

A Rational New Method of Moisture Sensitivity Testing

Moisture damage in asphalt pavements is a major concern for the asphalt industry. A quick, reliable and rational method for testing moisture damage susceptibility of mixtures will provide engineers and contractors the capability of testing each mixture, before, during and after lay down of HMA pavements. The MIST, Moisture Induced Sensitivity Tester, from InstroTek is designed to simulate the stripping mechanisms that occur in HMA pavement layers. This test is designed to simulate moisture damage that occurs due to water, repeated traffic loading and elevated in place temperatures. The test can be conducted on compacted laboratory and field samples.

The common term used for moisture damage in asphalt pavements is “stripping” or “raveling”. Stripping is a complex distress mechanism that can simply be defined as a loss of bond between aggregate and asphalt binder. Stripping generally takes place when moisture penetrates the pavement and causes the bond between the aggregate and binder to weaken. Stripping results in the reduction of pavement shear strength and could lead to rutting, fatigue cracking and bleeding of the binder to the pavement surface, which could reduce pavement’s skid resistance

The test method routinely used for moisture damage testing is the American Association of State Highway Transportation Officials (AASHTO) T-283. This test is performed during the mix design process and involves water saturating compacted hot mix asphalt (HMA) samples to between 55 to 80 percent, using a vacuum pump. The saturated samples are conditioned under freeze/thaw cycles for approximately 24 hours and then placed in a breaking machine such as the Pine Instrument Marshall Breaking Head to determine the tensile strength of the conditioned samples. The tensile strength for the conditioned samples is compared to unconditioned tensile strengths for the same mixture. A minimum tensile strength ratio (TSR) of 75 to 80 percent is generally specified by state agencies as the passing limit for a mixture.

Test method T-283 has several major problems and disadvantages. First, the testing time can be 24 or more hours, which is not conducive to production quality control and assurance testing. As mixture components change due to production variability, it is difficult to predict moisture susceptibility of the mix on a timely basis. Second, lack of tight control on the water saturation can result in wide variability in TSR results. Third, the test method was developed and fine tuned using 4” diameter Marshall designed samples. Superpave design requires 6” diameter samples, which could result in higher TSR values than 4” samples. Finally, T-283 does not replicate the dynamics of pressures and scouring encountered in the field with repeated pore pressure created by vehicle tire passing over a wet pavement.

A vehicle tire passing over a wet pavement will repeatedly push water into the pavement as it passes over any point on the surface of the pavement and will pull water out of the same point as the tire lifts off the surface. This action creates pore pressure and scouring within the pavement, which is known to cause stripping in pavement layers. The MIST from InstroTek is designed to simulate this stripping mechanism and to provide a rational

method for testing moisture susceptibility of HMA mixtures in approximately 3 hours by generating repeated pore pressure in a compacted asphalt sample.

The MIST is a self contained unit that operates at 120 volts AC. The device includes a hydraulic pump and piston mechanism that is designed to cyclically add and relieve pressure inside the sample chamber. The tests involves placing a 4 inch or 6 inch diameter sample of 1 to 6" thickness inside the sample chamber, filling the chamber with water, closing the sample chamber lid and starting the test. The machine will automatically heat the sample to 60°C and will start cycling between zero and 40 psi of pressure. The entire cyclic conditioning process takes approximately 3 hours, which allows asphalt practitioners to evaluate the mixture for susceptibility to moisture on an ongoing basis and to ensure that quality pavements are been constructed.

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