ABSTRACT

Most of the existing highway pavements are constructed as bituminous pavements with different thicknesses of bituminous layers. The bituminous layers are subjected to different conditions of loading (with varying magnitudes and speeds), temperature and moisture conditions and have to perform satisfactorily against distresses caused by fracture (low temperature as well as fatigue), permanent deformation and moisture damage. In the mechanistic-empirical design approach of bituminous pavements, the pavements are usually analysed using linear elastic layer theory for which the elastic moduli and Poisson's ratio values the pavement layers are essential inputs. Considering that bituminous mixes are visco-elasto-plastic in nature, resilient modulus (Mr), obtained by taking only the resilient component of the deformation, and considered to be analogous to elastic modulus, is used by many agencies for analysis and design of pavements While numerous predictive models are available for prediction of dynamic complex modulus (E*), there are only a few models available for prediction of resilient modulus. Extensive laboratory investigations were carried out in this study for determination of the resilient modulus of different types of bituminous mixes and for development of predictive models for Mr. For this purpose, mixes prepared using four different aggregate gradations, five binders and five binder contents were tested under different conditions frequency and temperature.

Rutting of bituminous mixes is a critical distress commonly occurring in bituminous pavements. Different binder and mix parameters having correlation to mix rutting are usually identified and specifications set for them to control mix rutting. Since bituminous mix is a visco-elastic material and thus a time lag is expected between the applied load and the resulting deformation. The existence of a good correlation between the mix time lag measured from resilient modulus test (especially when the test is conducted at higher temperature) and rutting susceptibility of the mixes evaluated using wheel tracking test has been demonstrated previously. Hence, time lag values have been extracted from the resilient modulus test data collected for all the combinations of mixes tested under different conditions of frequency and temperature. Predictive models have been developed for estimation of time lag for different mixes and for different test conditions.

The Mr predictive models developed in this study can be used to select appropriate resilient moduli for different bituminous mixes for different frequencies which are relevant for different traffic speeds and different temperature conditions. Similarly, the time lag models

will enable comparison of the rutting susceptibility of different bituminous mixes subjected to different conditions.

Keywords: Bituminous mixes, binder type, aggregate gradation, frequency, temperature, resilient modulus, time lag, predictive models