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Field Assessment of Non-nuclear Methods Used for Hot Mix Asphalt Density Measurement

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Abstract

Destructive nature along with the associated higher cost of the traditional core method used for hot mix asphalt density measurement has convinced researchers switching to some non-destructive technique for this purpose which is cost efficient as well. Earlier, nuclear density gauges were introduced for this purpose which was non-destructive as well. Since such devices were associated with the use of gamma rays, therefore, leading to safety and health issues. Last decade observed a revolution in asphalt density measurement technique with the evolution of non-nuclear density gauges. This research work is carried out with the objective to determine the efficiency and accuracy of a newly developed non-nuclear density gauge i.e. PQI-380 for field conditions as it needs its thorough evaluation prior to future uses in many of the developing countries including Pakistan. Density data obtained using standard core method and non-nuclear density gauge for 195 location confirms the satisfactory performance of the instrument. Results obtained show that the coefficient of correlation is near to 0.9. Which refers to a strong correlation between the density data. Moreover, performance criteria e.g. root mean square error and mean absolute error between the density data set is also very low confirming the good measuring abilities of the device. Instrument performed well for repeatability analysis giving maximum coefficient of variance less than 5 percent.

Keywords: Core Method; Non-nuclear Density Gauge; PQI-380; Density Measurement.

1. Introduction

The density of hot mix asphalt (HMA) has vital importance in paving industries because of many prominent reasons. One reason, for example, includes challenges involved in maintaining, rehabilitating and managing the pavement structure due to the aging of the roads, and budget consideration for the developing countries in particular and the developed countries in general [1].

Moreover, the density of hot mix asphalt is the decisive factor in predicting the future pavement failure as a low density may increase the rate of deterioration and may have the chance of oxidation to occur moisture issues and may lead to cracking and ravelling [2-6]. On the other hand, density values that are higher enough thereby reducing the air voids content less than 3 percent may cause premature rutting [7]. Since the density of HMA plays a vital role in funds allocation for maintenance program along with its direct impact on the performance of the structure thus gaining a vital position among the researchers.

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