



Washington State  
Department of Transportation

# CONSTRUCTION BULLETIN

State Construction Office  
Engineering and Regional Operations

## **New Asphalt Binder Test & Specification: Multiple Stress Creep Recovery (MSCR)**

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### **Purpose**

This Construction Bulletin provides information regarding the new Multiple Stress Creep Recovery (MSCR) test and specification for Performance Graded (PG) asphalt binders used in production of Hot Mix Asphalt (HMA).

### **Summary**

The MSCR test provides a major improvement in our ability to specify performance-related asphalt binders for highway materials, successfully identifies chemically modified asphalt binders, and eliminates the need to run other time consuming, less discriminating test procedures. The new MSCR specification will be implemented by WSDOT in January of 2018 and includes a major improvement in how grade bumping is done to accommodate increased traffic and loading.

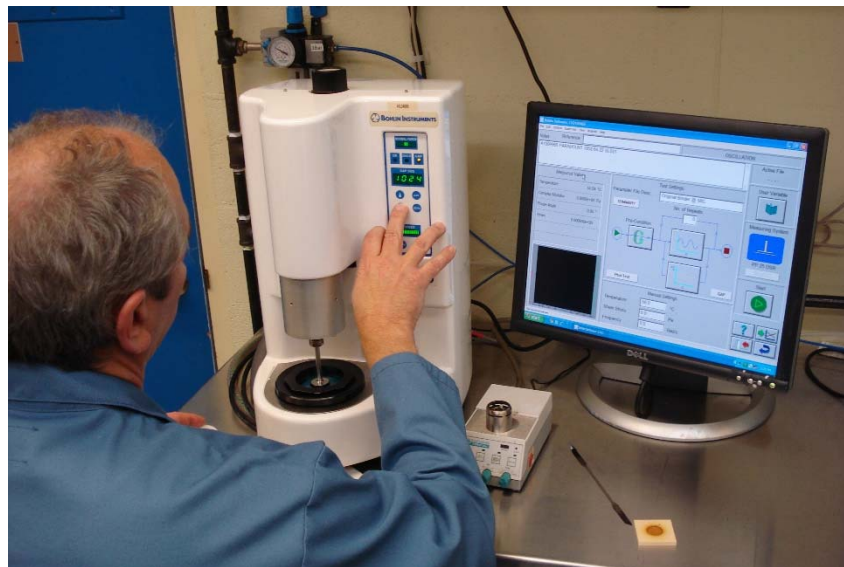
### **Background**

In 1993, the Performance Graded (PG) asphalt binder specifications were introduced as part of the Strategic Highway Research Program (SHRP). The PG specifications were eventually adopted by the American Association of State and Highway Transportation Officials (AASHTO) and formally implemented by WSDOT in 1999.

The PG asphalt binders are designed for the pavement service temperature where they are to be used and are identified by two different temperatures (in six degree increments). The first number is the average seven-day maximum pavement design temperature in Celsius (°C) and the second is the minimum pavement design temperature °C. For example, a PG 58-22 is designed to be used where the pavement high temperature will not exceed 58°C and the pavement low temperature will not exceed minus 22°C.

While the PG specifications provided a number of tools to address performance of asphalt binders used in production of Hot Mix Asphalt (HMA) pavements there are some shortcomings. The PG binder specifications were developed based on studies of unmodified binders, or what is referred to as "Neat" asphalt binders, but did not account for high traffic volumes and slow speed loading which can cause rutting in the pavement. Rather than change the specifications or test procedure, the researchers opted to elevate or bump the test temperature and require the same stiffness in the binder to reduce the risk

of rutting from increased traffic and loading. For example, if the temperature requirements for a location required a PG58-22 asphalt binder, but the location had high traffic volumes there would be an initial grade bump to a PG64-22 and if the location also had slow speed loading there would be a second grade bump to a PG70-22. This bumping process resulted in the asphalt binder being tested at elevated temperatures that they would not see in service and allowed asphalt producers to utilize various modification processes to stiffen the asphalt binders that could negatively affect the in service life of the pavement.



Dynamic Shear Rheometer (DSR)

### **The New Process**

The Dynamic Shear Rheometer (DSR) is used to run the Multiple Stress Creep Recovery (MSCR) test. In the MSCR test higher levels of stress and strain are applied to the binder which better represents what occurs in an actual pavement under traffic. By using the higher levels of stress and strain the MSCR test captures both the stiffening effects of the modified binder and the delayed elastic effects (where the binder behaves like a rubber band). The MSCR test successfully identifies chemically modified asphalt binders and can also be used to evaluate the presence of polymer modification in the binder while eliminating the need to run other time consuming, less discriminating test procedures.

The new MSCR specification includes a major change to the current PG specification in how grade bumping is done to accommodate increased traffic and loading. The initial or base grade MSCR binder is denoted by placing a S for "Standard" traffic loading just after the maximum pavement design temperature e.g., PG58S-22. Then if the location had high traffic volumes there would be an initial grade bump to a PG58H-22 for "Heavy" traffic loading and if the location also had slow speed loading there would be a second grade bump to a PG58V-22 for "Very Heavy" traffic loading. This results in the

asphalt binder testing being performed at the temperature that the pavement is expected to experience in the roadway. The table below shows the current performance grades used by WSDOT compared with the new MSCR performance grades, including the bumping for traffic and loading.

Asphalt Binder Performance Grades	
<ul style="list-style-type: none"> <li>• Current Performance Grades               <ul style="list-style-type: none"> <li>○ PG58-22 (Base Grade)</li> <li>○ PG64-22 (Bumped Once)</li> <li>○ PG70-22 (Bumped Twice)</li> <li>○ PG64-28 (Base Grade)</li> <li>○ PG70-28 (Bumped Once)</li> <li>○ PG76-28 (Bumped Twice)</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>• MSCR Performance Grades               <ul style="list-style-type: none"> <li>○ PG58S-22 (Base Grade)</li> <li>○ PG58H-22 (Bumped Once)</li> <li>○ PG58V-22 (Bumped Twice)</li> <li>○ PG64S-28 (Base Grade)</li> <li>○ PG64H-28 (Bumped Once)</li> <li>○ PG64V-28 (Bumped Twice)</li> </ul> </li> </ul>

The -22 grades are used across Western WA while the -28 grades are used across Eastern WA

**Additional Information**

The State Materials Laboratory has been working with asphalt binder users and producers to advance the implementation of the MSCR procedure and specifications by member states of the Pacific Coast Conference on Asphalt Specifications (PCCAS). The State Materials Laboratory has also formed a multi-state task group with FHWA Western Federal Lands which includes Idaho, Montana, Nevada, California and Oregon designed to get all member states familiar and proficient in running the MSCR test procedure and further advance the implementation of the new procedure and specification.

**Contact Information**

Any comments about this new process or questions about future implementation may be directed to:

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