

Evaluating fatigue performance of hot-mix asphalt using degradation parameters

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Abstract

Hot-mix asphalt (HMA) suffers a reduction in stiffness and strength under repeated cyclic loading, such that it eventually cracks. This paper reports the measurement of asphalt fatigue degradation in terms of stiffness modulus and dissipated strain energy (DSE). Three degradation rate parameters were derived from the linear parts of the relationships against a number of cycles: normalised stiffness modulus from the traditional approach (TA), and DSE and cumulative dissipated strain energy (CDSE) from the energy concept approach. Three techniques were used to perform the fatigue test: dynamic shear rheometer, two- and four-point bending tests. Different asphalts were made from open and dense gradings of limestone and granite aggregates, and with soft and hard binders according to British standards. The tests revealed that the DSE and CDSE degradation parameters were incompatible with the TA in the strain-controlled test mode, but compatible in the stress-controlled test mode. The variation and scattering of all degradation parameters was relatively low. In conclusion, the normalised stiffness modulus degradation rate parameter looks most promising for evaluating and predicting the fatigue performance of HMA regardless of the test technique and mode.