Utilization of Mobile Waste and LDPE Plastic in Preparation of Flexible Pavement

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Abstract— This study shows effect of waste plastic chips on black cotton soil is investigated. Different percentage of plastic waste is added to soil and its effect on various properties of soil is analyzed. Optimum polythene contains obtained from various literature is 5% Maximum Marshall Stability value is 1346.7 at 5% of polythene content and 15 % of mobile waste content. It is watched that the Marshall Stability value is increased at the percentage of 15% and that decreased. It is necessary to obtain Optimum bitumen content for a particular bituminous concrete mix from an economical and durability point of view. In the Marshall stability value increases with mobile waste content up to 15% and thereafter decreases.

Keywords: Mobile Waste, LDPE Plastic, Flexible Pavement

I. INTRODUCTION

The aggregates used in road construction have a greater affinity for water due inherent wetting nature. The results of the study showed optimized mixes with fly-ash content over 5 percent show a sharp reduction of stability values. The flow values of the mixes with fly ash are generally on the higher side but within the limits. Flow values are in the range of 8-12 (0.25 mm). Roberts et al. (2000) give a review of past present and future trends in asphaltic mixture design.

A. Polymer Modification of BC (LDPE)

Plastics are durable & non-biodegradable; the chemical bonds make plastic very durable & resistant to normal natural processes of degradation. Since the 1950s, around one billion heaps of plastic are discarded, and they could persist for tons of or maybe, thousands of years. The plastic gets mixed with water, doesn't disintegrate, and takes the shape of little pallets that causes the death of fishes and lots of different aquatic animals World Health Organization mistake them for food materials. thence any improvement within the property of the pavement is extremely essential considering this state of affairs. Today the supply of plastic waste is gigantic because plastic materials became half and parcel, of our way of 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 landfilling or it may be by incineration. Both 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.

B. Objectives of Mix Design Bituminous Concrete Using Waste Polythene and mobile waste

The bituminous mix design aims to estimate the proportions of bitumen, filler material, fine aggregates, coarse aggregates & polythene to produce a mix that should have

- To use waste plastic on the road
- To easily dispose of plastic waste and mobile waste on road pavement

II. RESULTS

A. Plotting Curves: - Five curves were plotted. i.e.

Marshall Stability Value vs. Bitumen Content
Marshall Flow Value vs. Bitumen Content
VMA vs. Bitumen Content
VA vs. Bitumen Content
VFB vs. Bitumen Content

B. Optimum bituminous concrete in marshal test

1) Marshall Stability Value vs. Bitumen Content:

With the help of the result given in table4.2 the graph is plotted. it is seen from Figure-6.1 that as we increase the bitumen content, the stability value of the bituminous concrete sample first increases and then decreases. This is because of the increase in the flow value.

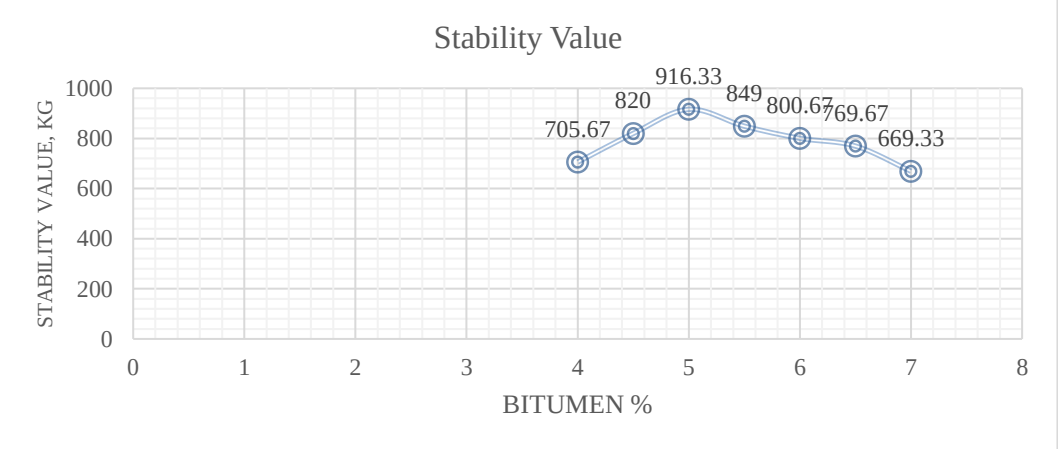

Fig. 1: Stability value vs Bitumen (%)

