PROJECT SUMMARY REPORT

0-7153: Develop Design of Hot-Mix Cold-Laid Mixtures with the Superpave Gyratory Compactor

Background

Hot-mix cold-laid (HMCL) asphalt mixes are often used as a blade-on/level-up material in Texas. Currently, the HMCL asphalt mixes are designed with a Texas gyratory compactor (TGC) and checked with the Hveem stability test. The Texas Department of Transportation (TxDOT) is undertaking an initiative to design all asphalt mixes with the Superpave gyratory compactor (SGC) and officially phase out the TGC in the near future. As a result, there is an urgent need to study an HMCL mix design method with an SGC and replace the Hveem stability test with new performance-related tests. The objective of this project was to establish a new HMCL mix design method with an SGC and new performance tests, ensuring high-quality and long-lasting HMCL mixes.

What the Researchers Did

The researchers conducted a comprehensive literature review, surveyed many TxDOT districts, and further interviewed different HMCL mix producers. Based on the obtained information, the researchers developed a balanced and factorial experimental test plan including HMCL mix type, aggregates, asphalt binder sources, and binder grades. With the approval of the Project Monitoring Committee, the researchers executed the experimental test plan. Five types of HMCL mixes were designed following the current mix design procedure. Then, the researchers evaluated 15 HMCL mixes in the laboratory in terms of compactability/workability, raveling, rutting resistance, and cracking resistance. In the end, the researchers analyzed the test results and recommended a new HMCL mix design method.

What They Found

The literature review, interviews, and laboratory study led to the following findings:

- HMCL Type D with crushed limestone and AC-0.6 binder is the most popular mix used by different districts.
- Binder contents determined from the current mix design method may be insufficient, resulting in poor compactability; the Hveem stability test is sometimes not sensitive enough to binder content.
- The Hamburg wheel tracking test and the overlay test are not suitable for evaluating HMCL mixes.
- The influence of binder sources and grades on laboratory-molded densities is relatively minor when compared to that of aggregates. However, binder source and grade significantly impact performance. For example, the AC-0.6 binder from Supplier 1 offers better resistance to cracking and rutting than the same binder from Supplier 2, while the AC-1.5 binder markedly enhances rutting resistance in comparison to AC-0.6 binders.
- N_{design} = 75 for SGC produces reasonable asphalt binder contents for HMCL mixes with different aggregates when the laboratory-molded density ranges within 94.0 ± 1.5 percent.
- Two performance tests (Figure 1), the Cantabro test and ideal rutting test, are necessary for ensuring the high quality of HMCL mixes; a maximum Cantabro loss of 15 percent is a useful criterion for screening raveling potential mixes,

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while a minimum rutting tolerance index (RT_{Index}) of 30 is critical to ensure adequate rutting resistance. Furthermore, the number of gyrations for compacting ideal rutting test specimens and the results of Cantabro tests are good indicators of potential cracking problems.

What This Means

The researchers successfully accomplished the research objective, replacing TGC with SGC and the Hveem stability test with two performance tests (i.e., Cantabro test and ideal rutting test).

presents the recommended HMCL mix design properties, test methods, and associated requirements. The requirements in Table 1 can assist in eliminating mixes with inadequate binder content and poor compactability from the existing mix design. Consequently, the proposed mix design method enhances the current HMCL mix design by improving compactability and performance.

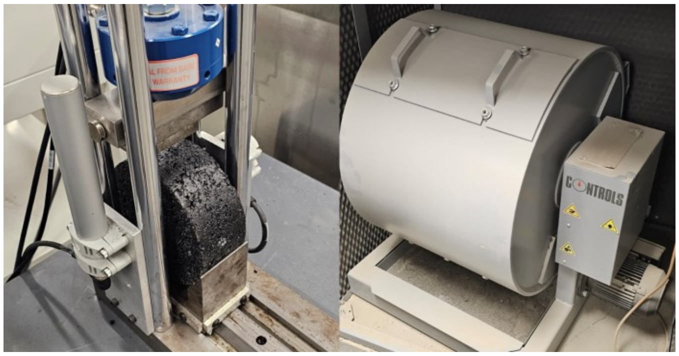

Figure 1. Two Performance Tests for HMCL Mixes (Left: Ideal Rutting Test; Right: Cantabro test).

Table 1. Laboratory Mixture Design Properties.

Property	Test Method	Requirement
Target laboratory-molded density, %[1]	Tex-207-F	94.0 ± 1.5
RT_{Index}, Min	Tex-XXX-F[2]	30
No. of gyrations, Max[3]	Tex-241-F	450
Cantabro loss, %, Max[4]	Tex-245-F	15
Hydrocarbon-volatile content, %, Max	Tex-213-F	0.6
Moisture content, %, Max[5]	Tex-212-F	1.0
Boil test, %, Max[6]	Tex-530-C	10

1. Unless otherwise shown on the plans.
2. Tex-XXX-F rutting test.
3. Number of gyrations with SGC is used to compact the ideal rutting test specimen to reach 7 ± 0.5 percent air voids.
4. Cantabro test specimens are compacted using SGC.
5. Unless otherwise approved.
6. Limit may be increased or eliminated when approved.

For More Information

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