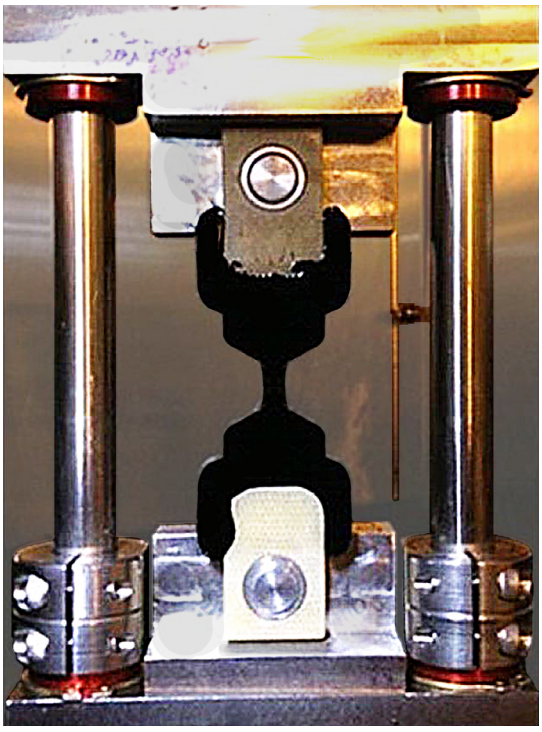
Florida Department of Transportation Research

Evaluation of New Binders Using Newly Developed Fracture Energy Test
BDK75 977-75

The flexibility and cohesion that give asphalt concrete its performance characteristics largely derive from the properties of binders. The durability of binders affects the function and lifetime of paving, and considering how extensive Florida's roadway system is, binder quality has huge economic implications. So, the search for better binders is ongoing; however, a critical aspect of this search is good testing methods — tests which can be conducted in laboratories or test tracks that correlate well with the long-term behavior of binders.

In earlier work, the University of Florida researchers engaged for this project had shown that existing methods of testing asphalt binder, including dynamic shear rheometer (DSR), elastic recovery, and force-ductility, failed to provide parameters that consistently correlated with the relative cracking performance of binder mixtures at intermediate temperatures (0–30 °C). The presence of rubber particles in rubber-modified binder and hybrid binder made DSR and multiple stress creep recovery test results suspect. The researchers developed a new binder test based on binder fracture energy (BFE) analysis.

In this project, the researchers used their newly developed BFE testing method to evaluate a number of alternative polymer-modified asphalt (PMA) binders. The Florida Department of Transportation (FDOT) selected and provided seven types of asphalt binder for the project. The additives used in the seven formulations were intended to create asphalt binders meeting the FDOT's PG 76-22 (PMA) specification with the use of any alternative polymer modifier in lieu of styrene-butadiene rubber (SBS). Specimens were aged in two different ways; AASHTO R 28 (PAV) only and AASHTO T 240 (RTFOT) plus R 28 (PAV). Specimen preparation followed AASHTO T 314-02. All asphalt binders in this project were tested at 15°C using an MTS servo-hydraulic testing machine and a specially built loading head.



Binder sample installed in the test device and ready for fracture testing.

Tests of the seven asphalt binders established a ranking according to fracture energy and produced true stress-strain curves for comparison. BFE test results were consistent and repeatable. As shown in previous work, true stress-strain curves from fracture energy tests were found to be closely related to binder type, specifically, the existence of a second stress peak indicated the presence of polymer in the binder specimen.

In addition to the evaluation of seven binders produced by the project, the testing was used to generate a standard testing protocol by which the BFE test can be economically and consistently applied.

A more accurate method for testing new binder formulations can lead to better and more durable road surfaces, thus adding to the efficiency and safety of roadways and reducing — perhaps significantly — repair and replacement costs.

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For more information, visit http://www.dot.state.fl.us/research-center