2) Marshall Flow Value vs. Bitumen Content:

With the help of result given in table4.3 graph is plotted. it is seen that as we increase the bitumen % the flow value of bituminous concrete sample increases Figure 6.2.

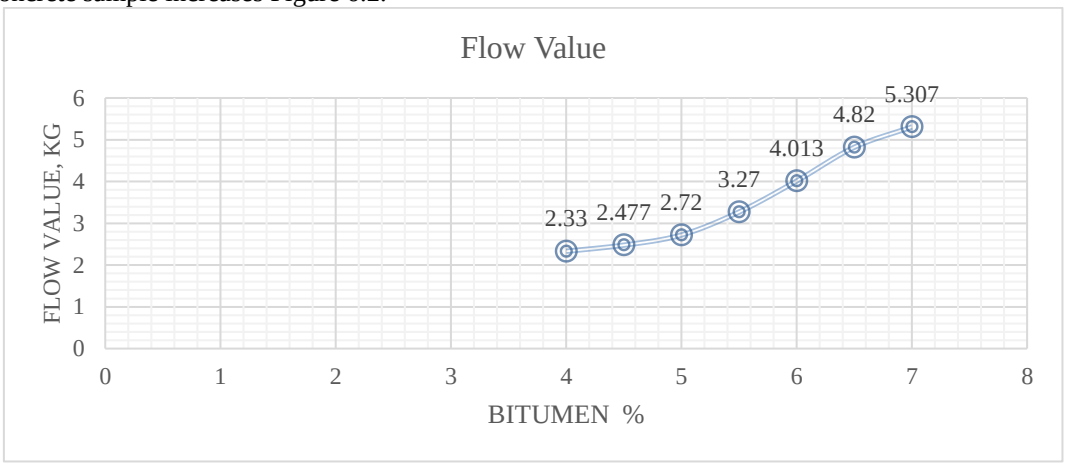

Fig. 2: Flow value vs Bitumen (%)

3) VMA vs. Bitumen Content:

With the help of result given in table 6.3 graph is plotted. it is seen that as we increase the bitumen % the VMA of bituminous concrete sample decreases. in Figure 6.4 we increase the bitumen % the VA of bituminous concrete sample decreases. In Figure 6.5 we increase the bitumen % the VFB of bituminous concrete sample increases.

