Assessment of in-situ compaction degree of HMA pavement surface layers using GPR and novel dielectric properties-based algorithms

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Field compaction of asphalt pavements is ultimately conducted to achieve layer(s) with suitable mechanical stability. However, the achieved degree of compaction has a significant influence on the performance of asphalt pavements. Providing all desirable mixture design characteristics without adequate compaction could lead to premature permanent deformation, excessive aging, and moisture damage; these distresses reduce the useful life of asphalt pavements. Hence, proper construction of an asphalt pavement is necessary to develop a long lasting roadway that will help minimize future maintenance. This goal is achieved by verifying and confirming that design specifications, in this case density specifications are met through the use of Quality Assurance (QA) practices.

With respect to in-situ compaction degree of hot mix asphalt (HMA) pavement surface layers, nearly all agencies specify either cored samples or nuclear/ non nuclear density gauges to provide density measurement of the constructed pavement. Typically, a small number of spot tests (with either cores or nuclear gauges) are run and a judgment about the density level of the entire roadway is made based on the results of this spot testing. Unfortunately, density measurement from a small number of spots may not be representative of the density of the pavement mat. Hence, full coverage evaluation of compaction quality of the pavement mat is needed.

The Ground Penetrating Radar (GPR), as a Non Destructive Testing (NDT) technique, is an example of a non-intrusive technique that favors over the methods mentioned above for assessing compaction quality of asphalt pavements, since it allows measurement of all mat areas. Further, research studies in recent years have shown promising results with respect to its capability, coupled with the use of novel algorithms based on the dielectric properties of HMA, to predict the in-situ field density. In view of the above, field experimental surveys were conducted to assess the effectiveness of GPR methodology to estimate the in-situ compaction degree of several test sections. Moreover, considering also the field density results as obtained with traditional methods, comparative evaluation was conducted to assess the potential of using the GPR technique as a surrogate tool for pavement compaction quality purposes.