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Review on Laboratory Work Used to Improve Quality of Asphalt Mix Using Different Waste Material Adding Stone Matrix Asphalt and Banana Fibre

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Abstract: ***Bituminous mixture is an admixture of coarse aggregate, fine aggregate and fill. Hot Mix Asphalt(HMA) is a type of bituminous mixture in which all molecules are mixed and compacted at high degree of temperature. HMA is available in two forms compact graded and Stone Matrix Asphalt(SMA), formally is known as Bituminous Concrete(BC) and another's known as gap graded. SMA needs added threads to minimize the drainage through the material. In this study, a work has been made to enhance the stability of SMA using banana fibers along with binder content(BC). The admixture has been prepared as per the MORTH specification. The probability of BC and fiber content is varied from 4 to 7% and from 0.1 to0.5% . A number of tests have been performed on the marble dust to check it's. As per the test analysis, Marble dust is introduced as an Optimum Binder Content(OBC) and has been used for the mix with an average value determined as 5% . After adding 5 of BC into the bitumen along with different probability of banana threads similar as0.1%,0.2%,0.3%,0.4% and0.5%. The tests have been performed on five different samples and tests values in terms of stability, inflow value, Air Void(VA) and Void in Mineral Aggregate(VMA) have been measured. From the test it has been observed that banana fiber enhances the stability of the mixed sample.***
Keywords: Bituminous Concrete, Stone Matrix Asphalt, Banana Fiber.

I. INTRODUCTION

The construction of the road ways covers a large amount of investment. To invest less, construction engineering must have to design road in such a way so that one can achieve a reliable performance of the road along with the built-in service. There are two factors that must be considered while using flexible pavement as well as the mix design.
These two factors are one of the key elements in the engineering-paving design and mixing design. This research deals with mixed design of bitumen.

Good design of bituminous mixtures should have following characteristics:
1) It should be Strong
2) It should be Durable
3) It should be free from Fatigue and durable deformation
4) It should not cause harm to the environment and
5) It should be Economic, etc.

Mix designer makes an effort to obtained all the above features with number of tests performed on the mix in which the materials are added in different proportion and then select that mix which provides best value.
The primary formal mixed design technique was primarily Hibbard Field mechanism that was designed on sand-asphalt mixture. Using this method, the mix with large number of aggregates was not handled. A number of stabilizing elements such as Cellulose fibre, mineral fibre and so on are added into the bituminous mix mostly with SMA so that the drain down of binder can be decreased. Natural fibre such as jute fibre, sisal fibre and coconut fibre has been also used by many research work. Attempts have been made to use naturally available fibres in this research work. It is called BANANA FIBER mixed in BC. Banana fibres are mix with the bitumen to increase the strength as well as stability of the material and also decrease the quantity of using bitumen.

A. Stone Matrix Asphalt (SMA)

SMA, also referred as "Stone Mastic asphalt" it is a gap graded HMA. This is basically designed to improve rutting resistance along with durability. The goal of the hybrid design is to form a mixture which as stone-to-stone contact. Because the aggregate does not deform like a bituminous binder under load, the contact of the stone with the stone largely lowers the rutting. SMA is usually quite expensive compared to dense HMA as it needs more durable aggregates, more inventory (sometimes more waste to create available inventory grading), higher bitumen content, modified asphalt bonding Agents and fibers. SMA is primarily used to pave high- volume U.S. interstates and roadways, achieving high situations of rutting resistance and durability. In addition to upgraded durability and rutting resistance, SMAs have actually good friction characteristics. SMAs have also been successfully used on high- volume national highways with heavy machine and truck trade. This is increasing the interlocking of the aggregates and provides better gravestone to gravestone contact which serves as loading carrying method in SMA and hence provides better rut resistance and durability.

- To increase the resistance to permanent deformation,
- To increase the life span of the pavement,
- To reduce the application and damage risk in thin layers,
- To reduce the need for drainage inhibitor

II. LITERATURES REVIEW

1) Megamer and Stuart (18, 1996) have discussed the influence of mineral fillers on the SMA mixtures properties. The researchers have selected eight types of mineral fillers based on their performance, grading, and so on. Also, the properties of SMA mixtures have been determined in the form of removing of the mastic, rutting resistance, low temperature cracking, moisture sensitivity, workability.

2) Lu et al. (19, 2000) have examined morphological as well as rheological characteristics of modified compound. The properties and composition of the polymer and the nature of the asphalt have been affected by the mixed type. When the continuous polymer phase is composed of approximately 6% of the highly polymer composition, the binding theology has significantly improved. The aging characteristics of the adhesive also depend on the type of polymer.

