

DSR-Based Test Procedures and Specification Guidelines for Grading PG 58-XX and PG 64S-XX Asphalt Binders in Kansas

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DSR sample between parallel plates

Introduction

This report addresses a shortcoming of the Multiple Stress Creep Recovery (MSCR) test method and specification system for virgin PG 58-XX and blends of PG 58-XX with reclaimed asphalt pavement (RAP) binders. The MSCR specification system limits the non-recoverable compliance, J_{nr} , to less than 4.5 kPa^{-1} for standard *S*-graded binders and disregards binders that do not satisfy this criterion. Also, the MSCR specification does not consider virgin binder grade adjustments when RAP is used. These binders, which are often blended with high percentages of RAP, have positively resulted in mostly a 64 °C high-temperature grade according to LTPPBind, with 98% reliability against rutting in Kansas.

Project Description

The Kansas Department of Transportation (KDOT) recently participated in a pooled-fund study to investigate the feasibility of implementing Dynamic Shear Rheometer (DSR)-based tests to grade or adjust the grade of asphalt binders (Bahia, Swiertz, & Lyngdal, 2016). However, the study did not investigate *S*-graded binders that must be polymer modified, and it did not address “soft” binders that do not satisfy the J_{nr} requirement for the *S*-grade designation. Because no clear guideline stipulates how to test and specify PG 58-XX, blends of PG 58-XX, and RAP binders using DSR-based tests, current research must investigate how the MSCR test and other DSR-based test parameters should be applied for grading and grade adjustment of these binders.

This research blended PG 58-28 and PG 58-34 virgin binders with four RAP binders and conducted MSCR tests to investigate this issue. Results showed that the high-temperature grade of PG 58-XX binders increased to 64 °C when they were mixed with RAP binder percentages of 15% or more. Furthermore, MSCR test results showed that the addition of RAP binder decreased the J_{nr} value to the *S* criteria when the requirement of J_{nr} difference percentage was omitted. Results also showed that the RAP binder can be screened using the rotational viscosity test to ensure the blends of PG 58-XX and RAP binders result in high-temperature grade adjustments and satisfy the *S* grade. A comprehensive set of PG 58-XX, PG 64S-XX, and multiple RAP binders used in Kansas should be tested to develop sound specification criteria based on PG and MSCR grading specifications.

Project Results

Based on the limited test results presented in this report, the following conclusions were drawn:

1. The rotational viscosity test can be used to determine whether RAP binders will improve the high-temperature grading and/or satisfy MSCR grading criteria when added to PG 58-XX binders.
2. Adding 15% or more RAP binders to virgin PG 58-XX will result in high-temperature grade adjustment from 58 °C to 64 °C, as shown in Figure 4.1. However, the RAP binder must be screened by studying the source or by conducting the rotational viscosity test to ensure the RAP binder is not too soft. RAP 144-106 results were excluded in Figure 4.1.
3. Adding 15% or more RAP binders to virgin PG 58-XX binders will satisfy the *S* grade condition based on the MSCR Jnr parameter, as shown in Figure 4.2. However, the RAP binder must be screened by studying the source or by conducting the rotational viscosity test to ensure the RAP binder is not too soft. RAP 144-106 results were excluded in Figure 4.2.

Project Information

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