

UW-Madison ARC Research Activities

The University of Wisconsin leads research activities for the Asphalt Research Consortium across all of the consortium's major work areas. UW's specific research plans are highlighted below.

Engineered Materials

The UW team plays a lead role in the ARC in the area of engineering materials. Research is centered around the main topics of enhanced performance and resource conservation.

Engineering asphalt binders can reduce the risk of pavement failures due to traffic and climate.

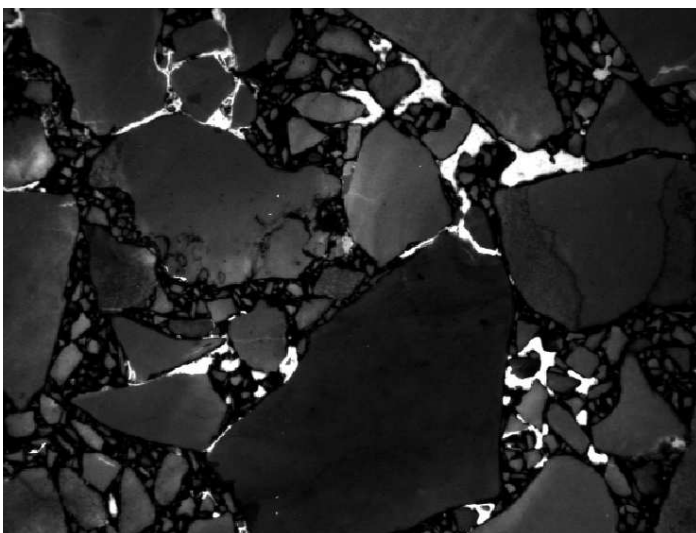
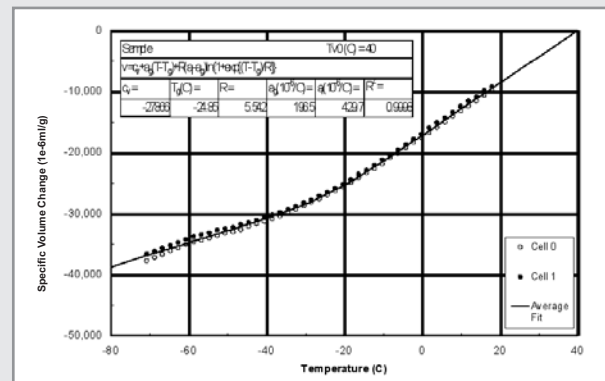
The team will focus on improved methods to characterize binder resistance to rutting using nonlinear viscoelasticity and binder damage resistance characterization. In addition, the team will develop improved methods to quantify thermo-volumetric properties to improve resistance to thermal cracking. The methods will advance knowledge of how to select modifiers to improve binder damage resistance under realistic field conditions.

Engineering asphalts can conserve resources by reducing energy needed for construction and by increasing reuse of recycled materials.

The team has developed detailed plans to advance understanding of warm mix and cold mix additives. The team will also join other ARC partners to develop improved methods to characterize binders in recycled asphalt pavements and to estimate the binder grade changes needed when high percentages of RAP are used in mix designs.



Measuring thermo-volumetric properties of modified binders, such as specific volume versus temperature, can explain how engineered modified asphalts could reduce thermal cracking.



Imaging is an essential tool to estimate and control the micromechanics of asphalt mixtures and the interaction of rocks, binders and air voids.

Fatigue Damage

In the area of fatigue, the UW team will seek to develop a reliable test to explain the role of binders in the fatigue of mixtures and pavements. Building on work it has pioneered since 2000, the team has a major goal to find a surrogate test using current dynamic shear rheometers. Beyond developing this test methodology, another major goal is understanding how modifiers can improve the fatigue life of binders. The team has a comprehensive plan to test various fatigue models for asphalts. It will select those models that can be implemented effectively to provide better fatigue life of pavements under various simulated conditions of traffic, climate and pavement structures.

Moisture Damage



Modifying the dynamic shear rheometer to measure cohesion and adhesion of asphalt–aggregate systems is essential for understanding moisture damage and reducing the risk of pavement failures due to moisture effects.

As its main goal in the area of moisture damage, the UW team identified the need to develop simple and reliable methods to measure cohesion and adhesion of asphalt binders. Using the pneumatic pull-off test and the dynamic shear rheometer test as its main techniques, the team will build on previous work to redesign hardware and develop testing protocols that can directly and effectively measure bond strength of binders to mineral surfaces. The protocols will provide a clear distinction between adhesive bond strength and cohesive strength of binders. The protocols will also

address such variables as temperature, rate of loading and environmental conditioning to reliably simulate moisture conditions and pavement material properties in the field.

Once developed, these protocols will be used to model the effects of factors that affect moisture damage, including modification, chemistry and age of various binders. Collected data will be used to verify the role of surface energy—as investigated by other ARC partners—and to develop next-generation binder and mixture specifications.

Tire-Pavement Interaction

While asphalt mixture design is well advanced for improved performance, traffic loading and climatic effects, there remains a need to focus on both skid resistance for safety and on noise mitigation. Using the concept of functional design, the UW team has begun work to control macro-texture and to improve noise absorption and reduction. Since methods to measure these properties in the lab are still emerging, part of the UW team’s plan is to test and assess promising testing technologies. This will support the team’s goal to recommend specific protocols to estimate skid and noise absorption from aggregate gradations and mixture compositions.

Validation

The UW team’s main contribution in the area of validation will be its ongoing assessment of binder specifications. The team will focus on identifying gaps in the binder specifications for “Superpave plus” systems, particularly with regard to modified asphalts. The team plans on challenging the use of historical index tests, such as elastic recovery and forced ductility, by using continuous scientific data both to assess the accuracy of these methods and to develop improved solutions to address gaps in the binder specifications.