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Influence of Wood Fiber On The Performance Of Stone Matrix Asphalt Using Slag As Aggregate Replacement

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Abstract- Stone grid black-top , was most importantly evolved in 1960 in Germany which currently generally assists in giving a more noteworthy long-lasting twisting obstruction, strength to surfacing materials, longer help life, worked on maturing ,high opposition in breaking, weakness, wear, better pallet opposition and like in diminishing with noising. It is a hole evaluated combination of totals which helps by boosting the black-top concrete substance and parts of coarse total . It is a steady, groove safe blend and extreme which depends on total contact for giving strength . Alongside rich mortar cover it gives better strength. The SMA test is ready by blending coarse total, fine total , filler according to the degree diagram given by the standard code while utilizing stabilizer and without stabilizers. . A fiber that is promptly accessible in nature. less practical contrasting with other non regular filaments has been utilized as stabilizer. It is Bamboo fiber, which is cellulose fiber separated from normally accessible Bamboo stem. It has high strength in fiber heading, more prominent pliable, flexural and influence strength. Slenderness level of fiber can without much of a stretch be gotten from it. It is sturdy in nature, has relentlessness and great soundness esteem. An endeavor has been made to figure out its appropriateness in expanding the steadiness and stream esteem in the combination of Stone Matrix Asphalt Mixes. For this undertaking, we have arranged SMA blends involving stone as coarse total, slag in halfway substitution of coarse total and utilized various stabilizers and have attempted to look at the outcomes at a differing bitumen content of 4,5,5.5,6,7 % bitumen. The stabilizers were utilized at an ideal of 0.3% of the heaviness of test.

Keywords- Stone matrix Asphalt, Bamboo fiber& SMA

I. INTRODUCTION

In the planning of Road Pavement, Flexible Pavement Designing is favored consistently over any remaining unbending asphalts. It is predominantly because of the better burden conveying limit, solidness, protection from tear and wear, more noteworthy solidarity to perform well during weighty burdens. This Properties of the street is basically accomplished because of its surface bituminous asphalt.

It is the surface covering over the Stone Matrix Asphalt which is the hole reviewed blend gives strength by stone to stone contact. Also, this properties of the SMA is resolved at first in the lab testing to give greatest soundness, better stream esteem utilizing Optimum folio Content.Stone Matrix Asphalt fundamentally comprises of coarse total of around 70-80% of complete total, fastener is taken 4-7% , filler 8-12% and fiber as stabilizer between 0.3 to 0.5%. Coarse total in the blend gives stone contact to oppose rutting, filler helps in making up for the shortfalls between total to forestall tearing and wearing, cover helps in restricting every one of the materials together. Fiber gave go about as stabilizer to expand the security restricting the combination during high temperature and forestalls seepage during creation, laying and transportation.

II.OBJECTIVE

- To determine the Optimum Binder Content (OBC) for every SMA mix taking various readings with different %age of Bitumen content.
- To find out the stability, flow value, VA and VMA of SMA mix using bamboo fiber using stone aggregate and slag aggregate as coarse aggregate .
- To obtain the suitability of Bamboo fiber over other conventional fibers as stabilizer in SMA mix over all other SMA mixes.

III.SCOPE OF THE WORK

In this work two different types of coarse aggregate are used which are Stone aggregate and Slag Aggregate keeping the stone aggregate as fine aggregate, Bitumen grade of 60-70 has been used throughout the study as

Binder. And two types of stabilizer is used,those of one fiber naturally available Bamboo Fiber whose results has been compared with SMA results without fiber for both the Coarse Aggregate and with the Topcel Cellulose as Stabilizer in Stone as coarse aggregate.

IV.METHODOLOGY

Stone Matrix black-top which is a hole evaluated combination broadly shifts in its outcome as per the fluctuating strategies, methodology, device and Materials to be utilized for the Mix planning thus the outcome likewise is substantial just to the specific district and conditions . In this subject it predominantly incorporates the choice of material sorts which incorporates Coarse and Fine Aggregate, Filler, Binder and Stabilizer. Here two sorts of Coarse Aggregates are taken i.e Stone total and Slag total. Folio is Bitumen of grade 60-70 as it is the fastener expected and for the most part liked by the designers because of its air state of India. Bamboo fiber and Topcel Cellulose are utilized as stabilizer to really take a look at their fluctuating outcomes.

