Designation: D8079 – 16

Standard Practice for Preparation of Compacted Slab Asphalt Mix Samples Using a Segmented Rolling Compactor[1]

This standard is issued under the fixed designation D8079; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

1. Scope

1.1 This practice covers the fabrication of slabs of asphalt mix using an automated laboratory rolling compactor (RC). Compacted specimens are suitable for volumetric and physical property testing. This practice should not be used for acceptance or rejection of a material or for purchasing purposes.

1.2 Units—The values stated in SI units are to be regarded as standard. No other units of measurement are included in this standard.

1.3 The text of this standard references notes and footnotes which provide explanatory material. These notes and footnotes (excluding those in tables and figures) shall not be considered as requirements of the standard.

1.4 *This standard does not purport to address all of the safety concerns, if any, 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 *ASTM Standards:*[2]

D979/D979M Practice for Sampling Bituminous Paving Mixtures

D1188 Test Method for Bulk Specific Gravity and Density of Compacted Bituminous Mixtures Using Coated Samples

D2041 Test Method for Theoretical Maximum Specific Gravity and Density of Bituminous Paving Mixtures

D2726 Test Method for Bulk Specific Gravity and Density of Non-Absorptive Compacted Bituminous Mixtures

D3666 Specification for Minimum Requirements for Agencies Testing and Inspecting Road and Paving Materials

D6752 Test Method for Bulk Specific Gravity and Density of Compacted Bituminous Mixtures Using Automatic Vacuum Sealing Method

D6857 Test Method for Maximum Specific Gravity and Density of Bituminous Paving Mixtures Using Automatic Vacuum Sealing Method

D7460 Test Method for Determining Fatigue Failure of Compacted Asphalt Concrete Subjected to Repeated Flexural Bending

E644 Test Methods for Testing Industrial Resistance Thermometers

2.2 *AASHTO Standards:*[3]

AASHTO T 321 Method of Test for Determining the Fatigue Life of Compacted Asphalt Mixtures Subjected to Repeated Flexural Bending

AASHTO T 324 Method of Test for Hamburg Wheel-Track Testing of Compacted Hot Mix Asphalt (HMA)

AASHTO M 323 Specification for Superpave Volumetric Mix Design

2.3 *Additional Resources:*[4]

Asphalt Institute MS-2 Asphalt Mix Design Methods

3. Terminology

3.1 *Definitions:*

3.1.1 *rolling compactor*—a device that uses a segment or arc of a circle composed of metal to compact asphalt mixture into a slab.

3.1.2 *rolling compactor foot*—the portion of the device that consists of the segment or arc of a circle composed of metal attached to the loading frame that rotates across the surface of the asphalt mixture.

3.1.3 *rolling compactor tray*—the portion of the device that the mold rests on during compaction. The tray can be stationary or can move horizontally to facilitate compaction.

3.2 *Definitions of Terms Specific to This Standard:*

3.2.1 *lab mix lab compacted (LMLC) asphalt mix*—asphalt mix samples that are prepared in the laboratory by weighing

[1] This practice is under the jurisdiction of ASTM Committee D04 on Road and Paving Materials and is the direct responsibility of Subcommittee D04.20 on Mechanical Tests of Asphalt Mixtures.

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[2] For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

[3] Available from American Association of State Highway and Transportation Officials (AASHTO), 444 N. Capitol St., NW, Suite 249, Washington, DC 20001, http://www.transportation.org.

[4] Available from Asphalt Institute at: http://bookstore.asphaltinstitute.org/catalog/book/ms-2-asphalt-mix-design-methods.

and blending each constituent and then compacting the blended mix using a laboratory compaction apparatus.

3.2.1.1 *Discussion*—LMLC typically occurs during the asphalt mix design phase.

3.2.2 *plant mix laboratory compacted (PMLC) asphalt mix*—asphalt mix samples that are manufactured in a production plant, sampled prior to compaction, then immediately compacted using a laboratory compaction apparatus.

