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Correlating the HWTT laboratory test data to field rutting performance of in-service highway sections

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Abstract
Rutting is one of the common distresses occurring in hot-mix asphalt (HMA) pavements that can be mitigated through adequate laboratory testing during the HMA mix-design screening stage. The Hamburg Wheel Tracking Tester (HWTT) is one of the test methods widely used in the routine HMA mix-design screening and quantification of the HMA rutting resistance potential in the laboratory. However, the occurrence of premature field rutting failures have been reported for some surface HMA mixes (even after being satisfactorily screened with the HWTT test in the laboratory), mostly in high-temperature environments, heavy truck-trafficked areas, and high shear-stress zones such as intersections, curves, etc. In an effort to improve the HWTT's screening and performance predictive capabilities, new models and HMA rutting parameters such as the rutting area, normalized rutting area, shape factor, rut-depth ratio, rutting resistance index, and the equivalent remaining laboratory rutting life were evaluated to supplement the traditional rut depth and number of load passes criteria. The fundamental theory for formulating these new models and HMA rutting parameters is to better account for the currently prevailing traffic loading and climatic conditions. However, one key challenge associated with such enhancements and new model developments prior to industry implementation is correlations and validation with field performance data. Using the Texas flexible pavements and overlays database, namely the Texas Data Storage System (DSS) as the data source, this study was conducted to correlate and validate the HWTT laboratory test data to field rutting performance of in-service highways. As extracted from the DSS, three Texas commonly used HMA mixes (ranging from fine to coarse-graded) and five in-service highways were used for the study. Overall, the laboratory HWTT yielded good correlations with field rutting performance data with a coefficient of determination generally exceeding 60% for most of the HMA rutting parameters evaluated. In particular, the rutting area and normalized rutting area parameters exhibited statistical superiority in terms of correlations with all the field rutting performance data, with coefficient of determination values averaging 69.9%. Nonetheless, more field correlations and validation studies of this nature are strongly recommended, among others, to aid in defining and establishing the pass-fail screening criteria/thresholds for the proposed HMA rutting parameters.