality, thickness and more impervious to water accordingly expanding solidness of roads with expanded protection from mileage of roads.

Index Terms - plastic waste, Non-biodegradability, Modified bitumen, Binder.

1. INTRODUCTION

The danger of removal of plastic won't solve until the down to earth steps are not started at the ground level. It is conceivable to improve the presentation of bituminous mix utilized in the surfacing course of road. Studies revealed in the utilized of re-cycled plastic, mostly polyethylene, in the production of mixed demonstrated diminished lasting twisting through rutting and decreased low - temperature splitting of the asphalt surfacing. The field tests withstood the pressure and demonstrated that plastic squanders utilized after legitimate preparing as an added substance would upgrade the life of the streets and furthermore tackle natural issues. Plastic is a flexible material. Because of the mechanical transformation, and its enormous scope creation plastic appeared to be a less expensive and viable crude material. Today, every imperative division of the economy beginning from agri business to bundling, vehicle, gadgets, electrical, building development, correspondence divisions has been for all intents and purposes reformed by the utilizations of plastics. Plastic is a non-biodegradable material and analysts found that the material can stay on earth for a long time without corruption. A few examinations have demonstrated the wellbeing peril brought about by inappropriate removal of plastic waste. The wellbeing risk remembers conceptive issues for human and creature, genital variations from the norm and so on., Looking forward the situation of present way of life a total restriction on the utilization of plastic can't be put, in spite of the fact that the waste plastic taking the substance of fiend for the present and group of people yet to come. We can't boycott utilization of plastic however we can reuse the plastic waste.

OBJECTIVE:

The main objectives of this research paper undertaking are:

- To assess the effect of total degree and bitumen content on Marshall mix .
- To evaluate the conduct of bituminous solid utilizing plastic Modified bitumen.
- Investigate the connection between all the parameter of Marshall mix configuration utilizing different proportion of plastic with bituminous concrete.
- To design the asphalt pavement with the plastic modified bitumen mix.
- To replace the bitumen by Waste plastic by different %.

2. STUDY OF MATERIAL & ITS SPECIFICATIONS

BITUMEN:

The bitumen ought to be viscosity grade (VC) paving bitumen according to IS specification IS:73 the sort and level of bitumen utilized rely on the climatic conditions and traffic over the asphalt. The quantity of test was performed on Laboratory, the outcome are shown:

Table 3.1: Specification of bitumen test

Tested property	Specification	Outcome
Penetration (100g, 5 sec at 25°C)	IS 1203-1978	60
Ductility test at 27°C, (5 cm/min pull),cm	IS 1208-1978	65
Softening Point at °C, (Ring & Ball Apparatus)	IS 1205-1978	51

Selection for viscosity based on climate condition:

Table 3.2: Specification Dependent on temperature

Lowest daily mean temperature in °C	Highest daily mean air temperature in °C		
	Less than 20° C	20 to 30°C	More than 30°C
More than 10°C	Viscosity grade -10	Viscosity grade -20	Viscosity grade -30
-10°lower	Viscosity grade -10	Viscosity grade -10	Viscosity grade -20

AGGREGATE:

Coarse Aggregate:

The coarse total ought to be comprises of crushed stone, rock or other hard material retained on 2.36 mm sieve . It ought to be spotless, hard, and solid, then again, actually the total ought to fulfill the physical necessities and where crushed rock is proposed for use as total, at least 95 % by weight of crushed material held on the 4.75 mm sieve will have at any rate two cracked countenances.

Fine Aggregate:

Fine aggregates should comprise of squashed or natural happening material, passing the 2.36 mm sieve and held on 75 micron sieve. The versatility list of division passing the 0.425 mm sieve will not exceed 4. The degree of aggregates and binder content according to **MoRT&H** .

Filler:

The filler are in every case liberated from natural debasement filler should to be a finely partitioned material, for example, rock residue or cement approve by examine.

Table 3.3: Grading As Per Mort&H Specification

GRADING IS Sieve (mm)	I Cumulative % by weight of total aggregate passing
20	100
12.5	95
10	69
6	62
4.75	45
2.36	36
1.18	27
0.60	21
0.30	15

0.15	9
0.075	5
Bitumen content % by mass of total mix	Minimum 5.2/Maximum 6

PLASTIC ROADS:

Plastic roads are partially made up of plastic and composite plastic ,roads are different from other roads. Plastic roads consist of an asphalt mix with plastic waste incorporated into the asphalt mixture. The implementation of plastics in roads also opens a new option for recycling post consumer plastics and many other countries have used technology which can incorporate plastic waste into an asphalt mix for replacing or utilization of waste plastic , it has been used in highway and road construction since 50-60 years. In my research papers, the main property i.e. Coating of plastic by replacing the bitumen plays an significant role for reducing distresses.

