PRELIMENARY MIX OF RUBBERIZED STONE MASTIC ASPHALT FOR MALAYSIAN ROADS

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Introduction

Stone Mastic asphalt (SMA) uses high quality totally crushed aggregates with a maximum size of 16mm. Approximately 80% of the aggregate are larger than 2 mm, with 65 to 70 percent larger than 8mm. The conventional 80/100-penetration asphalt is not suitable for use in SMA since it is soft. Stiffer asphalt with low penetration of 60/70 is quite ideal for use in Stone Mastic asphalt. By weight, the binder content ranges between 5.75 and 7 percent of the total mix, which is a little higher than the conventional mix. The main additives used to stabilise the mastic can be either cellulose or mineral fibres. However, the cellulose fibre has been widely used. The cellulose fibres are normally 1.5 mm long on the average. They are be added at a rate of about 0.3 percent by weight of the mixture.

Materials and Methods

Since the traditional asphalt is not appropriate for use in the SMA, the asphalt was modified with tire rubber to improve viscosity and penetration. Other type of modifiers like polymers is very expensive. As such the readily available Petronas rubberised asphalt was used in all the SMA research in UPM. As for the aggregates, granite was used as the main source since it is abundantly available in Malaysia. However, preliminary analysis was carried out to check its suitability for use as aggregate in SMA. In-order to assess the quality of the granite stones for use in SMA, several physical tests like L.A abrasion, Crushing value, impact value, soundness and petrography tests were carried. Special additives in the form of cellulose fibres were used to enhance the durability of SMA mix. The mix design was developed using the Marshall procedure and Asphalt Institute Method. The performance evaluation was carried out on SMA and compared with the conventional mix.

Results and Discussion

Dynamic creep modulus test was carried out on the samples using AusRoad Procedures to determine the number of load cycles to reach 1%, 3% strain and the ultimate failure. It was found that the performance of SMA against the conventional mix was excellent. The load cycles to rupture were several times higher. With the addition of a small amount of sulphur and butonal separately showed a marked increase in the dynamic creep performance of the SMA mix. Roads in tropical countries like Malaysia are exposed to extreme moisture conditions. As such it was deemed appropriate to carry out moisture induced damage test on the above samples. One set of sample was immersed in water and was pressure induced for about 20 minutes and tested for Tensile Strength. Another set was tested dry without undergoing any moisture inducement. It was observed that the tensile strength ratio of the SMA mix was higher than that of the conventional mix. Similar performance was observed in term of fatigue level. The number of repeated load cycles to failure for SMA was very much higher than that the conventional mix.

Conclusions

The Rubberised Stone Mastic Asphalt Mix is much superior to that of the conventional mix it minimises pavement cracking and rutting. From the SMA mix performance analysis it is obvious that tire rubber gives the maximum strength and stability. A much higher stability and strength can be achieved by using special enhancers like Butanol and Sulphur .The traditional 80/100 binder can also be modified with cellulose fibre, which is an organic material.

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