A REVIEW STUDY ON STONE MATRIX ASPHALT USING RECRON FIBRE

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Abstract: Stone matrix asphalt is a type of road surfacing mix made of 70 % Coarse Aggregates. The mix is bounded by the 'mastic' made up of crushed rock fines and bitumen. Stone matrix asphalt is a coarse graded rut resistant engineered hot mix asphalt surface layer. The stone matrix asphalt designs used a binder content of over 7 % by weight using polymer fiber or clayey admixtures stabilizing additives. The stabilizing additives are Recron Fibre, Synthetic fiber, Cellulose fibers and mineral fibers. Many SMA designs were developed with binder contents at this lower limit. Unavoidable binder content fluctuations during production, however, led in part to defects and damage. As a result several federal road construction ministries initially raised the minimum binder content to 6.5% by weight. This paper presents a review study to utilization of Recron fibre in the stone matrix asphalt.

Keywords: Stone Matrix Asphalt, Coarse Aggregates, Polymer fibre, Pavement.

1.0 INTRODUCTION

The stone matrix asphalt is made with high amount of the coarse particles. And the voids between the coarse aggregates are basically filled by the bituminous mortar. The present study is utilized to determine the nature and properties of the permeable asphalt pavement with recron fibers. Permeable pavement is allows water to pass through then at the same time providing the properties similar to asphalt pavement .Permeable pavements have low strength when compared to the normal pavement .The use of polymer fibers will increase the properties of the permeable asphalt pavement For this we identified the properties of aggregates to get optimum performance and for bitumen properties we conducted the penetration test, ductility test, softening ball point, marshal stability test. Bitumen and filler material and we find flow, stability and bulk density. In the stone matrix asphalt, the aggregate grading is similar to that of porous asphalt, but the voids are filled with mortar. The process of designing stone matrix asphalt mix involves adjusting grading to accommodate required binder and void content rather than the more familiar process of adjusting the binder content to suit the aggregate grading. It has cost effective despite high quality aggregate & higher binder content. Wearing courses made with stone mastic asphalt are especially stable and durable. They have proven their superior performance even in areas with heavy traffic and independent of any climatic influence.

1.1 PROPERTIES OF STONE MATRIX ASPHALT

Following are the various properties of Stone matrix asphalt:

1. better resistance to permanent deformation
2. high wearing resistance
3. less cracking due to cold or mechanical stress
4. coarse surface texture
5. good macro roughness
6. good long-term behavior

1.2 LITERATURE REVIEW

Vangari Manikanta et al studied the construction Permeable Asphalt Pavement using Recron Fiber. The objective of this study is to find out the various properties and nature of permeable asphalt pavement and to study the pavement performance, durability, maintenance requirements, hydrologic benefits, and environmental considerations of a full-depth permeable asphalt pavement in any Climate. In this study Recron -1s fiber is used to increase the pavement properties. Recron fiber prevents shrinkage split cracks in the pavement and provides additional strength to the pavement. The use of polymer fibers will increase the properties of the permeable asphalt pavement For this we identified the properties of aggregate to get optimum performance and for bitumen properties we conducted the penetration test, ductility test, softening ball point, Flash and fire test and marshal stability test. Bitumen and filler material and we find flow, stability and bulk density. The use of fibers make the pavement more stable and stronger this type of pavements are best suited for India The permeable pavements can allow water to percolate through them .when additional polymer fibers are added to the permeable asphalt pavement additional strength, resistance to shrinkage splits and stability may be provided to the pavement

G Anand et al studied the semi dense bituminous concrete by adding polymer fibers. The objectives of the study were to evaluate the performance of fibre modified bituminous mixes reinforced with Recron 3S fibre through laboratory investigations. Aggregate and binder tests were conducted to assess the suitability of the materials used in the study. In this study, tests are conducting on fibre modified and unmodified Semi Dense Bituminous Concrete (SDBC) and various inferences obtained from the experimental investigations are discussed. To study the efficiency of the fibre modified bituminous mixes, Marshall Stability test was conducted. Various tests were also performed on aggregate and bitumen to determine the engineering properties. Test results indicate that the viscosity of asphalt binder is increased with increasing polyester fiber contents, especially at lower temperature. With different polyester fiber contents, the complex modulus and loss modulus of asphalt binders are decreased. This study investigates on the characteristics and properties of fiber modified bitumen, which may have the benefit of improving the performance of road

pavement. After performing the various test the author concluded that optimum fibre content is 4.5 % for SDBC. A stability value of 13.74 KN is obtained without adding fibres at Optimum Bitumen Content.