Table-1:Physical properties of the Stone Aggregates

Test description	Coarse aggregates	Fine aggregates	Standard values
Combined flakiness& elongation index (%)	28	-	< 30
Specific gravity	2.76	2.64	2.6-2.9
Los Angeles abrasionvalue (%)	27	-	< 30
Impact value (%)	21.4	-	< 18
Aggregate Crushingvalue (%)	27	-	<30
Angularity number	10	-	0-11

Table-2: Physical properties of the Slag Aggregates

Properties of Slag Aggregates	Value		
	Limestone	Iron slag	Steel slag
Bulk sp. gr. (gr/ cm3)	2.65	3.44	3.51
Apparent sp. gr. (gr/ cm3)	2.69	3.63	3.74
Water absorption (%)	0.7	1.7	1.6
L.A. abrasion (%)	25.4	20.7	19.5
Soundness<comma> Na2SO4 (%)	4.5	3.2	2.4
Fine Aggregates			
Bulk sp. gr. (gr/ cm3)	2.43	2.91	2.98
Apparent sp. gr. (gr/ cm3)	2.77	3.68	3.86
Plasticity index	Non-plastic	Non-plastic	Non-plastic

Test description	Results	Standard values
Penetration at 25oC (1/10 mm)	65	50 to 89
Softening point oC	65.2	>48 oC
Ductility, cm	> 90	>50
Specific gravity	1.025	-

1. Apparatus Requirement

As per the code IRC:SP-79, the gradation of the materials are required. Hence the IS Sieve size of the same is required for the gradation which is done by sieving. After the Sieving is done, the sample is heated up to 155°C - 160°C for which Oven is required. Then the sample is mixed in the sample mixing apparatus adding Bitumen as binder. The Moulds are needed where the casting is done using the hammer of specific weight and fixed falling. Then before testing hot water bath is used for water bath of the sample at 60°C for 30 minutes. Finally Marshall Testing Apparatus, where the testing is done and stability and flow value readings are taken.

ZIS Sieve	Cumulative %	Mean	% retained
26.5	-	-	-
19	100	100	0
13.2	90-100	95	5
9.5	50-75	67.5	32.5
4.75	20-28	24	38.5
2.36	16-24	70	4
1.18	13-21	17	3
0.6	12-18	15	2
0.3	10-20	15	3
0.75	8-12	10	2

Table-3 Physical properties of Bitumen

Fig.1Moulds.

2.Preparation of test specimen:

In the SMA mix Bitumen is highly preferred by the engineers than other binders. It is dueto the properties of Bitumen like Water proof, Durable, Resistant to strong acid and Good cementing properties. For the stabilizing material Bamboo fibre and Topcel cellulose whose suitability is to be determined in the terms of stability and flow value has been taken. Bamboo fibre has been considered mainly for the reasons like it's strong durability, good stability, degree of fineness is very thin, Tenacity and it's easy readily availability and less cost effective comparing to other conventional fibres available naturally.

Fig-2 Bamboo fiber.

Fig-3 Topcel Cellulose

3.Preparation of Sampling:

- Examining of coarse and fine totals is done for 13mm STONE MATRIX ASPHALT arrangement as indicated by IRC:SP-79.
- The total, reviewed by IRC:SP-79 is dried and adequate sum is gauged (around 1200 g) to give a level of 63.5 + 1.3 mm when compacted in the shape.
- The total is then warmed in the stove to a temperature up to 150-160 °C not higher than over the cover temperature for 60 minutes.
- The expected measure of bitumen is weighted and warmed independently up to a temperature up to 170-190 °C .
- The total contained is then brought out and warmed in blending bowl. The folio is then poured in it and manual blending is completed until totals are appropriately covered. The blending temperature is kept inside the cutoff that is set for the cover temperature.
- An appropriately cleaned shape of 101.6 mm measurement and 76.2 mm level is furnished alongside base plate and an expansion collar.
- A piece of channel paper is fitted in the lower part of the shape and the entire blend is poured in it .
- The shape get together is put on the compaction platform and given 75 blows for no fiber and 50 blows for fiber by the 2500 g compacting hammer with falling level of457.2 mm. The example is then turned around by switching the form and given a similar treatment on the opposite side.
- The example is then painstakingly expelled from the shape, moved to a smooth level surface and permitted to cool to room temperature for 24 hours.
- At long last, the example is estimated and shown up air and water after paraffin wax covering is given (for volume assurance). The example is then stamped and put away for strength and stream estimations.
- Prior to leading the Marshall test, every one of the example was kept in serious trouble shower for 30 min. at 60 °C temperature.