3. MATERIAL TESTING

TESTING OF AGGREGATES:

Water Absorption Test:

Water assimilation strength a thought of rock. The stone which are having more water assimilation gives higher porosity in nature and are generally consider less reasonable dependent on quality. It additionally have lesser resistance from effect and hardness.

Specific Gravity Test:

The specific gravity of a material or aggregate is viewed as proportion of solidarity or nature of the material. Stones having low explicit are commonly more fragile than those of higher explicit gravity values. The specific gravity of total is accustomed to figuring the void substance in compacted bituminous mix.

Impact Value Test:

The aggregate impact test is utilized to assess the durability or the resistance of the stones. The aggregate impact test is to be directed on the predetermined size ,for example passing through 12.5mm sieve and retain on the 10 mm sieve.

The maximum value of impact as per the mort&H is 24% for the bituminous concrete surface. The impact value is communicated as the % of the fines passing 2.36 mm sieve appeared as far as the complete weight of the sample.

$$\text{Impact value of aggregate} = 100 \times W2/W1$$

Where,

W1-weight of oven dried sample.

W2-weight of broken aggregate passing through 2.36 mm sieve after 15 blows of hammer.

Crushing Value:

Crushing strength quality of road stones might be resolved on cylindrical shaped specimen cut out of the stones or by finding the obstruction of coarse aggregate under applied load.

Abration Value test:

As per the MoRT&H specifications the maximum los angeles abrasion value for bituminous concrete is 30 percent.

Combined Flakiness & Elongation Test:

The flakiness index of a aggregate is the rates by wt of the particles whose least measurement is under three-fifth of their mean measurement. This test isn't appropriate to sizes smaller than 6.3 mm.

The elongation index of a index is the rate by wt of particles whose most prominent measurement is more note worthy than one or four fifth time of their mean measurement, the elongation test isn't relevant of size smaller than 6.3 mm.

TESTING OF BITUMEN:**Ductility Test:**

The bitumen utilized in this paper is of viscosity grade 30 VG-30 for conventional just as for modified blends as a bituminous binder, different laboratory tests were conducted directed. These tests and their outcomes are demonstrated below.

Table 4.2 : Bitumen Ductility Test

S.No.	Description	Sample	
		I	II
1	Initial reading (A)	0	0
2	Final reading (B)	74.6	74.8
3	Ductility = (B-A) cm	74.6	74.8
Mean ductility value (cm)		74.7	

MARSHALL MIX DESIGN:**Marshal Method:**

Marshall Test apparatus contains a cylindrical mould, a hammer, a compression machine. There specifications are, the objectives of the strategy are unit weight-void analysis and stability-flow test of the sample.

The Marshall test are performed ,some initial steps are follows given below:

Preparation of Specimen:

The test specimen was prepared with different size of aggregate(different cement content) passing through different size of sieve. The binder is mixed in different proportion as per our selected material example Bituminous concrete (BC). The bitumen and aggregate both heated at the desired temperature separately above 160°C , and mixed them separately at required proportion at standard temperature. The sample was compacted by giving 75 blows on both the side faces of the test specimen . All the specification for the preparation of specimen is done on the basis of MoRT&H . All those specimen were prepared separately according to their proportion i.e. Conventional mix , and other specimen in which bitumen is replaced by waste plastic by varying in percentage. The cutting polythene was mixed with aggregate at desired temperature .the entire sample were prepared.

**Testing of Specimen:**

After the preparation of the mould, all the samples were kept in an exceedingly lab for temperature, then samples were kept on water bath for half-hour at 60°C. After that we were placed the sample on the mould in sequence and therefore the readings were taken. The Marshall Test gives two properties of specimen, for example stability and flow. After the test all results were tabulated separately.

4. METHODOLOGY ADOPTED

According to the standard test for determination of optimum bitumen content Marshall method is best. This technique utilizes standard test specimen. Before start the trial work assortment of material and their test has been performed. Most importantly gradation was finished. In my examination work the bitumen concrete is chosen as a surface course material. After the best possible evaluating the test specimen was set up with changing level of bitumen and concrete substance. Planning of test was finished with various details according to my exploration work the accompanying kind of test with their material was set up in my experimental work normal mix in with changing percentage of bitumen. According to the procedure plastic modified bitumen with various percentage of plastic. In this paper of plastic is replaced by the bitumen (% vary).

