Studies on the effect of distribution of aggregates on the mechanical response of asphalt mix

Abstract:

Asphalt mix is composed of aggregates of various sizes. The size distribution of the aggregates and their relative arrangement within the asphalt mix affect the mechanical property of the mix. In the present work, cross-sectional images are used to study the arrangement of aggregates within the asphalt mix. Given that the size of aggregates (in asphalt mix) varies by several orders of magnitude, single imaging equipment is found to be inadequate to capture complete information on the entire size range. Hence, multiple imaging equipment (namely, scanner, camera and scanning electron microscope) are utilized and the information captured by individual equipment is collated to obtain the overall distribution of the aggregates. It is hypothesized that the coarse-sized aggregates (up to certain size limit) primarily participate in the load transfer, while small aggregates remain suspended within the binder so and enhances its strength. Limited information is available in the literature on this possible size demarcation. Hence, several non-standard tests are proposed and conducted, and image analyses are performed on the corresponding samples in search of existence of such a size demarcation. From the experiments conducted, it appears that 4.75 mm can be considered as this demarcation, at least for the mixes used in the present study. Subsequently, experiments to study the effect of aggregate arrangements (primarily measured in terms of distribution of inter-aggregate distance) on the mechanical properties of the mix are conducted - separately for aggregates larger than 4.75 mm and smaller than and equal to 4.75 mm. Few other studies are also done on homogeneity in the arrangement of aggregates, distribution of angle of inclination of coarse aggregates, and effect of surface charge on the distribution filler particles, as an effort to understand how the arrangement of aggregates affect the mechanical property of the mix.