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EFFECT OF BAMBOO FIBER AND SLAG AGGREGATE ON THE PERFORMANCE OF STONE MATRIX ASPHALT

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Abstract - *Stone matrix asphalt provides a greater deformation resistance, longer service life, high resistance to cracking, fatigue, wear and skid resistance. A fiber which is readily available in nature having greater strength in the direction of fiber as well as having very good tensile, flexural and impact strength. It is durable in nature and possesses tenacity and good stability value. For this project we have prepared SMA using slag aggregate and bamboo fiber with varying percentage of bitumen content. The study of SMA made with conventional bitumen of grade 60/70 with bamboo fiber and slag aggregate. By the Marshall Method, we obtained Optimum Bitumen Content, stability value and flow values have been found. The maximum stability value of 10.5 kN and flow value is 4.1mm receptively is found on 5.5% of bitumen content and 0.4% of fiber content and 0.4% slag aggregate of mass of aggregate.*

Key Words: **SMA, Bamboo Fiber, Stability value, OBC, SA.**

1. INTRODUCTION

In road pavement design mostly flexible pavement design is preferred as compare to rigid pavements. The flexible pavement is having better load carrying capacity, good resistance to wear and tear, durability and skid resistance. It is achieved mainly due to bituminous surface. SMA basically consist of 65-85% of aggregate, 4-5% of binder, 15-25% of filler and 0.5-1% of stabilizer in which aggregate provides strength and resistance to heavy loads, binders helps to bind the materials properly, fillers helps in filling voids and resistance to wear and tear and stabilizers increases the stability binding of mixture in high temperature and transportation. SMA reduced the sensitivity and resistance to moisture. The optimum binder content can be used are 4%, 5%, 5.5%, 6% and 7% for the better result of SMA Mix.

2. OBJECTIVES

1. To determine the Optimum Binder Content (OBC) for SMA Mix with different percentage of Bitumen.
2. To find out the stability value, flow value, VA and VMA of SMA mix with bamboo fiber using stone aggregate and slag aggregate.
3. To compare the results of different SMA mix with and without addition of fiber as stabilizer in the SMA.

3. MATERIALS AND TESTS

In this study we have used two different types of aggregate which are stone and slag aggregate. The conventional bitumen is used of 60/70 grade. The various content of bitumen is varying as 4%, 5%, 5.5%, 6%, and 6.5%. The bamboo fiber is used of Tundla and Balcove species.

Tests on Aggregate: We have conducted various tests on aggregate like specific gravity, los angles abrasion test, Impact test. The test results are shown in the table 1.

TABLE -1: Test Result of Aggregate:

Test	Aggregate	Standard values
Specific Gravity	2.76	2.6- 2.9
L. A. abrasion value (%)	27	<30
Impact value (%)	21.4	>18

Test on Bitumen: We have conducted specific gravity tests of bitumen, Penetration test and softening point test on Bitumen. The results of the tests are given in table 2.

TABLE -2: Test Result of Bitumen:

Test	Results	Standard Values
Penetration at 25°C	65	50 to 89
Softening point °C	65.2 °C	>48 °C
Specific gravity	1.0025	0.9-1.2

4. PREPARATION OF SAMPLES

For the marshal stability test we have prepared the samples as per the standards. We prepared the samples for different SMA Mix. 3 samples were prepared for each SMA mix The details of the sample prepared are listed in the table 3. The typical marshal stability test setup is shown in the fig. 2.

Table- 3: Details of Sample.

Sr. No	Description	No of samples
1	Stone aggregate without bamboo fiber	15
2	Slag aggregate without bamboo fiber	15
3	Stone aggregate with bamboo fiber	15
4	Slag aggregate with bamboo fiber	15

Fig - 1: A typical Samples of SMA.

Fig- 2: Marshal Stability Test Setup.

5. RESULT

The Test Results obtained from the laboratory test conducted using various percentage of bitumen content, fiber and slag aggregate in SMA Mix are analyzed graphically. In this section to get the required results like effect of fiber and slag aggregate comparison is made between them and arrived at conclusion. Here Stabilized values are calculated using the co-relation method mention in refrence[12]. All the values like bulk volume, Volume of sample, G_{mb}, G_{mm} and P_s are required to

calculate GSB, VA and VMA value. The formula for calculating various elements of marshal mix design are listed below.