5. RESULTS & OBSERVATIONS

Marshall Test Observation:

Table: 6.1

Properties	% Bitumen Binder				
	5.2	5.4	5.6	5.8	6
Bulk Density(gm/cc)	2.452	2.456	2.462	2.458	2.456
Air Voids(%)	4.76648	3.66889	2.96748	2.73798	2.59186
VMA	17.3961	16.8922	16.7355	16.9851	17.3048
VFB	72.6003	78.2805	82.2683	83.88	85.0223
Stability(KN)	12.16	15.27	13.2	11	9.8
Flow(mm)	2.98	3.35	3.68	3.98	4.8

Table : 6.2

Properties	% Bitumen Binder				
	5.2	5.4	5.6	5.8	6
Bulk Density(gm/cc)	2.443	2.452	2.462	2.460	2.463
Air Voids(%)	4.48174	3.6838	2.742	2.19483	2.068
VMA	17.2483	16.683	16.3122	16.2861	16.6156
VFB	71.9291	77.98	83.18	86.5042	87.5527
Stability(KN)	12.63	14.72	16.03	13.99	12.33
Flow(mm)	2.99	3.19	3.94	4.8	5.34

Table : 6.3

Properties	% Bitumen Binder (CRMB)				
	5.2	5.4	5.6	5.8	6
Bulk Density(gm/cc)	2.458	2.468	2.472	2.466	2.462
Air Voids(%)	4.762	3.368	2.26	2.197	2.068
VMA	17.179	16.409	15.897	16.286	16.6156
VFB	72.279	79.4753	85.779	86.504	87.5553
Stability(KN)	13.26	15.63	17.53	14.72	12.87
Flow(mm)	2.96	3.13	3.73	4.45	5.03

Table : 6.4

Properties	% Bitumen Binder				
	5.2	5.4	5.6	5.8	6
Bulk Density(gm/cc)	2.459	2.467	2.482	2.483	2.478
Air Voids(%)	4.99	3.36	2.585	2.36	2.39
VMA	17.377	16.409	16.017649	16.426	16.8954
VFB	71.283	79.475	84.0187	85.62	85.813
Stability(KN)	13.55	14.79	15.99	13.39	11.89
Flow(mm)	3.01	3.49	3.96	4.82	5.49

Table: 6.5

Properties	% Bitumen Binder				
	5.2	5.4	5.6	5.8	6.0
Bulk Density(gm/cc)	2.462	2.469	2.486	2.488	2.462
Air Voids(%)	4.56	3.231	2.201	2.125	2.032
VMA	17.16	16.209	15.561	16.145	16.325
VFB	73.142	80.32	86.52	87.52	88.325
Stability(KN)	13.66	16.21	18.45	15.23	13.45
Flow(mm)	2.86	3.1	3.63	4.23	4.98

Table: 6.6

Properties	% Bitumen Binder				
	5.2	5.4	5.6	5.8	6
Bulk Density(gm/cc)	2.465	2.472	2.487	2.485	2.465
Air Voids(%)	4.301	3.10	2.16	2.07	2.012
VMA	17.179	16.409	15.897	16.286	16.6156
VFB	73.15	74.66	86.745	87.367	88.938
Stability(KN)	14.02	16.63	18.66	15.98	13.68
Flow(mm)	2.06	2.89	3.40	3.79	4.48

Table: 6.7

Properties	% Bitumen Binder				
	5.2	5.4	5.6	5.8	6
Bulk Density(gm/cc)	2.471	2.474	2.486	2.487	2.459
Air Voids(%)	4.301	3.10	2.16	2.07	2.012
VMA	17.179	16.409	15.897	16.286	16.6156
VFB	72.13	73.45	87.16	86.59	88.856
Stability(KN)	13.76	15.43	16.86	15.02	12.59
Flow(mm)	2.15	2.98	3.51	3.85	4.87

6. CONCLUSION

The stability of plastic Modified bitumen concrete mix with different plastic percentage is increased 14.7% , 22.2% , 25.8%, 30.8% as compared to standard BC mix. Thus we conclude that BC mix modified with plastic improve its property significantly and therefore the percentage of optimum bitumen content is reduced by using waste plastic. It also concludes that the utilization of plastic modified bitumen coated with plastic is a smaller amount liable to temperature, thus the standard bc mix fully replaced by the modified bc mix satisfactory, for both the grading per the MoRT&H for the required grading. This analysis has no negative effect to the environment because it decreases the amount of municipal plastic waste is employed beneficially & gives better technology within which proper utilization of waste plastic.

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