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Real-time Compaction Monitoring of Asphalt Concrete Pavement Using Ground Penetrating Radar

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Measuring density is crucial in asphalt concrete (AC) pavement quality control and quality assurance (QC & QA). Under- or over-compaction during pavement construction may lead to future distresses such as bleeding and rutting. Ground penetrating radar (GPR) can provide real-time monitoring of the density change during the compaction process. The Al-Qadi, Lahouar and Leng (ALL) model is widely used to provide the density of AC mixtures based on estimation of the dielectric constant. However, the presence of moisture on the pavement surface may jeopardize the density estimation accuracy. The moisture results from the sprayed water on the roller to prevent AC mixtures from sticking to the drum/pneumatic wheel surface. Previous research only focused on the removal of this issue using 2GHz air-coupled antenna. Two correction algorithms are proposed and are independent to the central frequencies of the antenna, namely, the modified reference scan method and mean correction factor method. Different levels of white Gaussian noise with SNR from 5dB to 20dB were added to the raw GPR signal in the time domain. The cut-off frequencies of the bandwidth in both algorithms were analyzed and the dielectric constant values were calculated and compared to the pre-set value. The outcome of the analysis and the related findings could be involved in a procedure to address AC density evaluation using GPR in terms of pavement quality control and assurance.

Keywords: ground penetrating radar, surface moisture effect, real-time compaction monitoring, asphalt concrete