Designation: D7870/D7870M – 13

Standard Practice for Moisture Conditioning Compacted Asphalt Mixture Specimens by Using Hydrostatic Pore Pressure[1]

This standard is issued under the fixed designation D7870/D7870M; 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 includes procedures for preparing compacted asphalt mixture specimens, exposing the specimens to hydrostatic pore pressure inside an enclosed chamber and guidance on testing the specimens for the effect of water on the tensile strength or change in other properties of the asphalt mixture, such as density, modulus, etc.

1.2 Specimens conditioned according to this practice can be tested using methods and test procedures referenced in this document and those results may provide information as to the effect of the moisture conditioning of this practice on the moisture sensitivity of those mixtures.

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 The values stated in either SI units or inch-pound units are to be regarded separately as standard. The values stated in each system may not be exact equivalents; therefore, each system shall be used independently of the other. Combining values from the two systems may result in non-conformance with the standard.

1.5 *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 Practice for Sampling Bituminous Paving Mixtures

D1561 Practice for Preparation of Bituminous Mixture Test Specimens by Means of California Kneading Compactor

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

D3665 Practice for Random Sampling of Construction Materials

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

D4013 Practice for Preparation of Test Specimens of Bituminous Mixtures by Means of Gyratory Shear Compactor (Withdrawn 2013)[3]

D4867 Test Method for Effect of Moisture on Asphalt Concrete Paving Mixtures

D5361 Practice for Sampling Compacted Bituminous Mixtures for Laboratory Testing

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

D6925 Test Method for Preparation and Determination of the Relative Density of Asphalt Mix Specimens by Means of the Superpave Gyratory Compactor

D6926 Practice for Preparation of Bituminous Specimens Using Marshall Apparatus

D6927 Test Method for Marshall Stability and Flow of Asphalt Mixtures

D6931 Test Method for Indirect Tensile (IDT) Strength of Bituminous Mixtures

2.2 *AASHTO Standards:*[4]

AASHTO TP 79 Standard Method of Test for Determining the Dynamic Modulus and Flow Number for Hot Mix Asphalt (HMA) Using the Asphalt Mixture Performance Tester (AMPT)

3. Significance and Use

3.1 This practice provides an accelerated conditioning method under cyclic loading. This system is capable of operating at higher than normal temperatures and creating pore pressure within a compacted asphalt mixture to achieve an

[1] This test method is under the jurisdiction of ASTM Committee D04 on Road and Paving Materials and is the direct responsibility of Subcommittee D04.22 on Effect of Water and Other Elements on Bituminous Coated Aggregates.

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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] The last approved version of this historical standard is referenced on www.astm.org.

[4] 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.

acceleration of the effects that a mixture would experience over time from traffic at normal temperatures and conditions. The accelerated conditioning in this practice is intended to simulate the stresses induced in a wet pavement by a passing vehicle tire. The pulse shape produced by this system approximates a Lorentzian function with a half peak width of approximately 1 s at 276 kPa [40 psi].

3.2 The factors that influence the potential for moisture damage to occur include aggregate mineralogy, mixture air voids, water, cyclic applied stress, and elevated temperature. This practice provides a method and apparatus that is capable of producing three of these factors: water, stress, and high temperature. Aggregate mineralogy and air voids are mixture properties.

3.3 Specimens conditioned by this system can be tested using a variety of different tests including, Test Method D6931, Test Method D6927, bulk specific gravity difference obtained by Test Methods D6926 or D6752 for before and after conditioning, dynamic modulus, flow number, AASHTO TP 79 and visual inspection for stripped aggregates.

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 Practice D3666 are generally considered capable of competent and objective testing, sampling, inspection, etc. Users of this standard are cautioned that compliance with Practice D3666 alone does not completely assure reliable results. Reliable results depend on many factors; following the suggestions of Practice D3666 or some similar acceptance guideline provides a means of evaluating and controlling some of those factors.

4. Apparatus[5]

4.1 Balance in accordance with Test Method D2726.

4.2 Water bath capable of maintaining a temperature of 25 ± 1°C [77 ± 2°F].

4.3 System (similar to Fig. 1) having a specimen chamber capable of testing one or more specimens with diameters of 150 mm [6 in.] or less. The system should be capable of applying a cyclic pressure peak of approximately Lorentzian function in shape with a peak pressure within ±30 kPa [±4 psi] of the pressure set point and a width of the pressure peak at half maximum of 1 ± 0.5 s.