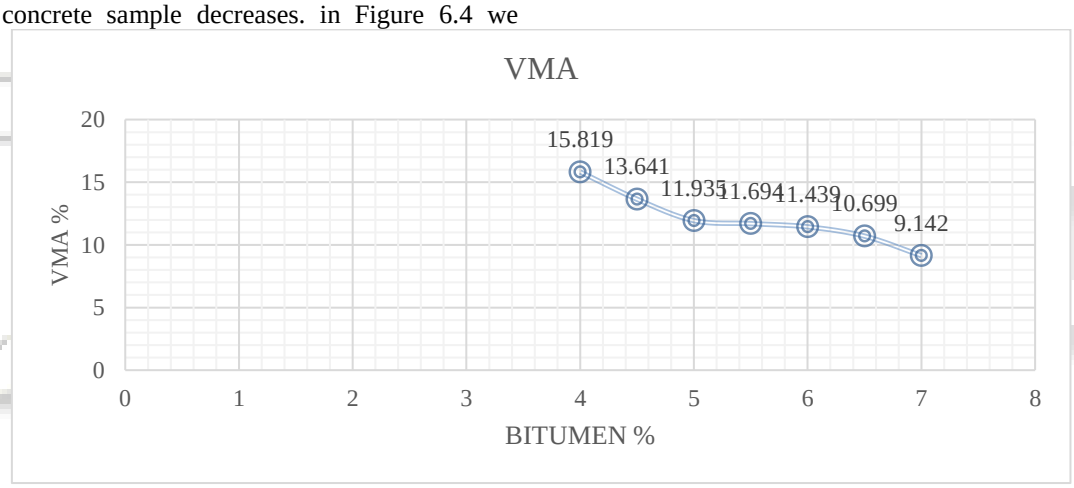

Fig. 3: VMA vs Bitumen (%)

From Figure 6.3 it is seen that as we increase the bitumen % the VMA of bituminous concrete sample decreases.

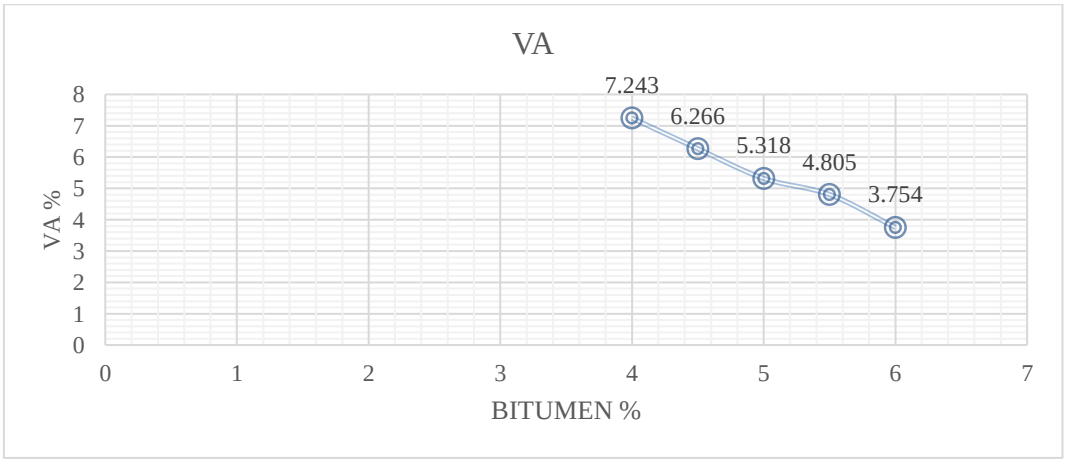

Fig. 4: VA vs Bitumen (%)

It is seen from Figure 4.4 that as we increase the bitumen % the VA of bituminous concrete sample decreases.

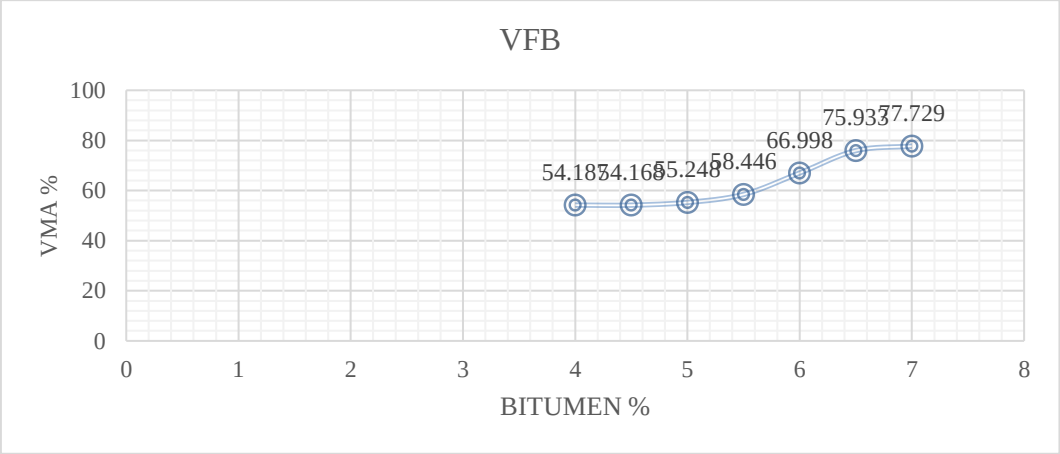

Fig. 5: VFA vs Bitumen (%)

