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16. ABSTARCT

A comprehensive study involving rut potential of Hot Mix Asphalt (HMA) was conducted. Both cylindrical and beam specimens of HMA were prepared using a Superpave Gyratory Compactor (SGC) and an Asphalt Vibratory Compactor (AVC), respectively. Mixture rutting performance was determined in the Asphalt Pavement Analyzer (APA). Initially, rut tests were conducted on three laboratory-prepared HMA for 8000 cycles of loading with 100 psi hose pressure, 100 lb wheel load, and 50 seating cycles. The rut values (8,000 cycles) varied between 2.0 mm and 6.4 mm. Rut depths were found to be sensitive to temperature when compared that to asphalt content.

Subsequently, this study evaluated rut potential of ten plant-produced mixes. Three of these mixes were of type A and six type B insoluble and one Type C. Only one mix showed a rut depth of more than 4 mm. The AVC beam specimens showed higher rut depth compared to cylindrical specimens. The APA rut test data were analyzed to identify the important contributing factors. Type A mixes were sensitive to percent asphalt content, where as Type B insoluble mixes were sensitive to material passing number 200 sieve.

This research investigated the relationship between rheological and mechanical properties for various Oklahoma unmodified and modified binders based on the asphalt mixture's rutting performance. The tests result showed that binder's Performance Grade (PG) affects mixture performance significantly. In general, modified binder showed better performance compared to the unmodified binders. Modified binders of same PG grade did not show the same performance when test parameters were held constant. Binder's viscosity and rut factor ($G^*/\sin\delta$) did not show significant effects on rutting performance of both modified and unmodified binders. Linear and nonlinear regression analyses were performed to investigate the contribution of binder properties to rutting. The nonlinear regression prediction of rutting was better than the linear prediction.

This study identified the most significant factors from a number of factors, which affect rut potential of HMA. Seven factors: binders PG, specimen type, test temperature, moisture, wheel load, asphalt content, and hose pressure, each at two defined levels were incorporated in a Superpave mix. Rut tests were designed to be the elements of an experimental matrix. The matrix test results were analyzed statistically. The analysis results showed that binders PG, specimen type, test temperature, and moisture, affected a mixture's rutting performance significantly. This study developed and described a statistical procedure to design and analyze an experimental matrix of test results.

This research investigated the repeatability and reproducibility of laboratory test data. An inter-laboratory study was performed on rut tests using the APA between the 'asphalt design laboratory' at the Oklahoma Department of Transportation (ODOT) and the 'asphalt laboratory' at the University of Oklahoma (OU). The tests result showed no significant variability in the collected data from two laboratories. This study developed a rut database for future model development. The APA rut results of HMA materials, which were used in a road section (funded by ODOT) of the National Center for Asphalt Technology (NCAT) Test Track at Alabama, were also included in the rut database.

17. KEY WORDS	18. DISTRIBUTION STATEMENT
Rutting, Asphalt Pavement Analyzer (APA), Asphalt Vibratory Compactor (AVC), Superpave, hot mix asphalt, binder, mix design, polymer, $G^*/\sin\delta$, rut factor.	No restrictions. This publication is available from the Office of Planning & Research, Oklahoma Department of Transportation.

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