

Standard Practice for Mixture Conditioning of Hot-Mix Asphalt (HMA)

AASHTO Designation: PP2-01^{1,2}

1. Scope

1.1 This practice describes procedures for mixture conditioning of compacted and uncompact hot-mix asphalt (HMA). Three types of conditioning are described: 1) mixture conditioning for volumetric mixture design; 2) short-term conditioning for mixture mechanical property testing (both of which simulate the precompaction phase of the construction process); and 3) long-term conditioning for mixture mechanical property testing to simulate the aging that occurs over the service life of a pavement. The long-term conditioning for mixture mechanical property testing procedures are preceded by the procedure for short-term conditioning for mixture mechanical property testing.

1.2 This standard may involve hazardous materials, operations, and equipment. This standard does not purport to address all of the safety concerns associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.

2. Referenced Documents

2.1 AASHTO Standards

- TP4 Preparing and Determining the Density of Hot-Mix Asphalt (HMA) Specimens by Means of the Superpave Gyratory Compactor
- PP3 Preparing Hot-Mix Asphalt (HMA) Specimens by Means of the Rolling Wheel Compactor

2.2 ASTM Standards

- D4402 Viscosity Determinations of Unfilled Asphalts Using the Brookfield Thermosel Apparatus

3. Summary of Practice - For mixture conditioning for volumetric mixture design, a mixture of aggregate and binder is conditioned in a forced-draft oven for 2 h at the mixture's specified compaction temperature. For short-term mixture conditioning for mechanical property testing, a mixture of aggregate and binder is conditioned in a forced-draft oven for 4 h at 135°C. For long-term mixture conditioning for mechanical property testing, a compacted mixture of aggregate and binder is conditioned in a forced-draft oven for 5 days at 85°C.

4. Significance and Use - The properties and performance of HMA can be more accurately predicted by using conditioned test samples. The mixture conditioning for the volumetric mixture design procedure is designed to allow for binder absorption during the mixture design. The short-term mixture conditioning for the mechanical property testing procedure is designed to simulate the plant-mixing and construction effects on the mixture. The long-term mixture conditioning for the mechanical property testing procedure is designed to simulate the aging the compacted mixture will undergo during seven to ten years of service.

5. Apparatus

5.1 Oven - A forced-draft oven, thermostatically controlled, capable of maintaining any desired temperature setting from room temperature to 176°C within $\pm 3^\circ\text{C}$.

5.2 Loading Device - A loading device capable of applying a static load of 56 kN to the specimen at the rate of 72.00 ± 0.05 kN/minute.

5.3 Thermometers - Thermometers having a range from 50 to 260°C and readable to 1°C.

5.4 Miscellaneous - A metal pan for heating aggregates, a shallow metal pan for heating uncompact HMA, a metal spatula or spoon, timer,

¹ This standard is based on SHRP Product 1031.

² Approved in October 1994, this provisional standard was first published in March 1995. The 2001 publication includes changes.

and gloves for handling hot equipment.

6. Hazards - This standard involves the handling of hot binder, aggregate, and HMA which can cause severe burns if allowed to contact skin. Follow standard safety precautions to avoid burns.

7. Mixture Conditioning Procedures

7.1 Mixture Conditioning for Volumetric Mixture Design

7.1.1 The mixture conditioning for the volumetric mixture design procedure applies to laboratory-prepared, loose mixture only. No mixture conditioning is required when conducting quality control or quality assurance testing on plant-produced mixture.

Note 1 - The agency may identify the need to condition plant-produced mixture to be more representative of field conditions, particularly where absorptive aggregates are used.

7.1.2 Place the mixture in a pan, and spread it to an even thickness ranging between 25 and 50 mm. Place the mixture and pan in a forced-draft oven for $2\text{ h} \pm 5\text{ minutes}$ at a temperature equal to the mixture's compaction temperature $\pm 3^\circ\text{C}$. The compaction temperature range of a HMA mixture is defined as the range of temperatures where the unaged binder has a kinematic viscosity of $280 \pm 30\text{ mm}^2/\text{s}$ (approximately $0.28 \pm 0.03\text{ Pa}\cdot\text{s}$) measured in accordance with ASTM D4402 (Note 1). The target compaction temperature is generally the mid-point of this range.

Note 2 - Modified binders may not adhere to the equi-viscosity requirements noted. The agency should consider the manufacturer's recommendations when establishing the mixing and compaction temperatures for modified binders. Practically, the mixing temperature should not exceed 165°C and the compaction temperature should not be lower than 115°C .

7.1.3 Stir the mixture after $60 \pm 5\text{ minutes}$ to maintain uniform conditioning.

7.1.4 After $2\text{ h} \pm 5\text{ minutes}$, remove the mixture from the forced-draft oven. The conditioned mixture is now ready for compaction or testing.

7.2 Short-Term Conditioning for Mixture Mechanical Property Testing

7.2.1 The short-term conditioning for the mixture mechanical property testing procedure applies to laboratory-prepared, loose mix only.

7.2.2 Place the mixture in a pan, and spread it to an even thickness ranging between 25 and 50 mm. Place the mixture and pan in the conditioning oven for $4\text{ h} \pm 5\text{ minutes}$ at a temperature of $135 \pm 3^\circ\text{C}$.

7.2.3 Stir the mixture every $60 \pm 5\text{ minutes}$ to maintain uniform conditioning.

7.2.4 After $4\text{ h} \pm 5\text{ minutes}$, remove the mixture from the forced-draft oven. The conditioned mixture is now ready for further conditioning or testing as required.

7.3 Long-Term Conditioning for Mixture Mechanical Property Testing

7.3.1 The long-term conditioning for the mixture mechanical property testing procedure applies to laboratory-prepared mixtures that have been subjected to the short-term conditioning for the mixture mechanical property testing procedure described in Subsection 7.2, plant-mixed HMA, and compacted roadway specimens.

7.3.2 Preparing Specimens From Loose HMA

7.3.2.1 Specimens Compacted Using the Superpave Gyratory Compactor

7.3.2.1.1 Compact the specimens in accordance with TP4.

7.3.2.1.2 Cool the test specimen in the compaction mold to $60 \pm 3^\circ\text{C}$, then level the specimen ends by applying a static load to the specimen at a rate of $72 \pm 0.05\text{ kN/min}$. Release the load at the same rate when the specimen ends are level or when the load applied reaches a maximum of 56 kN.

7.3.2.1.3 Cool the test specimen at room temperature for $16 \pm 1\text{ h}$.