

***Binder Characterization for the M-E Design Guide  
and for MP1a Specifications:***  
*A Proposal from the North Central Superpave Center  
to the NCSC Steering Committee*

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The long-awaited Mechanistic-Empirical Design Guide is now available for review and evaluation. The guide offers new models and algorithms for use in mechanistic-empirical pavement design. One component of the guide is the Witczak model for HMA modulus. An alternate model, the Hirsch model, can also be used to estimate the modulus value. Both models require determination of binder properties and development of master curves over a range of temperatures.

In 2001, AASHTO adopted a revision of the Performance Graded binder specification that uses a different method of characterizing binder behavior at low temperatures. The MP1a specification involves using the Bending Beam Rheometer (BBR) and Direct Tension (DT) test together to determine a critical cracking temperature. This also involves generation of a master curve. Few states have moved to the MP1a specifications to date; some are evaluating it and others are taking a wait and see approach.

Master curve development requires some involved and fairly sophisticated mathematics. For this reason, specialized computer software is employed to facilitate the development of these curves.

Some states have the capabilities to characterize binders in the laboratory and develop master curves, but others do not. While most states have a significant amount of experience running the BBR and the Dynamic Shear Rheometer (DSR), few in the region have spent much time using the Direct Tension (DT) device. States may not have the staffing and resources to devote a significant amount of time to this type of effort. Other states have not utilized the equipment to a great extent and therefore have not developed the required expertise to reliably measure the binder properties. Testing for the M-E design guide can be facilitated by using a programmable DSR to conduct the testing over a range of temperatures; not all states have this type of equipment.

The North Central Superpave Center has (or has access to) the necessary equipment to conduct the binder tests needed for both the M-E guide and the MP1a specifications. The NCSC has also invested in the necessary computer software for generating master curves. In addition, the NCSC staff has extensive experience in binder characterization using the DSR, BBR and Direct Tension test. For example, when the NCSC participated in the DT ruggedness experiment, the laboratory staff completed over 600 tests for that effort alone. The NCSC has also used the DT to characterize binders for several research projects.

The NCSC lab, staff and computer resources stand ready to assist states in the region with binder characterization for the M-E Design Guide or evaluation of the MP1a

specifications. Binder characterization for both applications requires the development of a master curve based on laboratory binder tests. The NCSC can assist either by providing the laboratory testing and analysis or can develop the master curves using binder test results provided by the states.

The NCSC will develop master curves from provided test results for participating states at *no cost*. Typically, results can be returned within one week, barring any scheduling conflicts.

The NCSC will provide full binder characterization for either MP1a or the M-E guide for up to five binders for each participating state at *no cost* as well. If additional characterizations are desired, a cost estimate can be prepared upon request, taking into account the desired number and types of tests. No overhead charges will be applied to the cost of this testing for those states that participate in the base funding pooled fund. The time required will also vary depending on the number of tests and current testing schedule. In general, binder characterization and analysis would likely take about two weeks.

The NCSC is pleased to offer this service to our participating states. Similar services can also be provided to states outside the region or to industry, however overhead charges would apply, no free testing or analysis would be offered and regional work would take priority over outside testing and analysis.