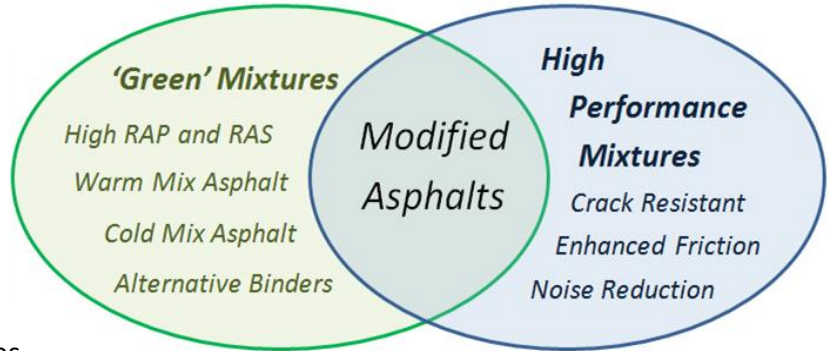




Introduction

This first research bulletin serves as a brief introduction to some of the more salient and timely developments and research findings at the Modified Asphalt Research Center (MARC) from the center's inception in 2008 to present. Detailed information on the technologies and practices described in this bulletin are available to all MARC partners upon request.

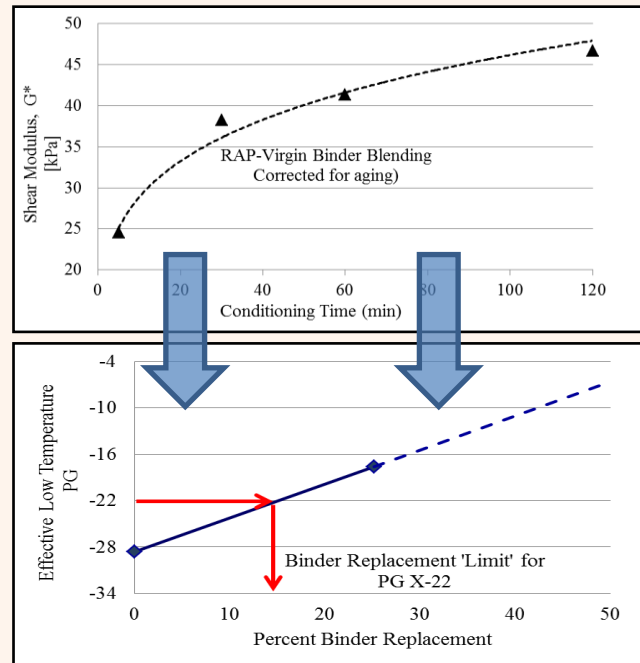


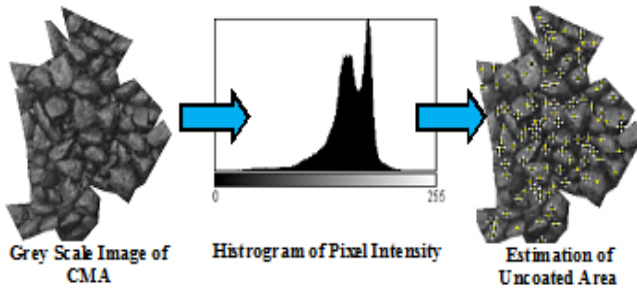
Warm Mix Asphalt

Recognizing a need for more comprehensive binder characterization methods for warm mix modified binders, MARC researchers developed the Asphalt Lubricity Test as an alternative test method for quantifying the role of warm mix modifiers on the workability of asphalt mixtures. The test measures the binder's internal frictional resistance against shearing as an indicator of field workability and has shown good correlation with mixture testing.¹

Estimating Binder Properties in RAP and RAS

A RAP and RAS binder characterization procedure developed by MARC provides reasonable estimations of the blending that occurs between fresh and recycled binders in field mixtures and the subsequent implications for mixture performance. Better performance prediction of high-RAP and RAS mixtures allows mix designers to optimize the amounts of RAP and RAS in new mixtures while maintaining serviceability.²



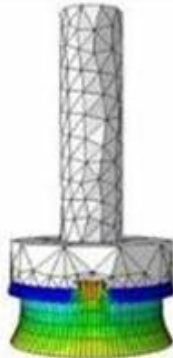
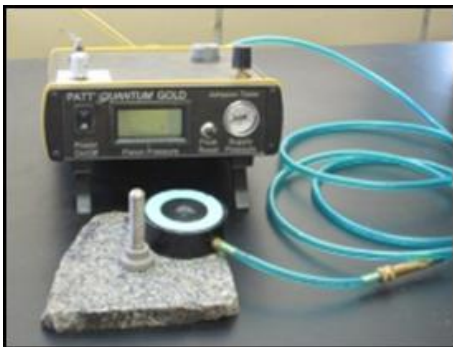


Emulsified Asphalts

The MARC research team has a significant role in the NCHRP 9-50 project, which will result in a performance related specification framework for asphalt emulsions. In addition, the MARC team has developed objective imaging methods to quantify aggregate coating in Cold Mix Asphalt, resulting in better prediction of the potential moisture susceptibility of these mixtures.³

Measuring Binder Fracture in a Modified BBR

Advancements in characterizing binder thermal cracking resistance have been made by the MARC team using the BBR-SENB test. The SENB-BBR test is a fracture-based modification of the standard BBR test conducted at low temperatures. Recent efforts have focused on using the BBR-SENB test to construct a thermal cracking master curve.⁴