3) Muni Andy and Huat (21, 2006) presented the work that used cellulose oil palm fiber (COPF). The designed fiber-modified binders have provided improved rheological properties after mixing the cellulose fibers in PG64-22 binder in different ratio of 0.2, 0.4, 0.6, 0.8 and 1.0 percent by weight of aggregates. The test results demonstrated that the PG64-22 binder can be modified and upgraded to the PG70-22 grade. The fatigue ability of SMA design mix has been increased using COPF and find maximum at 0.6% of fiber mix, and tensile stress and stiffness also exhibit similar performance trends. At a fiber content of 0.6%, the strain is determined as minimum.

4) Karaşahin, M., & Terzi, S. (22, 2007) have performed test on the sample prepared by mixing of marble dust in the asphalt mix. The marble dust has been obtained from the marble block during the shaping process. On the prepared sample Marshall Stability test has been performed. Indirect tensile test instrument is used to measure dynamic plastic deformation.

5) Zhu et al. (23, 2008) have used the fly ash produced by municipal solid waste incinerator (MSWI) as a partial replacement for fine aggregates or mineral fillers in SMA mix. He used to the Superpave and Marshall Mix design programs to compare the performance of the design mixture.

6) Jonny Hassan et al. (24, 2011) have discussed the consequences of using waste glass in the form of powder as mineral filler and determine the properties of SMA using Marshall Stability Test. Nine different types of mixtures has been prepared using three kinds of fillers such as powder of lime stone, OPC and glass powder in different percentages 4, 7 and 10 respectively. From the test results it has been determined that the 7% of glass powder provides better stability with low flow and density.

7) Vale et al. (25, 2013) have examined the coconut fiber mixed with asphalt mix. The advantage of using coconut fiber is because cellulose is found in large amount. The manifestations of these mixtures were investigated by performing two different tests; Marshall and Superpave. The test results showed that coconut fiber can be used as cellulose fiber and that the road is protected from asphalt drainage particularly in the construction process.

8) Kumar et al. (28, 2016) have studied the effect of natural fibers with and without fiber based on SMA mix in laboratory. It is understood that the combination of fibers represents a higher stability than the natural SMA. These fibers in the mixture can not only fill gaps in the specimen, but also act as stabilizers that can significantly reduce drainage and, therefore, hold the binder in the mixture. Fibers has also been provided homogeneity in the mixture

9) Dilkusha et al. (31, 2018) has developed a mix design and tests its performance using SMA natural Fibers and, when it comes

to the conclusion that the strength of banana fiber is not as much as that of sisal and coir fiber. All fibrous stabilized SMA blend with the highest tensile strength is about 0.3% From the test results performed individually on three different fiber mix design, the performance of coir fiber mix has shown maximum pulling strength with high cracking resistance, in contrast to other two fibrous stabilizers.

10) Kar et al. (33, 2019) has presented a study that has been utilized to find out the effective use of natural fibers such as sisal fiber. This has been used as a stabilizer in the SMA along with dense graded bituminous mix. The Marshall Stability test has been performed to evaluate the performance OBC and optimum fiber content (OFC) respectively. Also, as binder VG 40 bitumen along with waste as a filler material has been used. From the experiment it has been observed that at .3 % of sisal fiber with fly ash as a binding material an enhance mechanical property has been obtained.

III. OBJECTIVE OF WORK

1) To examine the effect of banana fibers on Asphalt concrete mix.
2) To analyze the influence of banana fiber at five different percentages, 0.1%, 0.2 %, 0.3%, 0.4% and 0.5% and insertion of marble dust as a filler element.
3) To determine the performance characteristics such as Air Void, Stability, flow, Void in Mineral Aggregate, Softening Point and penetration values.
4) SMA has a higher macro-texture than dense-graded pavements for better friction

