Texas A&M Transportation Institute

PROJECT SUMMARY

Texas Department of Transportation

0-6747: Seal Coat Quality: Does Low Cost Mean Low Quality?

Background

The primary functions of a seal coat are sealing and protecting underlying pavement layers while providing an abrasive surface with adequate skid resistance. Many factors affect the performance of seal coats, including properties of the asphalt and aggregates, strength and condition of the existing pavement, construction techniques, and the amount and types of traffic. The useful service life of a seal coat generally ends due to cracking or loss of skid resistance. Loss of skid resistance can be the result of aggregate polishing, loss of macrotexture from aggregate reorientation, or asphalt flushing. Loss of macrotexture is sometimes due to the use of softer aggregates that polish, wear, and break down under traffic.

When the correct materials and application rates are used for a seal coat, the Texas Department of Transportation (TxDOT) should expect a service life of at least 7 years or more. When incorrect materials and/or application rates are used, or when poor construction practices are used, the life of the seal coat can be a matter of months or weeks.

What the Researchers Did

The research team conducted a laboratory test program to evaluate the durability and wear characteristics of aggregates commonly used for seal coat construction. They also sampled commonly used seal coat binders from construction projects and tested the binders in the laboratory to evaluate their propensity for flushing characteristics.

Field test sections consisting of many of the commonly used binders were evaluated for performance in terms of bleeding and aggregate loss.

What They Found

In the laboratory test program for aggregates, the research team found that the gravel aggregates, which are also SAC A aggregates, performed the best in terms of wear resistance as measured with the methods described here. The remaining aggregates, which consisted of limestones, limestone rock asphalt (LRA), and lightweight aggregate, exhibited a range of wear characteristics. One of the limestone sources exhibited very poor performance in the micro-Deval test and yet performed like the other limestones in the abrasion resistance test. The abrasion resistance test does seem to distinguish between different SAC B materials and generally indicates that the LRA aggregates are poor performers in terms of wear resistance. This also seems to be consistent with field reports. Lightweight aggregate, a very popular seal coat aggregate with unique properties, also performed poorly in the abrasion resistance test.

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Asphalt binders were sampled from field projects and test sections. Three tests were conducted:

- Dynamic shear rheometer strain sweep test on asphalt binder.
- Multiple stress creep recovery (MSCR) test on asphalt binder.
- Pull-out test on aggregate embedded on asphalt binder.

The non-recoverable creep compliance values calculated from the MSCR test for commonly used seal coat binders, such as AC-10, AC-10-2TR, AC-15P, AC-20-5TR, AC-20-XP, and A-R, showed significantly different performances from binders tested at 64°C. Softer asphalt cement binders, such as AC-10, and softer but modified binders, such as AC-10 2TR, showed significant non-recoverable strain build-up during the 10 cycles of MSCR test for both unaged and rolling thin film oven aged binders. The stiffer binders, such as A-R, AC-20 XP, AC-20 5TR, and AC-15P, showed much improved performance in flushing behavior as indicated from lower non-recoverable creep compliance values. This shows that using low-cost softer binders in low average daily traffic highways is not likely to reduce flushing of the seal coat.

Field test sections, consisting of many of the commonly used binders, were evaluated for performance in terms of bleeding and aggregate loss. Blended surface condition index (SCI) scores were compared for all test sections. An SCI score is a combined score determined by averaging the values of SCI for aggregate loss and SCI for bleeding. The predominantly used binder by TxDOT is the AC-20-5TR, so most of the test sections were constructed using this binder. The median SCI values for all of the binder types are as follows:

- Polymer-modified binders (AC-10-2TR, AC-20-5TR, CRS-2P, and HFRS-2P): median SCI = 78.5.
- Unmodified binders (AC-10, CRS-2, and CRS-2H): median SCI = 72.5.

What This Means

While the polymer-modified binders overall performed at a higher level, the test section with the highest score happened to be an unmodified binder (AC-10). Many factors can influence the performance of seal coats, and material selection is only one. If the seal coat is constructed properly and if the roadway is a good candidate, unmodified binders may perform very well. For higher-volume facilities, it still seems that polymer-modified binders are likely to give better success. Even for lower-volume facilities, most of the laboratory and field data point to polymer-modified materials ensuring better performance. To assist in selecting materials, *Guidelines for TxDOT in Selecting Seal Coat Materials* was developed as part of this project.

For More Information

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