3. Experimental Investigation

3.1 Marshall Test On Specimen

- After keeping the prepared sample for 30 minutes in water bath maintained at 60oC the is placed in the marshal test apparatus.25 kN dial gauge is been used for dial gauge reading for stability. Marshall stability testing machine loaded is then allowed for loading at a constant rate of deformation of 5 mm per minute until failure.
- The total maximum load obtained in dial gauge is been noted as stability value, which is calculated again using the co-relation factor given for the standard 25kN dial gauge to obtain load in kN which causes the specimen to fail and is taken as Marshall Stability.
- The total amount of deformation in units of 0.25 mm is observed and noted which occurs when maximum load is applied is recorded as Flow Value.
- VA and VMA values are calculated using the sample characteristics of specific gravity, which is been calculated from the different weight of the sample taken in water and outside of water.

V.RESULTS AND DISCUSSIONS

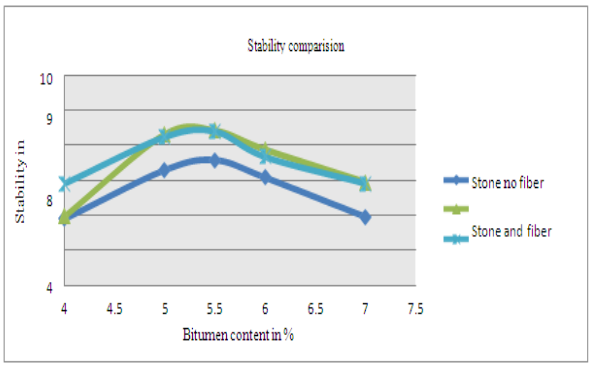

Fig. 4 Stability Comparison.

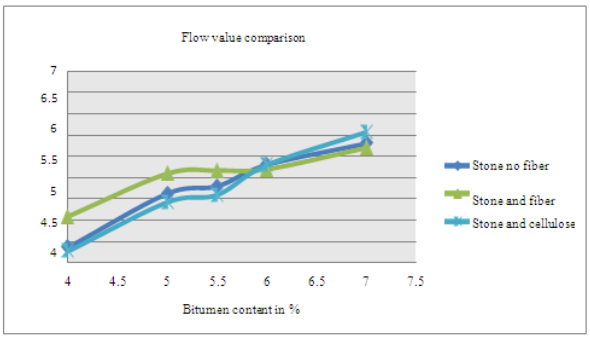

Fig.5 Flow value Comparison.

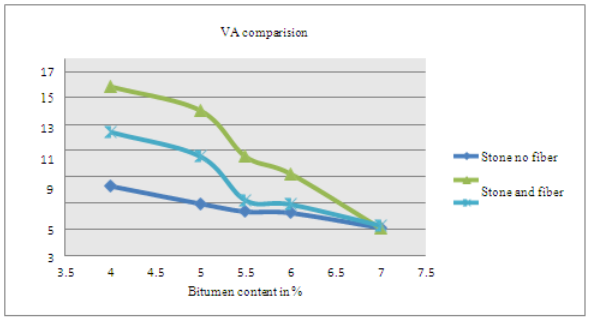

Fig. 6 VA Comparison

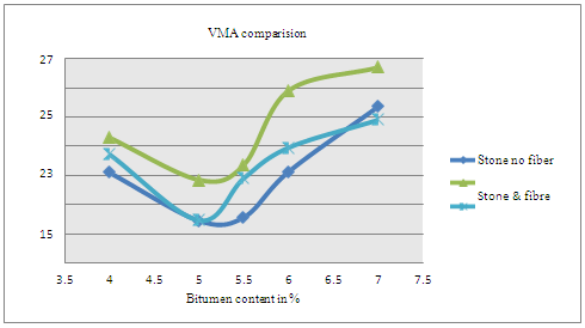

Fig.7 VMA Comparison.

VI.CONCLUSIONS

The investigation of the relative multitude of results, chart and correlation of the multitude of results each independently and entirely reasoned that:

- The Optimum Binder content for the SMA tests for every one of the cases besides for the situation where stone is utilized as coarse total with the bamboo fiber (where in the OBC is viewed as 5%) is viewed as 5.5%.
- Most noteworthy dependability accomplished, was by Slag total utilizing Bamboo fiber which is 4.16% higher to the solidness got utilizing Stone total with Bamboo Fiber.The least stream esteem accomplished was at 5.5% Bitumen content which is 4.1mm for Slag Aggregate without fiber and 12.2% lesser than that of Stone Aggregate Using Bamboo Fiber.
- The Slag as Coarse Aggregate with Bamboo Fiber is liked for the SMA blend over any remaining Mixes. The Stone as Coarse Aggregate utilizing Bamboo Fiber is liked as it gives reasonable worth over SMA blend without utilizing fiber and for Stone total utilizing Cellulose Fiber.

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