provides the high temperature grade and quality of polymer modification eliminating the need to run additional tests like elastic recovery on additional samples. The compliance value J_{nr} from the MSCR test provides the rut resistance and the amount of recovered strain from the test identifies the presence of polymer and also the quality of the blending of the polymer in the binder shown in Figure 4 below.

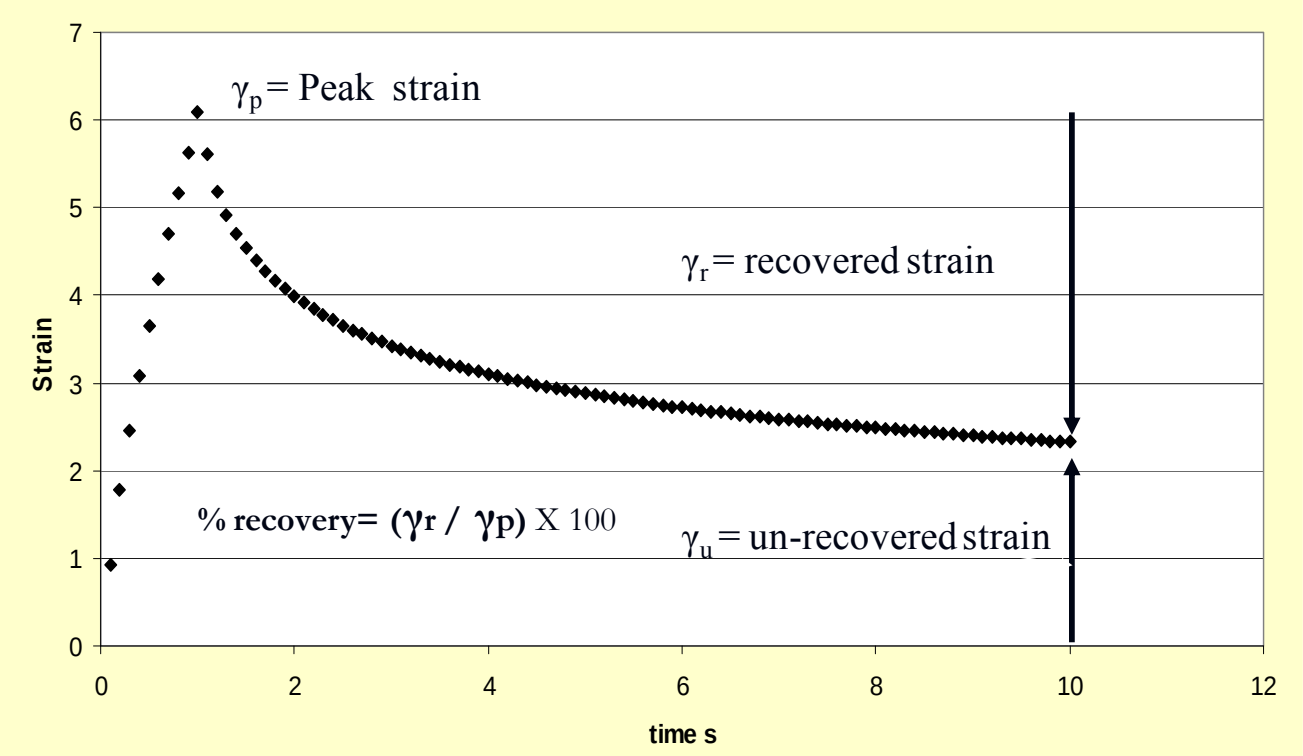

Figure 4. Plot showing the determination of the % Recovery in the MSCR test.

An experiment was conducted to demonstrate the improved ability of the MSCR test to identify the presence of polymer and quality of blending. Two samples were produced by adding 4% SBS polymer to the same base binder but using different blending techniques. One sample was produced with a linear SBS, not the optimum for the base asphalt, and it did not undergo high shear mixing. The other binder was produced with a radial SBS polymer, optimum for the base binder and mixed in with high shear. The existing Superpave specification indicates the binders have almost the exact same high temperature grade, however, the new MSCR parameter indicates that there is a significant difference between the binders. The MSCR indicates the binder with the optimum polymer mixed with high shear is much more rut resistant. The Elastic Recovery Test (ER) ranks the two binders as almost the same, but the % recovery from the MSCR test shows that the binders are very different. The binder made without high shear mixing and not the optimum polymer only had an MSCR % recovery of only 19%. The binder made with the optimum polymer and high shear mixing had an MSCR % recovery of 40%. In this case, both binders had 4% polymer, however, one was made to optimize performance by cross-linking the SBS and one was made to simply meet the Superpave PG specifications. The MSCR, in one simple test, clearly shows that the two binders, even though they both have 4 % SBS and the same base, are

very different and will provide different performance, which the ER and G*/sinδ could not show. The actual test data is shown in table 2 below.

Table 2: Comparison of data for SHRP criteria and new MSCR criteria

Comparison of binders with the same base and different polymers and mixing process.					
Continuous Grade	Polymer	Temp ^{o}C	J_{nr} $3.2kPa^{-1}$	ER	% Recovery $3.2kPa^{-1}$
66.7-24.1		64	3.12	5	0
75.7-22.3	4% SBS	70	1.85	73.8	19.2
76.6-25.2	4% SBS	70	1.18	86	40.3

AASHTO currently does not have a specification on items such as Elastic Recovery or any of the currently used SHRP + tests. In keeping with their current practice no actual specification was developed for the % Recovery in the MSCR test. Recommendations on minimum MSCR % Recovery are part of the TP 70 test procedure for MSCR. This can be used in graphical form or as a table shown below in Table 3.

Table 3: Minimum % Recovery values from the MSCR test for ranges of J_{nr} values to evaluate for delayed elastic response.

Minimum % Recovery for Measured Jnr values	
Jnr @ 3.2 kPa	Minimum % Recovery
2.0 - 1.01	30%
1.0 - 0.51	35%
0.50 - 0.251	45%
0.25 - 0.125	50%