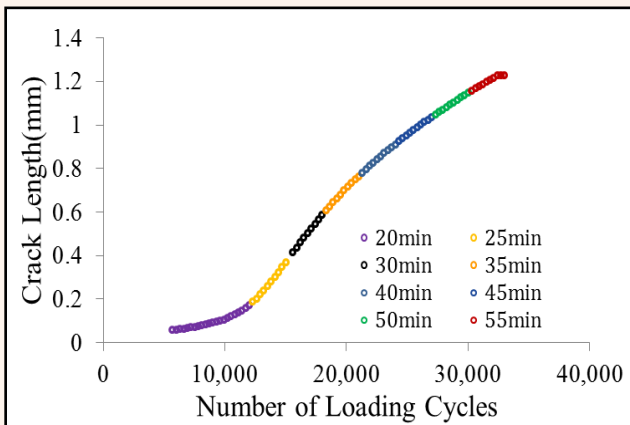
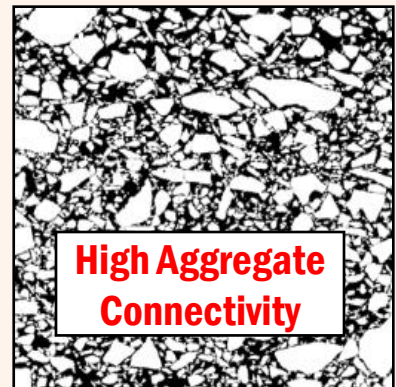
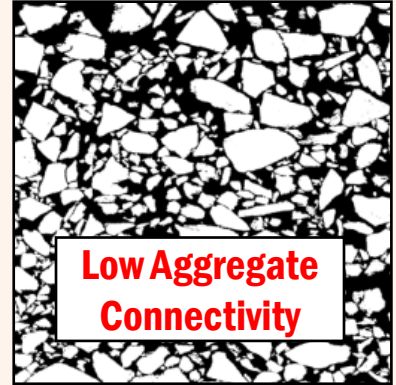
Bond Strength Assessment

The Binder Bond Strength (BBS) test developed and refined by MARC researchers measures the pull-off tensile strength of a thin film of asphalt binder bonded to an aggregate substrate. The BBS test has shown utility in evaluating moisture damage susceptibility, stripping potential of aggregate materials, bond strength of binder-aggregate systems, and emulsion curing characteristics. A standard developed by MARC has been approved by AASHTO (TP091-11-UL).⁵

Effect of Compaction Temperature on Aggregate Packing

MARC researchers played an integral role in developing and refining the Image Processing and Analysis System (iPas) software, currently in its second version. The iPas software has been successfully used to characterize the internal structure of asphalt mixtures, leading to a greater understanding of the mechanisms governing mixture compaction and performance.⁶

MARC has also used multi-scale modeling techniques to refine existing binder test methods, such as the Multiple Stress Creep and Recovery (MSCR) test. Recent work has provided insight into the most appropriate stress levels to be used during the test. In addition, these models are used to obtain realistic stress and strain distributions in asphalt mixtures to better understand the role of binders and mastics in mixture performance.⁷



Fatigue Cracking Resistance

Significant progress has been made in recent years characterizing asphalt binder fatigue by means of the Dynamic Shear Rheometer (DSR)-based Linear Amplitude Sweep Test. Recent interpretation of the LAS test using image analysis and fracture mechanics shows promise in creating a ‘fatigue cracking resistance master curve’ capable of predicting fatigue resistance at commonly encountered field conditions (i.e., temperature and loading rate). The LAS standard developed by MARC has been recently approved by AASHTO (TP101-12-UL).⁸

MARC Modular Training Courses

The MARC group has also conducted several modular training courses, or ‘short-courses’, on pertinent test methods, analysis techniques, design procedures, and utilization of test results for industry leaders and government officials. MARC researchers have conducted these training courses in South America, Asia, Europe, the Middle East, and the United States with success.

In the last 6 months MARC has offered training programs and seminars in Colombia, Chile, India and Sri Lanka.

Recent Projects and Events

During the last 6 months MARC

- Co-hosted ‘Recycle WISCONSIN: 2012’ with Liberty Tire Recycling, (August 2012).
- Completed contract obligations for Transportation Pooled Fund Project on Low Temperature Cracking (July 2012).
- Was awarded WHRP research project on development of modification guidelines for state of Wisconsin (April 2012).
- Was awarded 21 month Extension for the Asphalt Research Consortium contract (February 2012).

Current MARC Partners and Affiliations



Publications

MARC researchers have published over 30 refereed journal articles and many other publications in international and national conference proceedings. The following list illustrates the broad range of topics covered recently in MARC publications. For more information please see the “contact” section.

1. Hanz, et al., *In Journal of the Association of Asphalt Paving Technologists.*
2. Swiertz, et al., *In Transportation Research Record: Journal of the Transportation Research Board.*
3. Hanz, et al., *In Transportation Research Record: Journal of the Transportation Research Board.*
4. Velasquez, et al., *In Journal of the Association of Asphalt Paving Technologists.*
5. Moraes, et al., *In Transportation Research Record: Journal of the Transportation Research Board.*
6. Roohi, et al., *In Journal of the Association of Asphalt Paving Technologists.*
7. Arshadi, et al., *In Journal of the Association of Asphalt Paving Technologists.*
8. Hintz, et al., *In Journal of the Association of Asphalt Paving Technologists.*

Contact:

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