Testing for Mechanical Properties of FAM and Its Relation to Asphalt Concrete Mix

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Construction and maintenance of pavements is an expensive and time consuming process; so it is important to study and understand the fundamental properties of materials in order to make the investments worthwhile. Asphalt Concrete (AC) is a complex viscoelastic material, which is a blend of asphalt binder and aggregates at a specific gradation. Investigations at multiple length scales are proving to be an effective approach in better understanding AC so that proper cause and effect relationships can be established. This approach is also useful to understand phenomena like healing, moisture damage and aging, which are highly localized mechanisms.

The current study focuses on Fine Aggregate Matrix (FAM) and AC scales. FAM is a material which is one scale immediately below AC and is a blend of fine aggregate particles, asphalt binder, and filler at a specific gradation. Asphalt and aggregate materials from the Phoenix, Arizona are used to prepare FAM and AC samples in this research work. Laboratory tests on FAM and AC samples were carried out for two binder types to investigate the modulus and damage characteristics. A strong relationship between these two materials is observed, which suggests that tests on FAM can provide much needed insight in understanding the behavior of AC under various conditions. The study also investigates upscaling of the FAM properties to corresponding AC mixture properties using multiple upscaling micro mechanical models. Among several models, the inverse rule of mixtures model showed best upscaling prediction to the AC experimental results. Continuation of this research work will focus on developing numerical analysis based models for AC by utilizing FAM experimental results and its microstructure. The findings from this numerical modeling will be used to compare AC experimental results and draw conclusions. This work may also serves as an important link in identifying sustainable paving materials like warm mix AC, AC including recycled asphalt pavements in high proportion, fiber reinforced AC and other asphalt modifiers.