Angularity of Fine Aggregates Using Digital Image Technique and Conventional Approach

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Abstract

Fine aggregates are one of prime constitute in asphalt mix design. However, the effect of fine aggregate morphology (angularity) on asphalt mixtures behaviour is well recognized in literature. For example, the excessive use of natural fine aggregates (less angular or rounded shape) over manufactured sand (angular shape) reduce shear strength of mixes and reflect premature rutting phenomena on asphalt pavements. In the other words, fine aggregate angularity largely influences particle packing behaviour and ultimately affects stability and mechanical performance of asphalt mixes. In the present scenario, the fine aggregate shape is characterized using two well-known approaches. The first is conventional approach defined by Strategic Highway Research Program (SHRP) in the early nineties. The conventional approach measure fine aggregate angularity (FAA) value as the percentage of air voids present in loosely compacted fine aggregates. The basic underlying principle is that the aggregate with more number of fractured faces will give higher air voids. However, Superpave system defined the minimum requirement of FAA is 45 for the use in high traffic pavements. The second approach uses computer automated Aggregate Image Measurement System (AIMS) to characterize fine aggregate shape. AIMS works on digital image technique and measure fine aggregate angularity in the range of 1 to 10000. In addition, it further classifies the angularity values in different ranges i.e. low or rounded (1 to 2100), moderate (2100-3975), high (3975-5400) and extreme or highly angular (5400-10000). The current study measure and compare angularity of four different sizes, namely FA1 (P2.36-R1.18: passing through 2.36 mm and retaining on 1.18 mm sieve), FA2 (P1.18- 0.600), FA3 (P0.600-R0.300) and FA4 (P0.300-R0.150) of basaltic type fine aggregates using digital image technique and conventional approach. Additionally, an Analysis of variance (ANOVA) statistical approach was used to study the effect of aggregate size on angularity. The result and analysis reveal that both approaches for angularity measurement were provided different ranking among aggregate sizes. Also, it is found that measured angularity from both approaches were showing a negative Pearson's-correlation coefficient (r) = -0.82, indicating strong negative correlation. The indirect measurement and associated higher subjectivity of FAA test method may be a probable cause for negative correlation with digital image

technique approach. It is expected that the findings from the study will add strength to existing research repository. The study may also help over quality control of aggregates. Further, the study will pave the way to adoption of new technologies over conventional practices

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