3D VISCOELASTIC LINEAR AND NONLINEAR BEHAVIOR OF ASPHALT MIXTURES

Q.T. Nguyen *
PhD Student, University of Lyon/Ecole Nationale des TPE (ENTPE), FR
H. Di Benedetto
Professor, University of Lyon/Ecole Nationale des TPE (ENTPE), FR
C. Sauzéat
Doctor, University of Lyon/Ecole Nationale des TPE (ENTPE), FR
* University of Lyon/ENTPE, Département Génie Civil et Bâtiment CNRS 3237, 69518 Vaulx en Velin, France, quang-tuan.nguyen@entpe.fr

ABSTRACT

The three-dimensional (3D) viscoelastic linear and nonlinear behaviors of asphalt mixtures are investigated. Measurements of complex modulus E^* and complex Poisson's ratio ν^* characterizing the linear viscoelastic (LVE) properties of material in 3D are introduced. The viscous rheological properties of asphalt mixtures depend on the temperature. Sinusoidal cyclic loadings in tension and compression were applied on cylindrical samples at different temperatures (from -26 to 50°C) and different frequencies (from 0.01 to 10Hz). The behavior becomes nonlinear when the strain (stress) amplitude level increases. During sinusoidal loadings, for each temperature and frequency, three levels of strain amplitude (< 125 μm/m) were applied to characterize nonlinearity of an asphalt mixture. From experimental results, the Time Temperature Superposition Principle (TTSP) was verified and applicable in the 3D case. Nonlinearity of asphalt mixtures is observed even at small strain amplitude (< 100 μm/m). Experimental data show the influence of temperature and frequency on the nonlinearity of asphalt mixtures. From these results, the rheological properties are determined for any strain level amplitude (< 125 μm/m). Some improvements are proposed to take into account the observed nonlinearity.

KEY WORDS: Viscoelasticity, nonlinearity, bituminous mixture, complex modulus, experimental data