ASPHALT INSTITUTE

Guidance on the Use of the MSCR Test with the AASHTO M320 Specification

The Asphalt Institute (AI) Implementation Guidance Document, Implementation of the Multiple Stress Creep Recovery Test and Specification, provides guidance to the asphalt industry, users and producers, regarding the implementation of the new high temperature binder test – the Multiple Stress Creep Recovery, MSCR, (AASHTO TP70) – and specification (AASHTO MP19). It is AI's opinion that the MSCR test and specification represent a technical advancement over the current performance-graded (PG) asphalt binder specification, AASHTO M320, which will allow for better characterization of the high temperature performance-related properties of an asphalt binder.

Although the implementation of the revised performance-graded asphalt binder specification (which uses J_{nr} from the MSCR test instead of RTFO $G^*/\sin\delta$) is still the ultimate goal, the Asphalt Institute Technical Advisory Committee (AI-TAC) recognizes that many user agencies would simply prefer to use the MSCR test in conjunction with the AASHTO M320 specification rather than transitioning to a system that uses different grade names. In this case, the AI-TAC would recommend the following procedures for user agencies to consider:

- Use the MSCR test (AASHTO TP70) as a replacement PG-Plus test for modified asphalt binders that currently require an "elasticity evaluation" Plus test such as Elastic Recovery. Testing can also be conducted on standard, unmodified asphalt binders if desired.
- Conduct the MSCR test on the RTFO-aged asphalt binder following the procedures in AASHTO TP70. To have useful information, testing **must** be conducted on RTFO-aged material at the appropriate climate grade. Recommended test temperatures are shown in TABLE 1 below. Although TABLE 1 provides likely test temperatures, the 98% reliability high PG from LTPPBind 3.1 provides the most accurate representation of the climatic conditions and should be used if the agency is in doubt about the proper test temperature. A 98% reliability high PG map is shown in FIGURE 1 as a reference.
- Following AASHTO TP70, determine the J_{nr} values at 0.1 and 3.2 kPa shear stress and the corresponding MSCR Recovery values at the same stress levels.
- Using the data from the 3.2 kPa shear stress portion of the test, plot the MSCR Recovery as a function of J_{nr} and compare to FIGURE 2 below. Data points above the curve are considered to have sufficient delayed elastic response for an elastomeric-modified asphalt binder.
- Calculate the stress sensitivity parameter, $J_{nr,diff}$, by using the equation $J_{nr,diff} = (J_{nr,3.2kPa} - J_{nr,0.1\ kPa}) \div J_{nr,0.1\ kPa}$. If the ratio is greater than 0.75 then the asphalt binder is considered stress sensitive. In AASHTO MP19, a maximum ratio of 0.75 is permitted. If using the MSCR with AASHTO M320, it is suggested that the $J_{nr,diff}$ value be reported and noted if the criterion is not met.

As stated in the Implementation of the Multiple Stress Creep Recovery Test and Specification, AI recommends that if the MSCR Recovery is used to evaluate the delayed elastic response of the asphalt binder, then other PG-Plus tests with a similar purpose – such as Elastic Recovery, Force Ductility, and Toughness and Tenacity tests – should be eliminated. This saves testing time for both the user and supplier. If the current PG-Plus tests are not eliminated, then the time savings is lost. In this instance, the MSCR Recovery test should not be added.

Comparison testing between the MSCR Recovery value and the values of the current PG-Plus tests will no doubt be conducted. However, technologists should be cautioned not to expect a strong correlation because of the different test conditions that are used. AI has conducted some limited comparison testing between the MSCR Recovery and other PG-Plus tests and may be able to provide guidance on appropriate values to consider.

Please contact Mike Anderson of the Asphalt Institute (manderson@asphaltinstitute.org) with any specific questions or comments regarding this guidance.