It is seen from Figure 4.5 that as we increase the bitumen % the VFB of bituminous concrete sample increases

C. Finding Optimum Bitumen Content:

Test Property	Specified Value
Marshall Stability, kg	340 (minimum)
Flow Value, 0.25 mm units	8 to 16
Air voids in total mix, V_v%	3 to 5
Voids filled with bitumen, VFB%	75 to 85

Table 1: Marshall Mix Design Criteria for Bituminous concrete

Thus,

$$Bo = \frac{B1+B2+B3}{3} \quad (1)$$

Where:-
B_o = optimum content.
B_1 = % of asphalt content at maximum specific gravity.
B_2 = % of asphalt content at maximum stability.
B_3 =% of asphalt content at 4 % of air voids in total mix.

$$Bo = \frac{B1+B2+B3}{3}$$

$$Bo = \frac{5+5.5+5}{3}$$

Bo =5.1%
Marshall Stability= 902 kg
Bitumen content corresponding to maximum Stability = 5.1 %
Bitumen content corresponding to air voids = 4.805%
And VFB at 5.1 % = 67.89%

D. Mobile waste use as aggregate in marshal test

1) Marshall Stability Value vs. Bitumen Content:

With the help of the result given in table4.2 the graph is plotted. it is seen from Figure-4.1 that as we increase the bitumen content, the stability value of the bituminous concrete sample first increases and then decreases. This is because of the increase in the flow value.

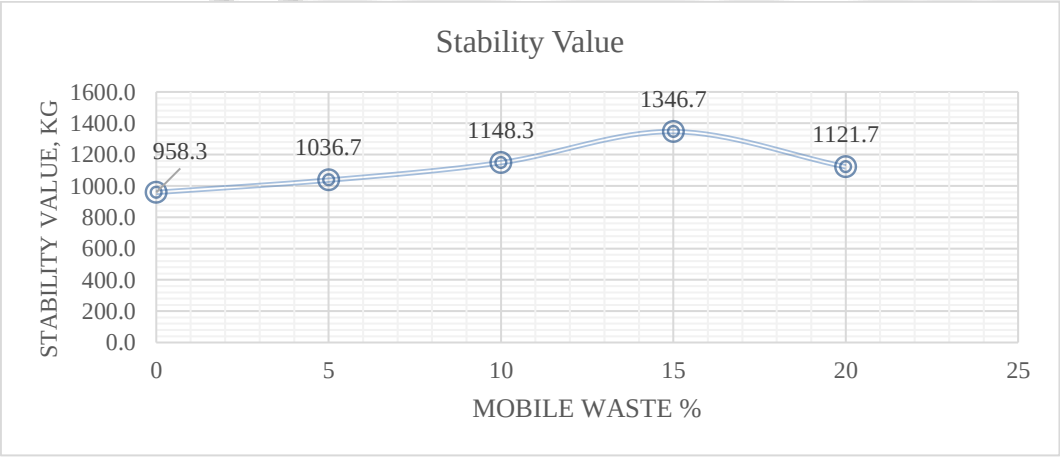

Fig. 5: Stability value vs Mobile waste

2) Marshall Flow Value vs. Mobile waste Content:

With the help of result given in table4.3 graph is plotted. it is seen that as we increase the bitumen % the flow value of bituminous concrete sample increases Figure 6.6.