3.2.2.1 *Discussion*—PMLC specimens are often used for quality control testing. Asphalt mix is not permitted to cool substantially and it may be necessary to place the mix in a laboratory oven to equilibrate the mix to the compaction temperature before molding.

3.2.3 *reheated plant mix lab compacted (RPMLC) asphalt mix*—asphalt mix samples that are manufactured in a production plant, sampled prior to compaction, allowed to cool to room temperature, then reheated in a laboratory oven and compacted using a laboratory compaction apparatus.

3.2.3.1 *Discussion*—RPMLCs are often used for quality acceptance and verification testing. The reheating time should be as short as possible to obtain uniform temperature to avoid artificially aging the specimens. Asphalt mix conditioning, reheat temperature, and time should be defined in the applicable specification.

4. Summary of Practice

4.1 A sample of loose asphalt mix is compacted in an automatic apparatus by the combination of vertical displacements of a segmented rolling compactor foot and horizontal movements of a rolling compactor foot relative to the compactor tray to produce a slab of compacted asphalt with a target theoretical density (that is, based on the geometric volume of the specimen).

5. Significance and Use

5.1 Asphalt slabs compacted with the rolling compactor can be used to obtain specimens for further testing, including bulk specific gravity following Test Methods D1188, D2726, and D6752, fatigue performance characteristics following Test Method D7460 or AASHTO T 321, and Hamburg wheel-track testing following AASHTO T 324.

5.2 Specimens to perform other standard tests could also be obtained, as long as their volume is contained within the volume of a slab.

NOTE 1—The quality of the results produced by this standard are dependent on the competence of the personnel performing the procedure and the capability, calibration, and maintenance of the equipment used. Agencies that meet the criteria of Specification D3666 are generally considered capable of competent and objective testing, sampling, inspection, etc. Users of this practice are cautioned that compliance with Specification D3666 alone does not completely ensure reliable results. Reliable results depend on many factors following the suggestions of Specification D3666 or some similar acceptable guideline that provides a means of evaluating and controlling some of those factors.

6. Apparatus

6.1 *Segmented Rolling Compactor*—A compactor capable of fabricating asphalt slabs comprised of the following system components: (*1*) reaction frame, (*2*) fully integrated loading system, including loading rams, controller, and data acquisition to record loads applied, height measurements, and number of cycles, and (*3*) segmented rolling compactor foot and mold. The compactor must comply with the following specifications:

6.1.1 Vertical load divided by the width of the mold perpendicular to the rolling direction is adjustable by the user up to at least 75 kg⁄cm.

NOTE 2—The vertical load should be measured and controlled to an accuracy of ±5 % of the applied load. The loading system used to achieve the required load can be electromechanical, pneumatic, or hydraulic.

6.1.2 The capability to perform at least four load cycles every minute.

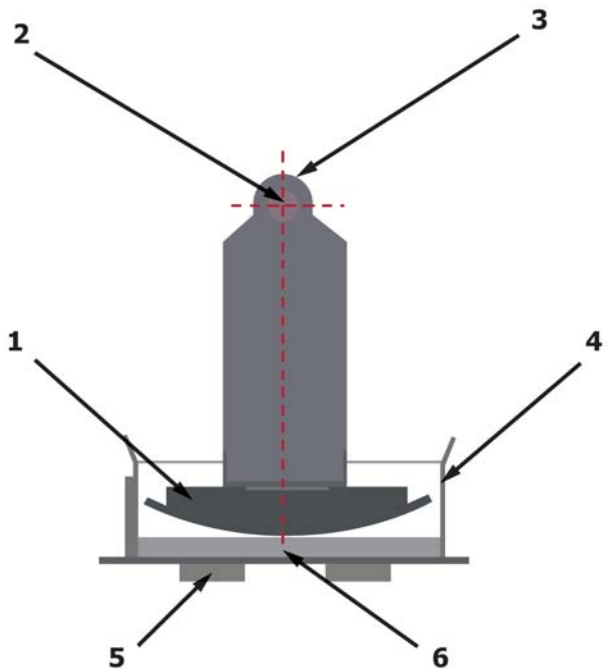
6.1.3 The compactor must be capable of producing compacted slabs with minimum dimensions of 300 ± 5 mm long, 260 ± 5 mm wide, and with a minimum height measured at the center of the slab of 38 mm.