Asphalt Institute Technical Advisory Committee
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TABLE 1: Recommended MSCR Testing Temperature (based on M320 Grade)

		MSCR Test Temperature[1], °C					
Grade[2]	**States[3]**	**46**	**52**	**58**	**64**	**67**	**70**
PG 46-28	1	X					
PG 52-28	3		X				
PG 52-34	4		X				
PG 58-22	9			X			
PG 58-28	25			X			
PG 58-34	12		X[4]	X[4]			
PG 64-10	1				X		
PG 64-16	4				X		
PG 64-22	38				X		
PG 64-28	31			X[5]	X[5]		
PG 64-34	7		X[4]	X[4]			
PG 67-22	5					X	
PG 70-10	2						X
PG 70-16	3						X
PG 70-22	22				X		
PG 70-28	22			X[5]	X[5]		
PG 70-34	4		X[4]	X[4]			
PG 76-16	1						X
PG 76-22	30				X		
PG 76-28	12			X[5]	X[5]		
PG 76-34	2		X[4]	X[4]			
PG 82-16	1				X[6]		X[6]
PG 82-22	6				X		
PG 82-28	2			X[5]	X[5]		

[1] All MSCR testing is performed on the asphalt binder after RTFO-aging.
[2] AASHTO M320 Table 1. "Premium" grades (defined as those grades where the temperature differential is 92 degrees or greater) are shown in red.
[3] Number of states listing the grade in the Asphalt Institute binder specification database (www.asphaltinstitute.org).
[4] Test at either 52°C or 58°C depending on the climate of the project. Users can test at both temperatures if desired.
[5] Test at either 58°C or 64°C depending on the climate of the project. Users can test at both temperatures if desired.
[6] Test at either 64°C or 70°C depending on the climate of the project. Users can test at both temperatures if desired.