4.3.1 The system shall be equipped with appropriate valves for automatically purging (de-airing) and removing air from the specimen chamber and allowing replacement of the accessible air void spaces with water.

4.3.2 The specimen chamber shall be capable of withstanding pressures of up to 690 kPa [100 psi].

[5] The sole source of supply of the apparatus known to the committee at this time is InstroTek, Inc., 5908 Triangle Drive, Raleigh, N.C. If you are aware of alternative suppliers, please provide this information to ASTM International Headquarters. Your comments will receive careful consideration at a meeting of the responsible technical committee,[1] which you may attend.

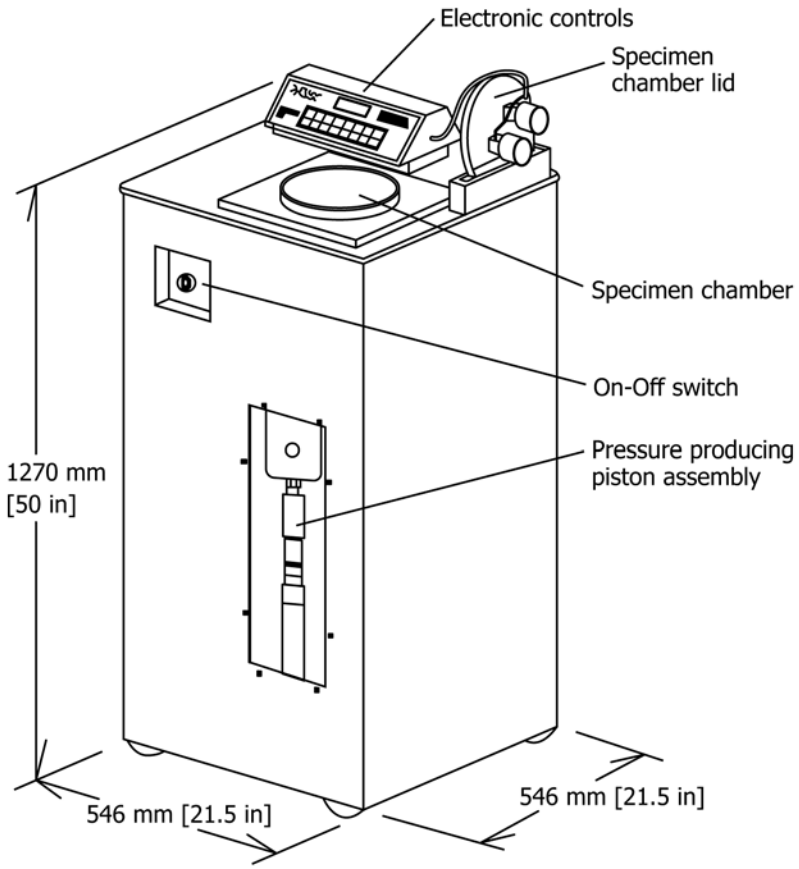

FIG. 1 Moisture Conditioning System

4.3.3 The system should be equipped with temperature controls to allow set point temperatures of between 30 and 60°C [86 to 140°F] with measurements accurate to within ±1°C [±2°F].

4.3.4 The system shall be capable of producing and controlling cyclic pressures between 200 and 420 kPa [30 to 50 psi] with measurements accurate to within ±30 kPa [±4 psi].

4.3.5 The system should be capable of applying and controlling cyclic pressure and temperature and controlling the water temperature and pressure within the enclosed specimen chamber at a desired level.

4.4 One or more containers sufficient in size to hold water and specimen(s).

5. Preparation of Test Specimens

5.1 *Preparation of Laboratory Test Specimens*

5.1.1 Prepare mixtures in batches of sufficient size to make at least three specimens for each test as specified in 5.1.2.

