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Proposed Methodology for Predicting HMA Permeability

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Abstract: Permeability is an important property that influences the performance of hot mix asphalt (HMA) mixes. It is a function of compaction effort, and several properties of HMA constituents such as asphalt content, size of aggregates and shape of aggregates. All these factors manifest themselves in different air void distributions, which in turn control fluid flow and permeability of asphalt mixes. The current practice is to relate measured permeability to the percent in-place air voids of HMA mixes. This paper relates HMA mix permeability to the three dimensional distribution of air voids. An innovative approach is developed to quantify air void connectivity, flow paths irregularity (Tortuosity), effective percent air voids, and specific surface area of air voids. This was made possible through Xray computed tomography to capture the three-dimensional internal structure of HMA mixes and developing imaging techniques to analyze fluid flow paths. The developed methods were used to find the components of a modified expression for the Kozeny-Carman equation to predict HMA permeability depending on air void distribution properties only. The predicted permeability values had reasonable correlation with laboratory measurements. The permeability equation was further simplified to allow predicting permeability based on percent total air voids and aggregate gradation. This simplified equation was shown to have good correlation with laboratory and field measurements of permeability for HMA mixes with a wide range of properties.