Modified Binders and Superpave Plus Specifications

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The Superpave performance graded binder specification (AASHTO MP1) is the predominant method used to specify asphalt binders for highway use in the United States today. The Superpave binder specification is a performance related specification based on the rheological properties of the binder, and the climate and loading conditions of the pavement where it is to be placed.

The Superpave binder specification uses various tests performed at multiple temperatures to characterize the asphalt binder. The relationship to performance, for these tests, has been validated in numerous studies. However, the current Superpave binder specification does not appear to adequately determine the performance characteristics of modified binders. Because of this, many highway agencies have included additional tests to the existing Superpave binder specification to assure a desired modifier is included in the binder. The problem that arises from the use of these Superpave plus tests is that they do not relate to performance, but only indicate the presence of a particular modifier in the binder. Before an agency uses Superpave plus specifications, the implication of their use should be considered very carefully.

Polymer modification, which is the most commonly used system (besides oxidation) to change the properties of asphalt binders, can increase the cost of the binder anywhere from 30% to 100%. This increase can make a significant impact on the cost of the hot mix asphalt (HMA), typically raising the price 10% to 40%. Because of the large increase in cost, it is critical that the use of polymer modified asphalt be evaluated to determine its cost effectiveness.

Many tests have been used for Superpave plus specification to determine if a particular polymer is present in the binder. These tests include elastic recovery, toughness and tenacity, force ductility, and many others. Most of these tests only indicate if a polymer modifier is present. The tests do not indicate the formulation or the performance of the binder. These tests can force suppliers to follow processes that can increase cost with little to no increase in performance.

There is no question that polymer modification can improve the performance properties of an asphalt binder. At the Federal Highway Administrations Accelerated Load Facility, polymer modified binders far exceeded their expected performance.

Before an agency requires a modified binder, they should perform a detailed evaluation to assure it is truly warranted. Common sense and performance history should be used in

conjunction with Superpave binder selection procedures for HMA applications. Many straight run, or neat, binders have performed very well under normal traffic conditions. In Mississippi on I –55, a test section placed using a straight run PG 64-22 exhibited only 3 millimeters of rutting after being loaded with 2.4 million ESAL's in two years time. The standard grade for most of the New England states is a PG 64-28, which is used in most paving applications. The Southeastern US typically uses a PG 67-22, which matches up well with the AC 30, which had been used successfully for years in the region. The typical paving grade for most highway agencies is still a straight run asphalt binder.

Modified asphalt binders are typically used in high stress applications. They have been used in intersections with stop-and-go traffic, high volume truck routes, and high volume interstates. Modifiers have also been used in extreme climate conditions to reduce aging in desert climates and to help produce binders for extreme low temperature applications such as –34 and –40 areas. Used in the proper way and in the right place, modified binders can be a very cost-effective way to minimize pavement distress.

There is currently a great deal of work underway to improve the ability of the Superpave binder specification to identify the performance properties of modified binders. The combination of the bending beam rheometer test results with the direct tension test results to identify the low temperature critical cracking grade is just one example where the specification has been made blind to modification. The NCHRP 9-10 research has identified several promising criteria for both high temperature and fatigue properties of the binder. Work on developing new specification criteria for these aspects of the asphalt binder is being done through task groups of the Transportation Research Board's Superpave Binder Expert Task Group (ETG). In the near future, new specification parameters should be available for inclusion in Superpave.

The Superpave binder specification has provided the industry with tremendous improvement in the way we specify asphalt binders. The new testing equipment provides much more information than in the past about the physical properties of the binders. The system is not perfect. There are many gaps in our knowledge about the performance characteristics of binders. However, we are closing those gaps. In the near future we will have the answers to many of the questions about the performance characteristics of binders. Until that time, the highway agencies will have to use engineering judgment in specifying modified asphalt binders.

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