An Experimental Study to Evaluate the Effective Specific Gravity Estimation on Percent Air Voids of Asphalt Mixture Design

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Abstract

Asphalt concrete is one of the most widely used surfacing compounds consisting of mineral aggregates with asphalt (Bitumen) binder. Various types of bituminous mixtures such as cold mix asphalt, hot mix asphalt, plant mix, and warm mix asphalt are used with relevance to the environment while tropical countries like Sri Lanka use hot mix asphalt mixes for surfacing. In hot mix asphalt mixes, the theoretical maximum specific gravity (Gmm) value plays a significant role when considering the performance and durability. The impact of theoretical maximum specific gravity (Gmm) can be noticed directly on properties of paving mixtures like bleeding, rutting, raveling, and fatigue. Precise calculation of Gmm is critical in the mix design process in determining exact values of percent air voids in a compacted mix (VIM), percent voids filled with bitumen (VFB), and optimum asphalt binder content in a compacted mix. Manual Series-2 published by Asphalt Institute recommends determining Gmm directly by performing the standard test method called RICE method (AASHTO T209, ASTM D2041) for every binder content or by performing the RICE test for a selected binder content around optimum binder content to obtain effective specific gravity (Gse) of aggregate mix and then to calculate Gmm for other binder contents using a back-calculation method as an indirect method. Sri Lankan road industry used to determine Gmm for every binder content using the effective specific gravity (Gse) which is pre estimated as the average of apparent and bulk specific gravities of the aggregate mix. It has been found that the measured air voids content using the Gmm value measured by rice test is lower than the average estimated method used in Sri Lanka in about 20% and 9% for limestone and basalt, respectively. This research aims to study the impact of the effective specific gravity estimation method for asphalt mixture on the percent air voids and other characteristics of asphalt mixes when using granite as the aggregate. To achieve this objective, an extensive experimental program was designed using 10 different sample projects. Maximum theoretical densities of the samples were determined using the rice method according to ASTM D2041, while bulk and apparent specific gravities were taken from the mix designs which were done for the same hot bin and bitumen samples. Based on the results, the impact on percent air voids and optimum binder content was evaluated to determine the accuracy of the average estimated method compared to the standard rice test method.

Keywords: *rice test, percent air voids, optimum asphalt content, granite aggregate*

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