6.1.4 The controller must also be capable of automatically terminating the compaction run after meeting one of three termination criteria: sample height, number of loading cycles, or target density. The controller shall state that the compaction is finished and the termination criterion (height, cycles, or theoretical density) shall be recorded.

NOTE 3—Since the dimensions of the mold and the mass of the mixture are known, the theoretical density can be calculated.

6.1.5 The reaction frame shall be rigid and capable of sustaining the maximum forces generated during the compaction process. It shall also be able to sustain the reaction forces being applied to the mold.

6.1.6 The loading system (see Fig. 1) shall consist of a



1. Rolling compactor foot
2. Pivot
3. Linear loading point
4. Mold
5. Rolling compactor tray
6. Sample

FIG. 1 Example Schematic of a Rolling Compactor

controlled vertical axis loading system capable of applying a compressive load to the mix during compaction. The system shall be able to control the height of the rolling compactor foot using displacement or vertical load. The system can use lever arms, electric motors, pneumatics, hydraulics, or a combination thereof to control the height or load of the rolling compactor foot.

6.1.7 The machine shall be designed such that the rolling compactor foot movement ensures constant distance between the foot and bottom of the mold along each cycle.

6.2 *Mold Plates*—Wear plates used on top and bottom of the specimen and rolling compactor foot. All mold plates and the rolling compactor foot shall be fabricated from metal strong enough to withstand the applied forces. The mold bottom plate shall be flat (<0.5 mm over 300 mm).

6.3 *Thermometer*—A platinum resistance thermometer (PRT), thermocouple, or dial-type thermometer with a range of at least 10 °C to 232 °C. Calibrate the thermometer system (probe and readout) in accordance with Test Methods E644. Corrections shall be applied to ensure accurate measurements within ±3 °C.

6.4 *Balance*—At least one balance with a minimum capacity of 8000 g, with a sensitivity of 0.1 g.

6.5 *Oven*—At least one forced draft oven, capable of heating the asphalt binder, aggregates, and equipment to the compaction temperature specified by the asphalt binder manufacturer, and thermostatically controlled to ±3 °C. If short term oven aging is going to be conducted on the mix, an additional forced draft oven capable of maintaining ±3 °C must be available for use.

6.6 *Miscellaneous*—Miscellaneous equipment may include: flat bottom metal pans for heating aggregate and asphalt mixes; scoops; containers for heating asphalt binders; mixing spoons; spatulas; tine rake; protective gloves for handling hot equipment; portable aids to lift moderately heavy items in a laboratory setting; and mechanical mixers.

7. Preparation of Apparatus

7.1 Follow manufacturer's recommendations for turning on the rolling compactor.

7.2 Place the mold in the oven at the selected compaction temperature at least 30 min prior to loading the mix in the compactor.

7.3 Heat or coat any tools with an asphalt release agent to prevent mix from adhering to the tools.

8. Preparation and Conditioning of the Loose Mix

8.1 To prepare and condition the mix prior to compaction, follow local and national standards for preparation of samples and adjust the quantities of materials such that the total mass of the mix produced in the laboratory or obtained from a plant is sufficient to produce the required compacted specimen volume and a companion loose mix sample suitable to determine the theoretical maximum specific gravity of the asphalt mix according to Test Methods D2041 or D6857.

NOTE 4—The total mass will depend on the target density of the slab and the slab width, length, and height. For typical asphalt mixes, weights between 10 and 90 kg have been used to make slabs.

8.1.1 To obtain a sufficient mass of asphalt mix for PMLC or RPMLC mixes, use Practice D979/D979M. Otherwise, for LMLC mixes, prepare a sufficient quantity of asphalt mix using AASHTO M 323 or Asphalt Institute MS-2.

