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THE INFLUENCE OF AGGREGATE PROPERTIES ON ASPHALT PERFORMANCE

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ABSTRACT
Asphalt engineers sometimes overlook the fact that 85% of the volume of an asphalt mixture consists of aggregate. They can also forget that the stiffness of an unbound aggregate is considerably greater than that of a pure bitumen (at in-service temperatures). This paper draws on laboratory test data, which demonstrates the differences in stiffness between asphalt mixtures, which appear to be identical other than having different aggregate sources. The aggregate types investigated include limestone, igneous rock and slag from steel production. Further data is presented regarding the difference between unbound materials made up of these aggregate types. Similar stiffness ratios are found. An explanation for these differences is offered, relating both to the frictional properties of the aggregate particles and to the mineral stiffness. This explanation is supported by advanced 3D discrete element modeling. This leads to the hypothesis that the properties at an aggregate contact point are actually still highly significant in a bituminous mixture. This explanation is shown to satisfy both the experimental data and the demands of logic. However, lack of adhesion between bitumen and stone is also shown theoretically to lead to loss of stiffness and it is acknowledged that this effect may also explain some of the data.

KEY WORDS: Asphalt, Stiffness, Aggregate, Particle Contacts, Modeling