

Comparison of Elastic and Viscoelastic Modeling for Asphalt Concrete Surface Layer

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Abstract : Hot mix asphalt concrete (HMAC) is a mixture of aggregates and bitumen. The primary ingredient that determines the mechanical properties of HMAC is the bitumen in it, which displays viscoelastic behavior under normal service conditions. For simplicity, asphalt concrete is considered an elastic material, but this is far from reality at high service temperatures and longer loading times. Viscoelasticity means that the material's stress-strain relationship depends on the strain rate and loading duration. The goal of this paper is to simulate the mechanical response of flexible pavements using linear elastic and viscoelastic modeling of asphalt concrete and predict pavement performance. Falling Weight Deflectometer (FWD) load will be simulated and the results for elastic and viscoelastic modeling will be evaluated. The viscoelastic simulation is performed by the Prony series, which will be modeled by using ANSYS software. Inflexible pavement design, tensile strain at the bottom of the surface layer and compressive strain at the top of the last layer plays an important role in the structural response of the pavement and they will imply the number of loads for fatigue (Nf) and rutting (Nd) respectively. The differences of these two modelings are investigated on fatigue cracking and rutting problem, which are the two main design parameters in flexible pavement design. Although the differences in rutting problem between the two models were negligible, in fatigue cracking, the viscoelastic model results were more accurate. Results indicate that modeling the flexible pavement with elastic material is efficient enough and gives acceptable results.

Keywords : flexible pavement, asphalt, FEM, viscoelastic, elastic, ANSYS, modeling

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