Skysong Innovations
Advancing the Arizona State University Knowledge Enterprise

1475 N. Scottsdale Road, Suite 200
Scottsdale, AZ 85287-3538
Phone: 480 884 1996 Fax: 480 884 1984

Case ID:M20-114P^
Published: 11/19/2020

Inventors

Elham Fini

Daniel Oldham

Contact

Shen Yan
shen.yan@skysonginnovations.com

Moisture-Induced Shear Thinning Index (MISTI) to Assess Effects of Water on Bitumen

Background

According to a survey conducted by the Colorado Department of Transportation, 42 out of 50 state department of transportation agencies reported that moisture damage is an issue for asphalt pavement performance (Aschenbrener, 2002). With regard to current means of testing for moisture damage, the survey found that laboratory tests give mixed results and do not adequately assure satisfactory field performance. A breakout session of 30+ experts in the asphalt pavement industry further revealed that current moisture damage tests do not actually measure fundamental material properties (Berger et al., 2003). Therefore, there is a need for a testing method that directly measures fundamental material properties to accurately indicate bitumen susceptibility to moisture. This would provide road authorities and asphalt contractors with improved data quality to aid in the management of resources and risk.

Invention Description

Researchers at Arizona State University have developed a bitumen testing method, known as the Moisture-Induced Shear Thinning Index (MISTI), that provides fundamental measurements to detect moisture susceptibility in bitumen prior to use in roadway construction. Existing moisture tests are not able to reliably predict field performance degradation from moisture damage, due in large part to a lack of focus on the damage mechanism itself. Because current tests typically measure single values that are influenced by multiple mechanisms, results risk misinterpretation. For instance, water damage is often accompanied by stiffening in the bitumen matrix due to simultaneous oxidation and water diffusion; hence, a stiffness measurement does not allow the two processes to be independently analyzed. MISTI, on the other hand, removes ambiguity by targeting one damage mechanism with one indicator—the extent of change in interactions between inclusions (glass beads) and the matrix (bitumen). The test is based on a fundamental material property, uses much less material, and is more accurate than existing options. MISTI would therefore provide both state agencies and contractors with a more consistent means of testing for moisture susceptibility, which helps prevent costly mischaracterization of bitumen in highway construction. Additionally, MISTI can serve as a design tool for verifying moisture resistance of new targeted modifiers.

Potential Applications

- Asphalt testing
- Filler-matrix testing
- Pavement design

Benefits and Advantages

- Easy to perform with minimal material
- Accurate
- Isolates the precise physical mechanism of interest
- Versatile application can be extended to other filler-matrix pairs common in the polymer, composites, and construction industries

Faculty Profile of Professor Elham H. Fini