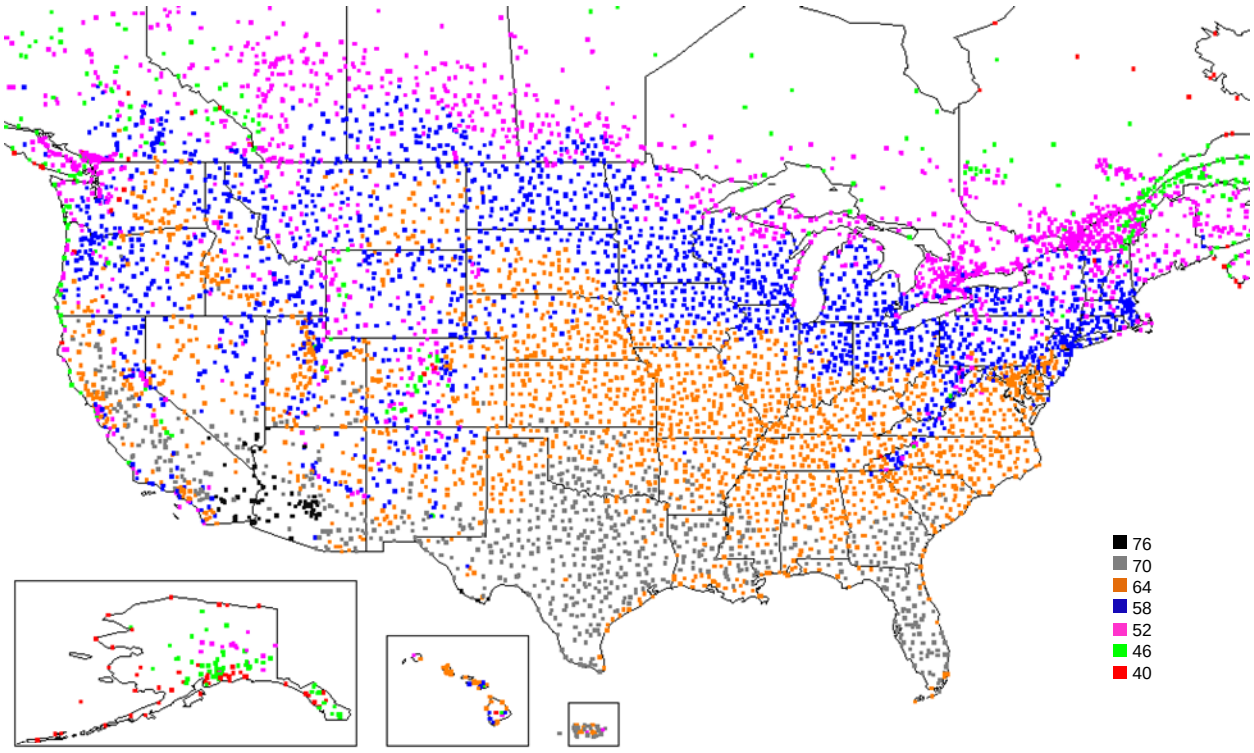

FIGURE 1: LTPPBind 3.1 Map – 98% Reliability High Tempertaure

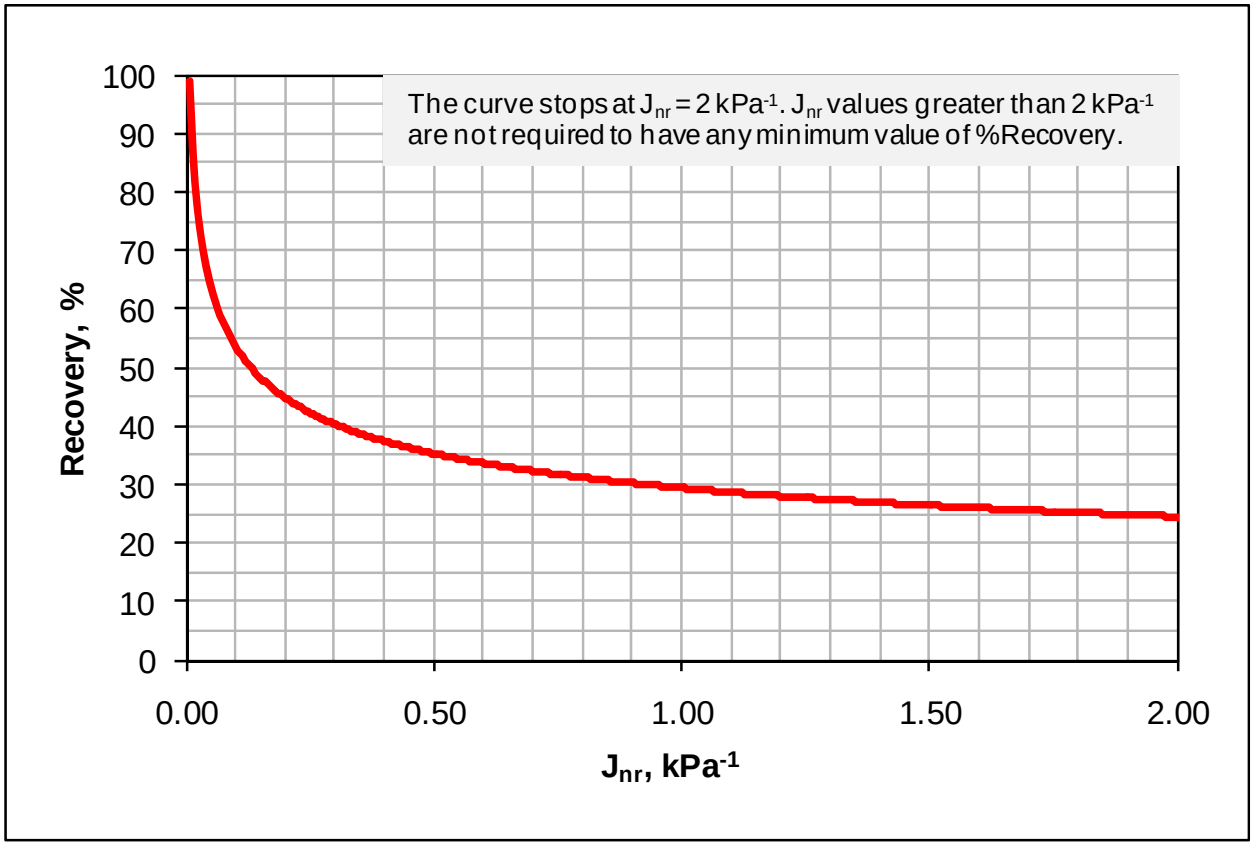

FIGURE 2: Comparison of MSCR J_{nr} and Recovery to Assess Delayed-Elastic Response