9. Procedure

9.1 *Preparation and Filling the Mold:*

9.1.1 Distribute the total mass to be used during compaction in equal amounts in separate pans. Record the total mass to be placed in the mold.

NOTE 5—Pans with net weights of asphalt mix between 5 kg and 7 kg are manageable during the compaction process.

9.1.2 Heat mix to compaction temperature.

9.1.3 Remove heated mold from oven and place it in a safe and convenient location.

9.1.4 Transfer the loose mix from the pans into the mold.

9.1.5 With a scoop, place 1.0 to 2.0 kg of mix in small mounds evenly spaced throughout the mold to reduce segregation and to prevent low and high density areas. Spread out the mounds with a spatula or tine rake for each layer. Use a vibrating motion with a spatula or rake to settle the mix and fit it within the mold.

NOTE 6—If the asphalt mix contains fiber reinforcement, follow the fiber manufacturer's instructions for molding the sample to avoid fiber orientation bias.

9.1.6 Once all the mix has been placed, spread the surface of mix such that it is approximately level with a spatula or tine rake.

9.2 *Compaction of a Specimen:*

9.2.1 Slide the mold and asphalt mix onto the rolling compactor tray and lock the mold to the frame following the manufacturer's instructions.

9.2.2 Enter the number of cycles and height or density to terminate the test. Load cycle is the horizontal linear movement of the rolling compactor foot or mold that allows the rolling compactor foot to move from the edge of the compaction mold to the opposing edge and then return to the starting initial edge. Select whether the rolling compactor foot will be lowered by incremental height or load. Enter other specimen information as required in the rolling compactor software.

NOTE 7—Experienced operators can complete steps 9.1.3 – 9.2.2 in less than 5 min. To maintain temperature, the process should take no longer than 10 min.

9.2.3 Follow the manufacturer's instructions to start the sample compaction. When the required vertical load or displacement is applied to the sample, compaction takes place until one of the selected termination criteria, sample height, number of loading cycles, or target density, is achieved.

9.2.4 When a termination criterion is achieved, the rolling compactor foot is removed vertically to avoid further compaction.

9.2.5 When the termination criteria cannot be achieved, the rolling compactor should have software controls in place to terminate the compaction.

9.3 *Removing the Compacted Slab from the Mold:*

9.3.1 Remove the locking mechanisms restraining the mold to the tray.

9.3.2 Remove the mold from the machine.

NOTE 8—The mold containing the compacted asphalt mix will be heavy. It is recommended that two people move the mold onto a rolling table or cart that is at the same height as the rolling compactor tray.

9.3.3 Remove the sides of the mold.

9.3.4 Allow the slab to cool to room temperature for at least 2 h on the bottom wear plate before moving, testing, cutting, or coring the slab.

10. Standardization

10.1 Items requiring periodic verification or calibration include the vertical load and specimen height measurement system. Verification of calibration, system standardization, and quality checks shall be performed by the manufacturer, agencies providing standardization services, or in-house personnel.

10.2 Verify or calibrate the following items following the manufacturer's recommendations: vertical load and specimen height measurement system. Vertical load annually, after repairs to the machine, or when the machine is moved; height measurement annually, after repairs to the machine, or when the machine is moved.

11. Report

11.1 Report the following information:

11.1.1 Mix and specimen identification details, including mix production date and LMLC, PMLC, or RPMLC.

11.1.2 Date and time of specimen preparation.

11.1.3 Mass of the specimen, to the nearest 0.01 kg.

11.1.4 Nominal mold dimensions of length and width.

11.1.5 Vertical load used during compaction.

11.1.6 Nominal thickness of the slab.

11.1.7 Termination criterion used in 6.1.4.

12. Keywords

12.1 air voids; asphalt; beam fatigue; beam samples; compaction; density; Hamburg wheel-trackers; HMA; rolling compactors