Formulae:

Gmb =Mmix/Bulk Volume of the Mix

Ps= Magg/Mmix

VA=[(Mmix/Gmb-Mmix/Gmm)/(Mmix/Gmb)]*100

Gmb = Mmix/bulk volume of mix

Gmm = Mmix/Volume of the mix air voids

VMA= [(Mmix/Gmb- Mmix Ps/Gsb)/ (Mmix/Gmb)]

Gsb = Magg/Volume of (aggregate mass+ air void in aggregate+ absorbed bitumen)

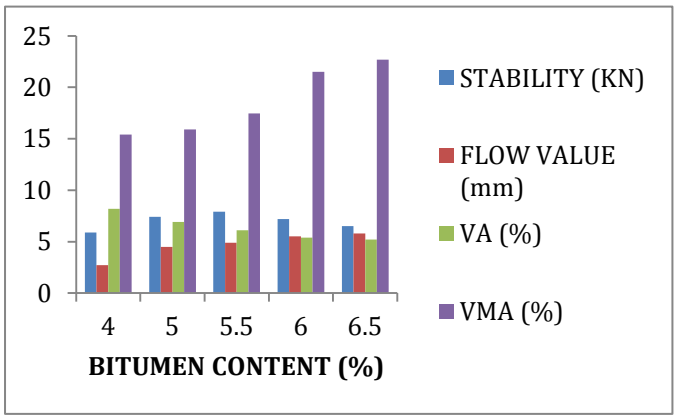

CHART-1: Stone Aggregate without Bamboo Fiber

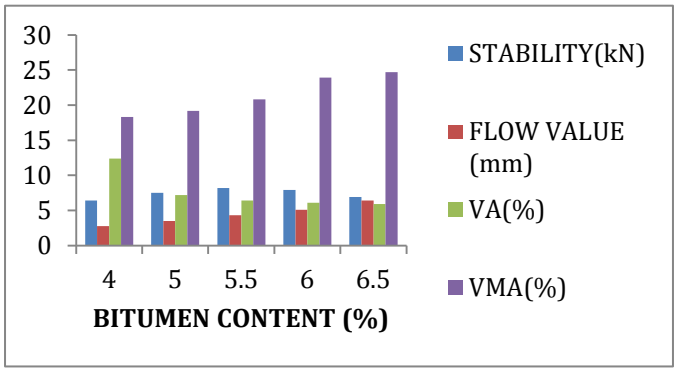

CHART- 2: Slag Aggregate without Bamboo Fiber

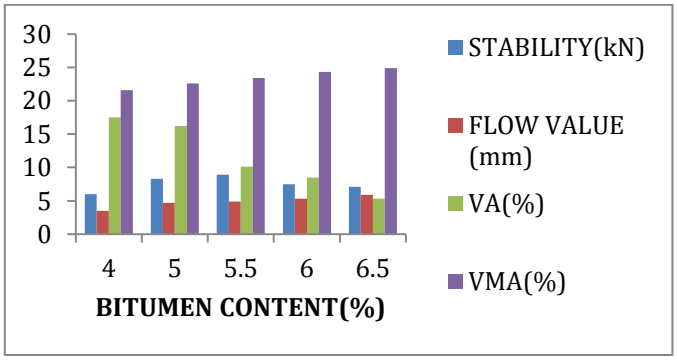

CHART- 3: Stone Aggregate with Bamboo Fiber

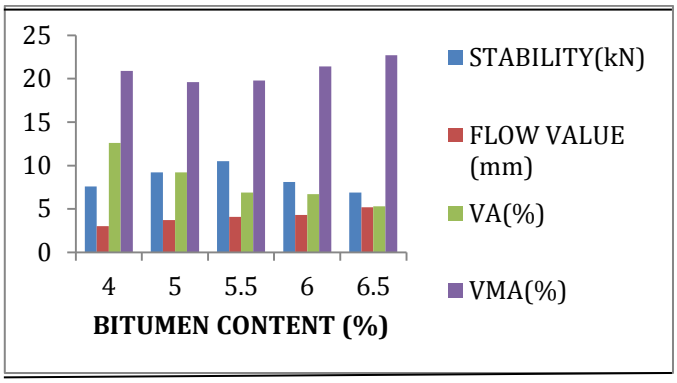

CHART- 4: Slag Aggregate with Bamboo Fiber

6. DISCUSSION ON RESULT

The SMA Mix gives the stability value more than expectations as per the IRC specification for the construction of road surface with bituminous material. The tests which are performed in the laboratory as per the IS code procedures has given the maximum stability value of 10.5 kN, flow value of the same is of 4.1 mm, voids in aggregate is 6.7% and voids in minerals aggregate is 19.8% at 5.5% of bitumen content and 0.4% of bamboo fiber content in slag aggregate. It is observed that increasing bitumen content will increase stability value up to 5.5% of bitumen content. Beyond 5.5% of bitumen content stability value starts decreasing.

7. CONCLUSIONS

I. The Optimum Binder content for the SMA samples is found to be 5.5%.

II. Highest stability achieved, was by Slag aggregate using Bamboo fiber. The least flow value achieved was at 5.5% Bitumen content for Slag Aggregate without fiber.

III. It is noted that maximum limit of binder content can be 5.5%, maximum stability value can be found in SMA Mix with slag aggregate using bamboo fiber.

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