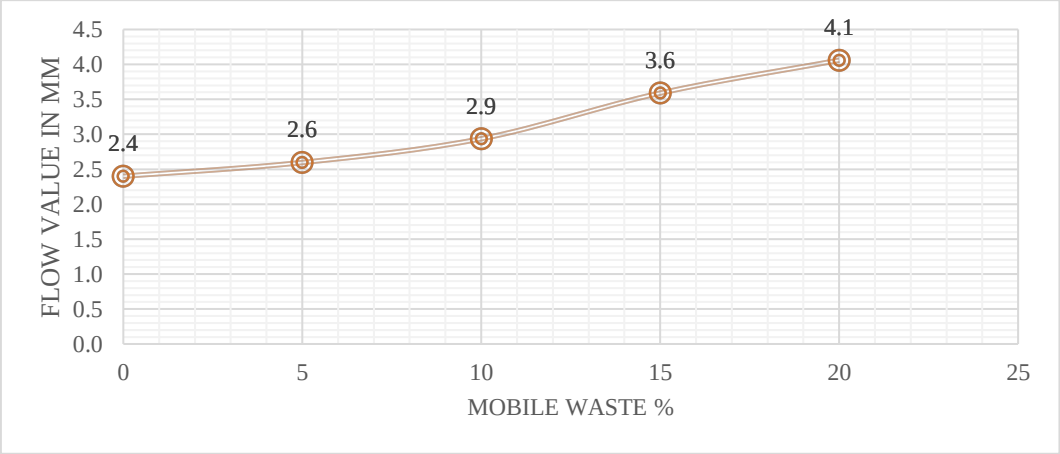

Fig. 6: Flow value vs Mobile waste (%)

III. Conclusion

The conclusion resulting from the present study is presented in this chapter, the following conclusion has been drawn from the study.

1) Optimum bitumen content obtained using the marshal stability test is 5.1%.
2) It is observed that the increased Marshall Stability value with bitumen contains up to 5% and thereafter decreases.
3) Marshall Flow value increases with the increase in the percentage of bitumen contain.
4) Optimum polythene contains obtained from various literature is 5%
5) Maximum Marshall Stability value is 1346.7 at 5% of polythene content and 15 % of mobile waste content.
6) It is watched that the Marshall Stability value is increased at the percentage of 15% and that decreased.

For a country like India, where hot temperature prevails in summer in several parts, permanent deformation of the bituminous layer is a major concern. This problem can be addressed by adopting courser gradation for wearing course. It is necessary to obtain Optimum bitumen content for a particular bituminous concrete mix from an economical and durability point of view. In the Marshall stability value increases with mobile waste content up to 15% and thereafter decreases.

IV. References

[1] Chavan, A.J., 2019. Use of plastic waste in flexible pavements. International Journal of Application or Innovation in Engineering and Management, 2(4), pp.540-552.
[2] Rohilla, V. and Malik, P.,2018 Use of waste high density polyethylene as bitumen modifier in asphalt concrete mix.
[3] Shu, X. and Huang, B., 2018. Recycling of waste tire rubber in asphalt and Portland cement concrete: an overview. Construction and Building Materials, 67, pp.217-224. Vancouver
[4] Manjunath, K.R., Rohith, L., (2015), "Effect of Stone dust on the Strength characteristics of Black cotton soil stabilized with Rice husk ash", International Research Journal of Engineering and Technology (IRJET), e-ISSN: 2395 -0056, Volume: 02, Issue: 06, Sept, p-ISSN: 2395-0072, pp: 155-159.
[5] Subramanian, R.M., Jeyapriya, S.P., (2009), "Study of effect of waste tyres in flexible pavement system", Indian Geotechnical Society-Chennai chapter, pp: 19–23.
[6] Bhageerathy K. P, Anu P. Alex, Manju V. S, Raji A. K (2014) "Use of Biomedical Plastic Waste in Bituminous Road Construction" International Journal of Engineering and Advanced Technology (IJEAT) ISSN: 2249 – 8958, Volume-3 Issue-6.
[7] S.K. Khanna and C.E.G. Justo "Highway Engineering" 2008
[8] Mix Design Methods for Asphalt Concrete and Other Hot-Mix Types, Asphalt Institute Manual Series No. 2 (MS-2), 6

