EFFECT OF TESTING GEOMETRY ON MEASURING NONLINEARITY OF ASPHALT BINDERS

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Asphalt binder is a major component of asphaltic surface courses in pavements. The mechanical performance evaluation of this material has been a challenge for pavement engineers. It is widely observed that asphalt materials exhibit nonlinear behavior, which means a modulus depending on strain (or stress) amplitude. Nonlinearity is a reversible phenomenon that causes stiffness to be dependent of the loading levels. The most common procedure to investigate nonlinearity in asphalt materials is the application of amplitude sweeps, i.e., tests that include some loading cycles at different levels of stress or strain amplitude. The selection of an appropriate test geometry for use with the Dynamic Shear Rheometer (DSR) is critical to the investigation of the nonlinear response. There are two different geometries typically used to test asphalt binders with a DSR. The first and most common is the specimen between two parallel plates with the top plate being subjected to torsion and the bottom plate being fixed. The second configuration, although not as commonly used for asphalt binders, is the cone and plate geometry. The major difference between cone and plate and parallel plate geometries is that the cone and plate geometry induces a homogeneous strain field in the sample. On the other hand, the parallel plates geometry induces a linear radial distribution of strain in the sample: this distribution is considered by the rheometer in the computation of the stiffness modulus. Regarding the presented context, the research herein is to determine how geometry affects the mechanical response of asphalt binder during cyclic loading. This study investigates the nature of nonlinearly response of asphalt binders using different geometries with computational simulations. The obtained results indicated that the nonlinearity on geometries respects the Time Temperature Superposition Principle (TTSP) and there are differences between the complex modulus and the phase angle measured.

Palavras-chave: Asphalt binder. Computational simulation. Nonlinearity. Geometry.