



BITUMINOUS MIXTURES LABORATORY FACT SHEET

Research that is Essential, Indispensable, and Connected to our Customers.

PURPOSE

The Bituminous Mixtures Laboratory (Mix Lab) develops and improves bituminous mixture design technology and performance-based tests, and evaluates aggregates, binders, additives, and new materials. The laboratory also provides the Federal Highway Administration (FHWA) and its customers with an unbiased evaluation of mixtures and test procedures.

DESCRIPTION

The Mix Lab specializes in research on asphalt pavement mixtures, which consist of asphalt binder and specially sized stone. The lab's activities are aimed at extending the life and improving the performance of asphalt pavements, reducing vehicle wear-and-tear, and shortening construction delays.

The Mix Lab's advanced technology allows researchers to anticipate potential long-term pavement damage and to optimize asphalt mixtures for specific highway applications. The laboratory has the capability to perform mixture designs and to conduct accelerated performance testing.

SPECIAL CAPABILITIES

This laboratory tests mixtures for density, stability, resilient modulus, and compressive, tensile, shear, and flexure strength. Repeated load and wheel-tracking tests that simulate highway traffic can be applied to mixtures to estimate their susceptibility to rutting and fatigue cracking.

MAJOR COMPONENTS

The Mix Lab staff researchers are actively conducting studies and evaluations using the following resources:

Superpave Equipment

- **Superpave Gyrotory Compactor (SGC)** simulates the kneading action of rollers used to compact asphalt pavements by applying a vertical load to a sample of hot asphalt mixture in a mold while gyrating the mold, which is tilted at a specified angle.
- **Superpave Shear Tester (SST)** is used to evaluate the permanent deformation (rutting) and fatigue cracking susceptibility of asphalt mixtures.
- **Indirect Tensile Test (IDT)** evaluates the low-temperature cracking susceptibility of asphalt mixtures.
- **Beam Fatigue Fixture** flexes a beam of asphalt mixture to determine its susceptibility to fatigue cracking.

Wheel-Tracking Tests

- **Laboratoires Central des Ponts et Chaussées (LCPC) Pavement rutting Tester** measures the rutting susceptibility of asphalt paving mixtures using a reciprocating pneumatic rubber tire.
- **Georgia Loaded-Wheel Tester** measures the rutting susceptibility of asphalt paving mixtures by rolling a steel wheel across a pressurized hose positioned on top of a beam specimen.

- **Hamburg Wheel-Tracking Device** measures the rutting and moisture susceptibility of an asphalt paving mixture by rolling a steel wheel across the surface of an asphalt concrete slab immersed in hot water.

Other Mechanical Mixture Tests

- **MTS® Servohydraulic Testing System** is an all-purpose testing system used to perform strength, creep, tri-axial, stress relaxations and repeated load tests at controlled temperatures. It is capable of performing the complex modulus test (E*) and the Simple Performance Test (SPT).
- **Thermal Stress Restrained Specimen Test (TSRST)** evaluates the low-temperature cracking susceptibility of asphalt paving mixtures.
- **Engineers Gyrotory Testing Machine (GTM)** is a combined compactor and shear strength tester for soils, unbound aggregates, and asphalt mixtures.
- **Marshall and Hveem Mixture Design Equipment** consists of the equipment needed for Marshall and Hveem mixture designs, including the Marshall hammer, Marshall stability tester, and Hveem stabilometer.

Compactors

- **Linear Kneading Compactor** used to compact asphalt mixtures into slabs needed for various asphalt mixture tests, including the three wheel-tracking tests.

The Turner-Fairbank Highway Research Center (TFHRC) has more than 24 laboratories for research in the following areas: safety; operations, including intelligent transportation systems; materials technology; pavements; structures; and human centered systems. The expertise of TFHRC

scientists and engineers covers more than 20 transportation-related disciplines. These laboratories are a vital resource for advancing this body of knowledge created and nurtured by our researchers. The Federal Highway Administration's Office of Research, Development, and Technology

operates and manages TFHRC to conduct innovative research to provide solutions to transportation problems both nationwide and internationally. TFHRC is located in McLean, Virginia. Information on TFHRC is available on the Web at www.tfhrc.gov.

- **French LCPC Plate Compactor** uses a reciprocating rubber tire to compact asphalt mixtures into slabs needed for various asphalt mixture tests.
- **California Kneading Compactor** is used to fabricate cylindrical and beam specimens.

Other Equipment

- **French Thermo-Regulated Mixer, Laser Particle Size Analyzer, CoreLok™, and SSDetect™.**

PRODUCTS

- **Dynamic Angle Validation (DAV) Kit** – DAV was developed by the FHWA Office of Infrastructure R&D in partnership with the Test Quip Company. DAV measures the internal angle of gyration provided by the SGC.
- **Non-destructive, Non-nuclear Density Measurements** – Completed a detailed evaluation of promising devices, which led to enhanced product development and State Department of Transportation (DOT) field trial studies.

CURRENT ACTIVITIES

- **Validation of Tests That Measure Rutting and Fatigue Cracking Susceptibility** – FHWA is validating Superpave asphalt binder tests and specifications, Superpave mixture tests and performance models, and other laboratory tests used to predict the performance of asphalt mixtures.
- **Understanding the Performance of Modified Asphalt Binders in Mixtures** – The objective of this study is to determine if asphalt binder performance is correctly captured by the Superpave asphalt binder specification developed under the 1987 to 1993 Strategic Highway Research Program (SHRP) and post-SHRP modifications.
- **Simple Performance Test (SPT)** – The Mix Lab is currently evaluating the SPT, which was recently developed to measure rutting and fatigue cracking resistance.

FUTURE ACTIVITIES

- **Full-Scale Performance Testing for Superpave and Structural Validation** – Mixtures with polymer-modified asphalt binders will be evaluated to assist the highway community in finalizing the Superpave system for asphalt mixture design and analysis.

EXPERTISE

The staff consists of civil and chemical engineers and asphalt paving technologists. Laboratory Manager: Kevin Stuart
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LAB PARTNERS

The Mix Lab works closely with the Transportation Research Board (TRB) and the National Cooperative Highway Research Program (NCHRP). In addition to research studies, forensic analyses of specific, and often unique, pavement performance problems have been performed for several State DOT's, including Colorado, Illinois, Maryland, Massachusetts, North Carolina, and Texas. To implement the DAV Kit, the Mix Lab is working with the TRB Superpave Mixture and Aggregate Expert Task Group (ETG). The ETG is currently overseeing the project. The laboratory also supported various States including Colorado, Georgia, Maryland and Missouri, in designing and analyzing Stone Matrix Asphalts (SMA).