G Pradeep Reddy et al conducted a study on the design of Polyester (recron-3s) fiber reinforced flexible pavement. The objectives of this study were to find out the properties of bitumen by adding different proportions of Polyester (Recorn-3S). and to modify the strength of the bitumen and the sample by using Polyester(Recorn-3S) Fiber. One of the Fiber Polyester (Recron-3S) Fiber is a artificial material obtained from polyester. Polyester (Recron-3S) keeps the smaller scale shrinkage splits created amid hydration. This Fiber helps to resist the cracks obtained by heavy loaded vehicles. It also helps to increase in flexural strength to the pavement. Bitumen is viscous fluid material which has binding nature. Bitumen has an adhesive property which binds all the components in it without any changes in their properties and it has and is insoluble and it act as sealant. The various tests Aggregate Impact Test, Crushing Test, Specific Gravity and Water Absorption Test, Penetration Test, Softening Point and Marshall Mix Design were performed in this study. After performing these tests the authors concluded that The unit weight is more for nominal mix when compared to the modified bitumen where in modified bitumen the unit weight is least for the mix-3 proportion. The void percentage is more for the nominal bitumen mix when compared to the modified bitumen mix. The least percentage value of voids is 2.16%.

Bindu C.S et al conducted a study on Influence of additives on the drain down characteristics of stone matrix asphalt mixtures. This paper focuses on the influence of additives like coir, sisal, banana fibres (natural fibres), waste plastics (waste material) and polypropylene (polymer) on the drain down characteristics of SMA mixtures. A preliminary investigation is conducted to characterize the materials used in this study. Drain down sensitivity tests are conducted to study the bleeding phenomena and drain down of SMA mixtures. Based on the drain down characteristics of the various stabilized mixtures it is inferred that the optimum fibre content is 0.3% by weight of mixture for all fibre mixtures irrespective of the type of fibre. For waste plastics and polypropylene stabilized SMA mixtures, the optimum additive contents are respectively 7% and 5% by weight of mixture. From the drain down study of the SMA mixtures, The author concluded that all the five additives used in the stone matrix asphalt for the present investigation act as effective stabilizing agents. The role of additive is to stiffen the mastic and thereby reducing the drainage of the mixture at high temperatures during storage, transportation, placement and compaction of SMA mixtures. Due to the gap graded gradation and rich binder content in SMA, the control mixture is subjected to heavy drain down.

Tapkin conducted a study on "The effect of polypropylene on bituminous performance". Marshall Stability and flow tests were used and indirect tensile tests were carried out in order to calculate the fatigue life of the bituminous specimens. The calcareous-based aggregate obtained from a quarry and 60/70 penetration bitumen was used in all the experiments. Preliminary experiments on Marshall Specimens (prepared with 50

blows on each side) established the mixture proportioning used in this study. In these experiments, the optimum bitumen content was determined as 5.5%. In this research, the bituminous concrete with 0.3%, 0.5% and 1% polypropylene fibres were investigated.

Mahrez et al conducted a study on "Fatigue and deformation properties of glass fiber reinforced bituminous mixes". This study investigated the characteristics and properties of glass fiber reinforced stone mastic bituminous. To evaluate the effect of the fibre content on the bituminous mixes, laboratory investigations were conducted on the sample with and without fibres. The testing undertaken in this research comprise the Marshall test, indirect tensile test, creep test and resistance to fatigue cracking by using repeated load indirect tensile test. The glass fiber content in this research was varied between 0.1%, 0.2%, 0.3%, 0.4% and 0.5% by weight of mix. The optimum binder content for the original mix was 5.5% by weight of the mix, while the modified mixtures were prepared using the optimum binder content (5.6%, 5.7%, 5.8%, 5.9% and 6%) corresponding each fiber content (0.1%, 0.2%, 0.3%, 0.4% and 0.5%) respectively. The fiber length in the mixture was preserved as constant parameter with a value equal to 20 mm.

CONCLUSION

Following are the various conclusions drawn after studying the various researches:

1. The aggregate interlocking effect results in a rut resistant layer with high stability and high skid resistance.
2. The SMA has been found to be an excellent and durable surface course for high speed highways, heavy trucks lanes, near signalized intersections and in stopping areas.
3. The resistant to rutting and high skid resistance will increase with the use of SMA.
4. The percentage of air voids is decreased as the fibre content increased.
5. The voids filled with bitumen increases with increase in the bitumen Content.
6. SMA's longer service life gives it a better return on investment than most alternative materials even though the initial costs may be higher.

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