5.1.2 Use specimens 100 mm [4 in.] in diameter and 63 ± 2 mm [2.5 ± 0.08 in.] high or 150 mm [6 in.] in diameter and 100 ± 5 mm [4 ± 0.2 in.] high. The percent air void of each sample used for conditioning shall be in the range of 6.5 to 7.5 %. If compacting to an optimum percent air void to match compaction at the time of construction, all individual sample conditioned shall not be more than ±0.5 % different from the optimum percent air void. Average the air voids of the specimens being conditioned at one time in order to get as close to the optimum air void value of 7 % or optimum void level measured or expected in the field at the time of construction. Follow the procedures in Test Method D4867 and Practice D5361 to prepare the samples. Compact the specimens by using any one of the following: Test Method D6925, or Practices D1561, D4013, and D6926.

5.1.3 Extract the specimen from the mold and cool to room temperature.

5.2 *Preparation of Field Specimens*

5.2.1 Select a truck to be sampled in accordance with Practice D3665.

5.2.2 Secure a specimen from the truck at the plant in accordance with Practice D979.

5.2.3 Compact the specimens in accordance with 5.1.1.

6. Procedure

6.1 Follow manufacturer's recommendation for setting up the moisture conditioning system. The system shall be capable of conditioning a total of three 100 mm [4 in.] in diameter and 63 ± 2 mm [2.5 ± 0.08 in.] high or two 150 mm [6 in.] in diameter and 100 ± 5 mm [4 ± 0.2 in.] high samples.

NOTE 2—Specimens with 100 mm [4 in.] diameter may saturate quicker and condition differently than specimens with 150 mm [6 in.] diameter. Specimen size variation should be considered when comparing results for different size specimens to each other for a given asphalt mixture.

6.2 Place the first specimen in the system and fill with sufficient water at 20 to 40°C [68 to 104°F] water to cover the specimen.

6.3 Place a specimen plate on top of the specimen separator spacers. Specimen separator spacers are used to ensure proper separation between specimens. Place the second specimen on top of the specimen plate (see Fig. 2). Specimen shall not be stacked directly on top of each other at anytime during or after the conditioning process.

6.4 Pour sufficient water in the system to cover the second specimen. Water temperature should be less than the test temperature.

