Florida Department of Transportation Research

Validation and Refinement of Mixture Volumetric Material Properties Identified in Superpave Monitoring Project II – Phase II

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Current Situation

Superpave is a set of methods and materials for asphalt paving and the primary method used by the Florida Department of Transportation. It is well documented that performance of asphalt mixtures is strongly affected by size composition of aggregate, which makes up between 80 and 90 percent by volume of hot asphalt mix. Asphalt mixes that perform well in laboratory rutting tests may not have acceptable cracking performance in the field. The size composition of aggregate presents an opportunity to improve cracking behavior of asphalt pavements.

Cracking is an early step in the decay of a road surface. It leads to spalling and potholing, often requiring repeated repair.

Research Objectives

University of Florida researchers sought to characterize limestone and granite aggregate using analytical methods, focusing on selected parameters, and correlating aggregate characteristics with pavement cracking performance. The goal was to establish criteria for aggregate that would lead to consistently improved cracking performance and longer-life pavements.

Project Activities

Florida limestone and Georgia granite aggregate were mixed with either unmodified or polymer-modified binder. An approach to aggregate size composition, or structure, developed by this research team — Dominant Aggregate Size Ratio-Interstitial Component (DASR-IC) — was used to evaluate the aggregates used in this project.

Superpave IDT tests were conducted at one temperature (10°C) and three different conditioning levels: short-term oven aging (STOA); long-term oven aging (LTOA); and cyclic pore pressure conditioning (CPPC). Test mixtures were designed according to the Superpave Volumetric mix design method, using parameters defined by DASR-IC model. The Energy Ratio (ER) parameter, calculated from fracture energy and creep compliance rate, was primarily used to compare cracking performance of test mixtures subjected to the same level of oxidation and moisture conditioning. Finite element analysis was used to supplement laboratory test results and to better understand the relative effects of aggregate characteristics on stress and strain distribution within the small spaces occupied by aggregate in asphalt pavements.

Project Benefits

A better understanding of the behavior of aggregate, which makes up most of an asphalt pavement, can improve pavement performance, leading to more durable roadways. The potential savings are significant.

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