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Correlating the asphalt-binder high-temperature properties (DSR) to HMA permanent deformation (RLPD) and field rutting: A laboratory-field study

Lubinda F. Walubita [a], Enad Mahmoud [b], Luis Fuentes [c,⇑], Adrianus Prakoso [a], Sang I. Lee [b], Mena Souliman [d],Julius J. Komba [e]

[a] Texas A&M Transportation Institute (TTI) – The Texas A&M University System, College Station, TX 77843, USA

[b] Texas Department of Transportation (TxDOT), Austin, TX, USA

[c] Civil & Environmental Engineering Department, Universidad del Norte (UniNorte), Barranquilla, Colombia

[d] Department of Civil Engineering, University of Texas @ Tyler (UT Tyler), Tyler, TX, USA

[e] Council for Scientific and Industrial Research (CSIR) & University of Pretoria (UP), Pretoria, South Africa

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Abstract

Asphalt-binders are part of the key material constituents affecting the performance of hot-mix asphalt (HMA), and ultimately, the field performance of flexible pavement structures. Quite often, it is desired/useful to predict the HMA permanent deformation (viscoelastic) properties and field rutting from the asphalt-binder properties. Using the Texas flexible pavements and overlays database, namely the Texas Data Storage System (DSS), as the data source, this laboratory-field study was conducted to correlate the asphalt-binder properties to HMA permanent deformation (viscoelastic) properties and field HMA-layer rutting performance of in-service highway sections. Data extracted from the Texas DSS included asphalt-binder high-temperature rheological properties measured using the dynamic shear Rheometer (DSR) test, HMA permanent deformation (PD) and viscoelastic properties from the repeated load permanent deformation (RLPD) test, and field rut depth (RD) data for the HMA layers of in-service highway test sections. Two Texas asphalt-binder types, four HMA mixes, and four in-service field highway sections were used in the study. For some parametric comparisons, the corresponding results indicated good statistical correlations among the asphalt-binders, HMA mixes, and field rutting performance, with a coefficient of determination (R2) over 60%. Overall, the study findings indicated that the HMA PD properties and field HMA-layer rutting can be predicted from the asphalt-binder high-temperature rheological properties, with a linear or logarithmic model, to an accuracy exceeding 60%.