IV. CONCLUSIONS

1) In recent years, Stone Mastic Asphalt has proven to be superior on busy roadways all over the world. Both the asphalt industry and road authorities are becoming more and more accustomed to using SMA.
2) SMA's longer service life gives it a better return on investment than maximum alternate materials truly though the initial costs may be road ways. Given that a life span increase of at least 5 – 10 years can be attained and that additional advantages covered before are gained, it's clear that the choice of SMA can be a good investment.
3) The Marshall Stability value has been obtained maximum at BFC of 0.3% and after that it starts decreases
4) To gain the maximum benefit from SMA it's important to ensure that the admixture is well designed and a high standard of product and laying is maintained.
5) Stone mastic asphalt with or without polymer modified binder is one of the new and innovative materials being used by road authorities in their challenge to provide cost effective outcomes for highway carrying a steadily rising volume of commercial vehicles.
6) Also, the air Void has been increased upto 0.3 % of banana fiber content and after the addition of more fiber content the VA increases.
7) Therefore, it is concluded that an optimum value of parameters has been obeserved at banana fiber content of 0.3 % in the bitumen mix design

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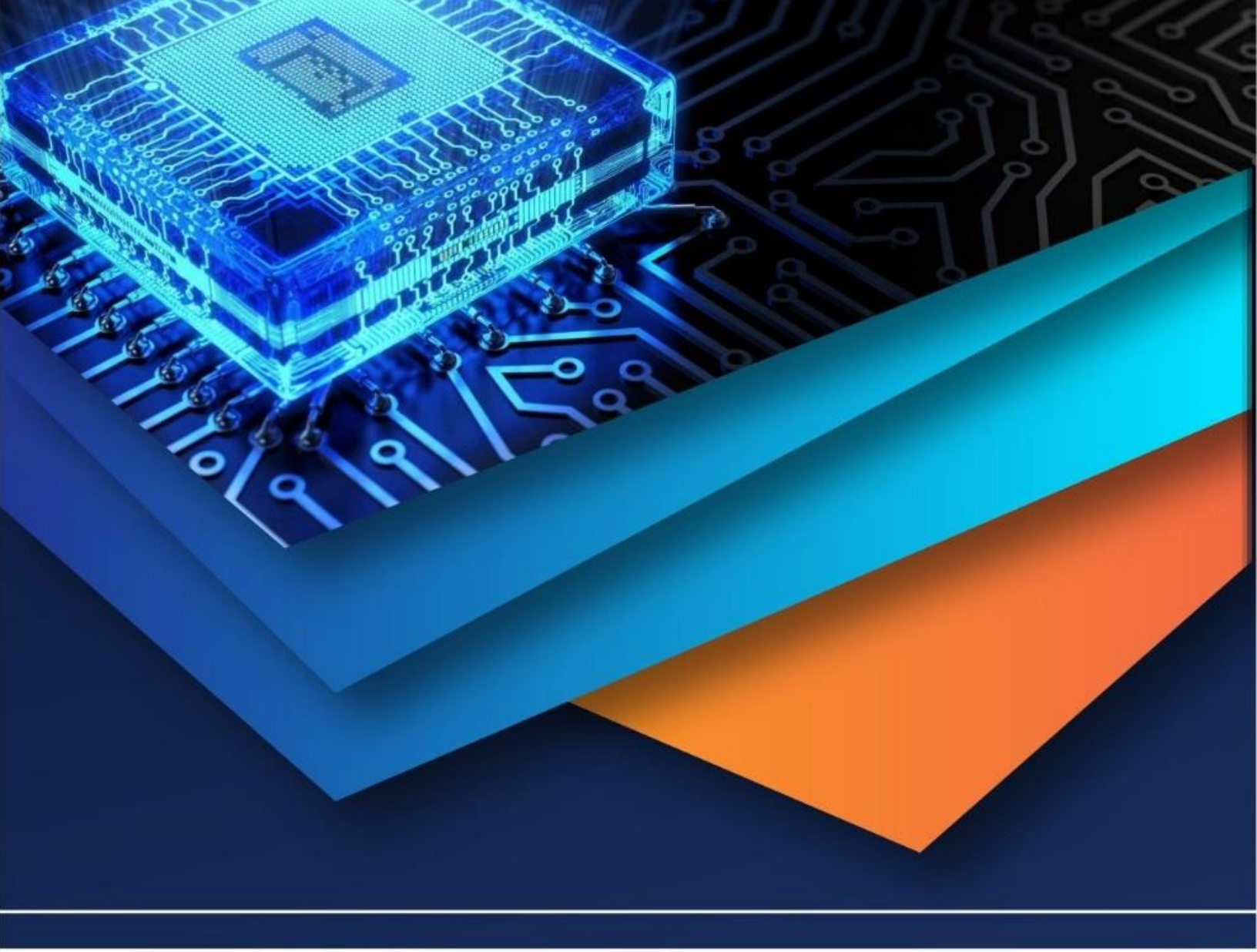

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