# 5-6925-01: Implementation of Improved Performance Grade (PG) Testing of Asphalt Binders

## Background

Given the importance of the quality of asphalt binder in resisting crack growth in asphalt mixtures, there is a critical need for a simple and accurate test method to evaluate the cracking resistance of asphalt binders. This need is underscored with the increasing use of asphalt binder modifiers, additives, and recycled materials. Most current test methods are based on rheological indices and do not induce cracking in asphalt binders. As a part of a previous project, researchers identified the potential for developing and using a simple "poker chip" test to evaluate the cracking resistance of asphalt binders in terms of a ductility parameter derived from this test. The main goal of this study was to validate the ability of this test to screen asphalt binders for cracking susceptibility using a broad spectrum of modified asphalt binders and in-service binders extracted from field sections with known performance.

## What the Researchers Did

Researchers redesigned the test procedure used in the preceding study into a method that was simple, repeatable, sensitive, accurate, and would not require a significant capital investment. Researchers worked with an equipment manufacturer, ADMET, to develop a low-cost loading frame that could be used to conduct this test. This device has a small footprint and does not require any special facilities beyond a 110V power supply. Researchers blended different base asphalt binders with different modifiers (e.g., elastomer, chemical) to demonstrate the sensitivity and repeatability of the method to the type and concentration of modifiers. Researchers identified 22 field sections that were being monitored by Texas Department of Transportation (TxDOT) for another study (Walubita et al., 2017) to validate the ability of the proposed method to predict cracking in the field. Researchers obtained cores from these sections to extract and recover asphalt binder samples. The ductility from the poker chip test as well as other rheological properties were measured in this study.

## What They Found

*Sensitivity to detect modifier type and concentration*

Researchers demonstrated that the proposed test parameter was both sensitive and repeatable in terms of being able to detect the type of polymer as well as the polymer concentration. Elastomeric polymers clearly demonstrated an increase in ductility with increase in concentration. Certain chemical and other polymers did not show any significant improvement in ductility of the binder.

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*Service life prediction*
A comparison of field cracking to ductility indicated that 87% of sections that had a ductility of less than 150% also showed some form of cracking. It must be emphasized that these 22 sections were in very different climatic regions in the state of Texas and varied in terms of mixture gradation, binder content, traffic volume, surface layer thickness, and overall asphalt thickness. These results strongly support the ability of this test method to serve as a cracking indicator for an asphalt binder.

## What This Means

The project's findings yielded the following benefits:

1. The study developed a simple and unique method to measure the tensile strength and ductility of asphalt binder in a state of stress that is representative of an asphalt mixture. The method requires a very simple loading frame with small footprint and entails a sample preparation and testing procedure that is not only repeatable but also easy to perform (Fig. 1).

2. Results from this study clearly show the impact of different modifier types, concentrations, and aging on the ductility of the asphalt binder and provide tentative limits to use this measurement for quality control, screening, and health monitoring purposes.

3. The poker chip test and proposed specification limits can be used in several different ways to avoid premature cracking failure due to asphalt binders, saving millions in repair and maintenance costs. These include their uses as tools to: screen binders based on ductility that may otherwise pass current PG requirements, assess the quality of reclaimed asphalt pavement (RAP) stockpiles with respect to the asphalt binder contributed, assess the health condition of binders in in-service pavements, design binder blends to maximize the use of RAP and rejuvenators without compromising on long-term performance, and evaluate the use of new modifier technologies on the cracking resistance of asphalt binders.

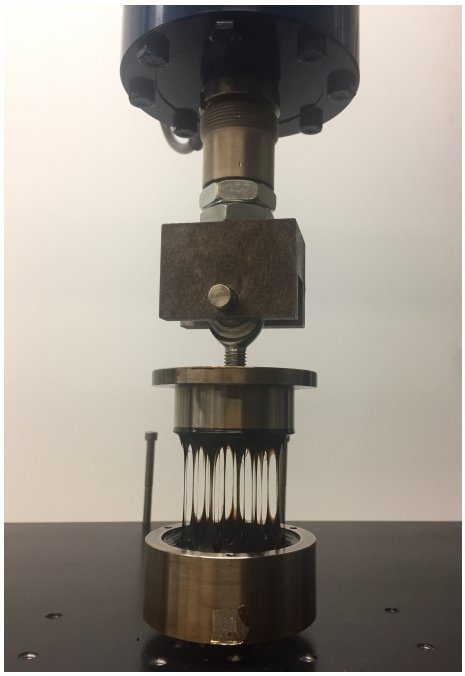

**Figure 1.** Test specimen at the end of a poker chip test, a simple and accurate way to assess asphalt binder ductility in a realistic stress state.


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