Effect of Styrene – Butadiene – Styrene (SBS) on Mixing Process and Laying of Asphalt Concrete

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Abstract

Construction of flexible pavements involve the production and utilization of asphalt concrete (AC) for the wearing course and the binder course. The sustainable production of AC mixtures has become a major concern internationally. Recycling of waste polymer materials can be identified as an effective method which improves the aspects of sustainability and economy of highway construction projects. This research was conducted to investigate the modification of asphalt properties using Styrene-Butadiene-Styrene (SBS) as a modifier and to check the performance of the modified asphalt mixtures in the aspects of the quality and the cost at plant scale production.

At the initial phase, the selected bitumen binder was mixed with the SBS modifier to produce an AC mixture in which SBS acts as a binder modifier for bitumen, and as a filler modifier for aggregates. Mix design details for AC were obtained from the Marshall mix design. The first set of production was done for 6% of SBS to the total bitumen weight. SBS was added quickly to the pre-blending bitumen tank while stirring at 180 °C -190 °C temperature during the wet process. Then the mixture was allowed to flow through the high shear mixing and dissolving tank to produce a uniform mixture. Subsequently, the modified bitumen was mixed with the aggregates at a mixing temperature of 170 °C – 180 °C. Then the mixture was placed before it reaches the recommended laying temperature of 140 °C.

The optimum compacting temperature was obtained by changing the temperature of the mixture. The asphalt mixture was heated at the respective temperature and it was kept for 10 minutes at boiling water temperature to find the mixing temperature for a better coating of the modified bitumen.

At the final phase, the physical properties of asphalt mixtures were investigated using Marshall test parameters including the stability value, the flow value, the percentage of air voids, and the percentage of voids in mineral aggregates (VMA). Wheel tracking test was also conducted. Cost analysis of the above production process was investigated by varying the parameters of the plant operation such as the mixing time, the control temperature, and the set of plant modifications. Considering the outcomes of this research, it is recommended to improve the efficiency of the plant operation processes for the modification of AC. This will also enhance

the sustainability by minimizing the hazards to the environment due to the waste polymer materials causing environmental pollution.

Keywords: Asphalt concrete, SBS, Aggregates

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