6.5 Repeat section 6.4 and 6.5 if conditioning three specimens at one time (see Fig. 3).

6.6 Fill the specimen tank with water and secure the lid. Water temperature should be less than the test temperature.

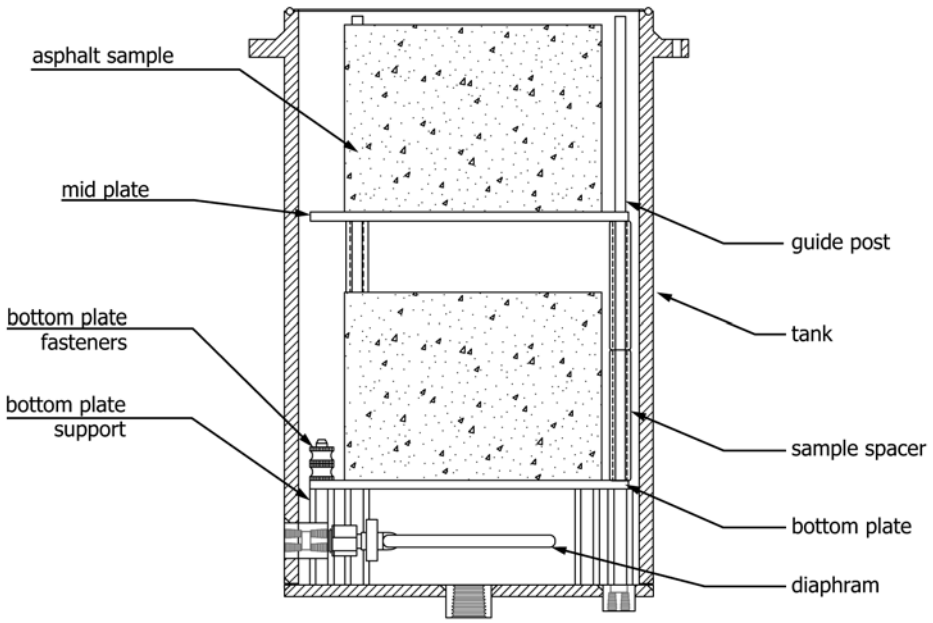

FIG. 2 Two Sample Configuration

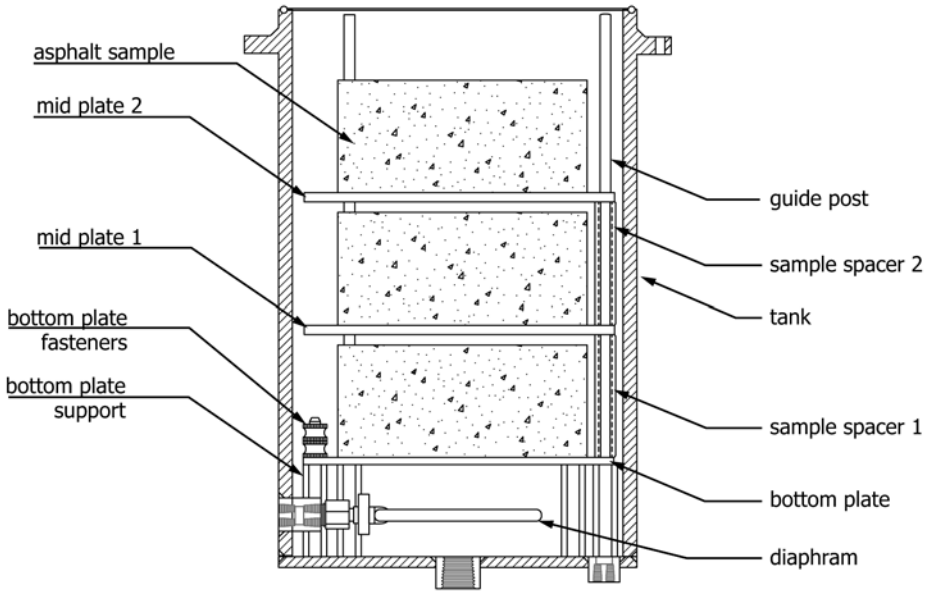

FIG. 3 Three Sample Configuration

6.7 Partially fill both of the overfill cups on the lid in order to replenish the chamber with water during the de-airing process. De-airing will continue periodically throughout the conditioning process. The overfill cups are necessary to ensure water is supplied to the system, as air is pushed (pumped) out of the specimen(s) during pore pressure generation.

6.8 Set number of cycles to 3500.

6.9 Set Pressure to 40 psi.

6.10 For mixtures containing PG high temperature grades higher than 60, set the temperature to 60°C.

6.11 For mixture with PG high temperature grades less than 60 and all Warm Mix Asphalt (WMA) mixtures, set temperature to 50°C.

6.12 Allow the system to heat the water and the specimen(s) in the specimen chamber to the set point temperature, to initiate the pressure cycle operation and complete the conditioning process. These steps should be automatically controlled and performed by the system within the specified limits.

6.13 When the cycling process is completed, open the drain valve and allow all water to drain. This step shall be performed automatically by the system or manually a maximum of 20 min after the cycling process is completed.

6.14 Remove the lid.

6.15 Close the drain valve, after all water has been drained from the chamber.

6.16 Pour sufficient tap water, 18 to 27°C [65 to 80°F], in the specimen chamber to cover the specimen(s). This will help reduce the specimen(s) temperature and to ensure the specimen(s) do not fall apart during removal from the chamber.

6.17 Allow 2 to 3 min for the specimens to cool. Open the drain valve and allow the water to drain out.

6.18 Carefully remove the specimen(s) from the specimen chamber and place the specimen(s) in a water container capable of maintaining a temperature of 25 ± 1°C [77 ± 2°F] for 2 to 3 h. Specimens shall not be stacked or placed directly on top of each other, during loading, unloading and conditioning process.

NOTE 3—When conducting fundamental, mechanical and tensile strength tests to determine the sensitivity of the mixture to moisture damage and relative change in sample properties from before to after conditioning. the test should be started no longer than six hours after the completion of the conditioning by this practice.

7. Keywords

7.1 antistripping additives; asphalt concrete paving mixtures; cyclic stress; moisture; moisture conditioning; pore pressure; tensile strength; water