Aggregate Effect on Asphalt Mixture Properties by Modeling Particle-to-Particle Interaction

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A number of researchers have studied aggregate characteristics including elongation, flatness, and other shapes that are believed to affect asphalt mixture properties such as internal resistance, rutting resistance, tensile strength, and complex modulus etc. However, the aggregate modulus also affects the asphalt mixture modulus significantly, which has not been taken into consideration. In this paper, the effect of aggregate particle-to-particle interaction was studied through numerical modeling using the discrete element modeling (DEM) approach. The individual material phases (e.g., aggregates and mastic) were modeled with clusters of discrete elements based upon laboratory testing of the individual phases. For a given set of material parameters for each phase, the degree of particle-to-particle contact in an asphalt mixture was found to have a profound influence on overall mixture modulus. A parametric investigation of aggregate modulus revealed that the contribution of aggregate modulus to overall mixture modulus was very significant. Pending further experimental verification on asphalt mixtures, this finding may shed new light on the importance of aggregate stiffness on overall mixture properties.