STANDARD PRACTICE FOR MIXTURE CONDITIONING OF HOT MIX ASPHALT

AASHTO R 30

GLOSSARY

Short term mixture conditioning -- a laboratory procedure used to simulate the effects of HMA aging and binder absorption that occurs during the precompaction phase of the construction process.

Oxidation -- a type of chemical reaction that occurs between binder and oxygen that changes the stiffness of the binder.

Long term mixture conditioning -- a laboratory aging procedure used to simulate the effects of HMA aging that occurs over the service life of a pavement.

MIXTURE CONDITIONING OF HOT MIX ASPHALT (HMA)

Samples of HMA prepared in the laboratory have different properties from mixtures produced in a HMA plant for a number of reasons. One of these reasons is that the HMA ages as the mixture goes through the plant, and during storage and transportation, until the mixture cools down. The binder reacts with oxygen in the air and becomes harder and more brittle. Some volatile fractions of the binder may also be driven off at the high temperatures encountered during construction. Absorption of some of the binder into the aggregate may also occur during construction while the binder is still fluid enough to migrate into the pores of the aggregate. Aging continues at a slower rate throughout the service life of the pavement. The aging (or oxidation) reaction proceeds at a higher rate in hot climates or during the summer months when the temperatures are higher.

Accounting for the changes in the mixture properties when preparing mixtures in the lab is important. One way to account for these changes is to condition the laboratory mixtures in such a way as to simulate the aging that happens during construction and service. The short term mixture conditioning procedure is used to simulate the aging that occurs during construction (up to the point of compaction) and is used during the mix design procedure. Long term aging is used to simulate the aging that occurs over the many years that the pavement is in service. Consequently, long term aging is used when performing tests to simulate mixture properties late in the life of the pavement, such as when analyzing the resistance of a mixture to low-temperature cracking using Superpave mixture analysis and the Indirect Tension tester. Long term mixture conditioning follows short term condition for laboratory prepared mixtures.

Apparatus

Forced-Draft Oven, capable of maintaining temperatures from room temperature up to 350 ± 5°F (176 ± 3°C).

Loading device, capable of applying a static 12.5 kip (56 kN) load at a rate of 16 ± 0.01 kip/min (72.00 ± 0.05 kN/min).

Thermometers, covering the range from 122°F to 500°F (50°C to 260) readable to the nearest 2°F (1°C).

Miscellaneous equipment, shallow metal pan for aging loose mix, metal spatula or spoon for stirring, oven gloves.

Procedure

Mixture Conditioning for Volumetric Mixture Design

The mixture conditioning procedure for volumetric mix designs applies to laboratory-prepared, loose mixture only. No mixture conditioning is required when conducting QC/QA testing on plant-produced mixture.

1. Place the mixture in a pan, and spread the mixture to an even thickness ranging between 1 to 2 in. (25 and 50 mm)

2. Place the mixture and pan in a forced-draft oven for 2 h ± 5 minutes at a temperature equal to the mixture's compaction temperature ± 5°F (± 3°C).

   (Note: The compaction temperature range of an HMA mixture is defined as the range of temperatures where the unaged binder has a kinematic viscosity of approximately 0.28 ± 0.03 pa-s (280 ± 30 mm^2/s) measured in accordance with ASTM D 4402. The target compaction temperature is generally the mid-point of this range. When using modified asphalts, the binder manufacturer's recommendation for compaction temperature should be considered. INDOT requires that the mixture design compaction temperature be 300 ± 9°F (150 ± 9°F) for dense graded mixtures and 260 (150) for open graded mixtures)

3. Stir the mixture after 60 ± 5 minutes to maintain uniform conditioning.

Mixture Conditioning for Short-Term Aging

The short-term conditioning for the mixture mechanical property testing procedure applies to laboratory-prepared, loose mix only and is done a follows:

1. Place the mixture in a pan, and spread the mixture to an even thickness ranging between 1 to 2 in. (25 and 50 mm)

2. Place the mixture and pan in a forced-draft oven for 4 h ± 5 minutes at a temperature of 275 ± 5°F (135 ± 3°C)

3. Stir the mixture every 60 ± 5 minutes to maintain uniform conditioning

Mixture Conditioning for Long-Term Aging

The long term mixture conditioning procedure may be applied to laboratory-prepared samples following short term aging, to plant-mixed HMA, or to compact roadway samples when needed to simulate long term aging effects. This mixture conditioning step is used when samples will be tested for mechanical properties, such as Indirect Tensile creep or strength.

Loose-Mix -- Gyratory Compacted Specimen

Laboratory-prepared mixture should be conditioned following the procedure described for short-term aging above. Plant-mixed material does not need to be short term aged.

1. Compact the HMA sample according to T 312 to the level of compaction required for the tests to be conducted. Do not extrude the specimen from the mold.

2. Condition the compacted sample by cooling in the mold to 140° ± 5°F (60° ± 3°C). This typically takes about 2 hours.

3. The ends of the specimen may not be parallel. The ends are squared up by applying a static load in a testing device. Increase the load from 0 kN at a rate of 16 ± 0.01 kip/min. (72.00 ± 0.05 kN/min). Release the load at the same rate when the ends of the specimen are level or when the load reaches a maximum of 12.5 kip (56 kN).

4. Remove the specimen from the testing machine and allow to cool 16 ± 1 hours at room temperature. The sample should be extruded from the compaction mold after cooling for 2-3 hours.

Loose-Mix -- Rolling Wheel Compacted Specimens

1. Compact the specimen in accordance with PP 3

2. Cool the specimen at room temperature for 16 ± 1h

3. Remove the slab from the mold, and saw or core the required specimen from the slab

Compacted Roadway Specimens

1. Cool the test specimen at room temperature for 16 ± 1 h

2. Place the specimen in the oven at 185 ± 5°F (85 ± 3°C) for 120 ± 0.5 h

3. After 120 ± 0.5 h, turn the oven off, open the oven doors, and allow the test specimen to cool to room temperature. This typically takes about 16 hours. Do not touch or remove the specimen from the oven until the end of this cooling period.