Designation: D6925 – 15

Standard Test Method for Preparation and Determination of the Relative Density of Asphalt Mix Specimens by Means of the Superpave Gyratory Compactor[1]

This standard is issued under the fixed designation D6925; 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 test method covers the compaction of asphalt mix into cylindrical specimens using the Superpave Gyratory Compactor (SGC). This standard also refers to the determination of the relative density of the compacted specimens at any point in the compaction process. Compacted specimens are suitable for volumetric, physical property, and mechanical testing. Smaller specimens may be cut from the compacted cylindrical specimen for specific test specimen geometry requirements. The compaction procedures apply to Laboratory Mix Laboratory Compacted (LMLC) and Plant Mix Laboratory Compacted (PMLC) asphalt mix.

1.2 The values stated in SI units are to be regarded as standard. The value given in degrees for the angle of gyration is a mathematical conversion from the SI units and is provided for information regarding the commonly used unit of degree.

1.3 *The text of this test method 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]

D8 Terminology Relating to Materials for Roads and Pavements
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
D4402 Test Method for Viscosity Determination of Asphalt at Elevated Temperatures Using a Rotational Viscometer
D4753 Guide for Evaluating, Selecting, and Specifying Balances and Standard Masses for Use in Soil, Rock, and Construction Materials Testing
D6752/D6752M Test Method for Bulk Specific Gravity and Density of Compacted Bituminous Mixtures Using Automatic Vacuum Sealing Method
D6857/D6857M Test Method for Maximum Specific Gravity and Density of Bituminous Paving Mixtures Using Automatic Vacuum Sealing Method
D7115 Test Method for Measurement of Superpave Gyratory Compactor (SGC) Internal Angle of Gyration Using Simulated Loading
E2251 Specification for Liquid-in-Glass ASTM Thermometers with Low-Hazard Precision Liquids

2.2 *AASHTO Standards:*[3]

PP35 Provisional Practice for Evaluation of Superpave Gyratory Compactors (SGCs)
PP76 Standard Practice for Troubleshooting Asphalt Specimen Volumetric Differences between Superpave Gyratory Compactors (SGCs) Used in the Design and the Field Management of Superpave Mixtures
R30 Standard Practice for Mixture Conditioning of Hot Mix Asphalt (HMA)
R35 Standard Practice for Superpave Volumetric Design for Hot Mix Asphalt (HMA)

[1] This test method is under the jurisdiction of ASTM Committee D04 on Road and Paving Materials and is the direct responsibility of Subcommittee D04.20 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.

R47 Standard Practice for Reducing Samples of Hot Mix Asphalt (HMA) to Testing Size
T312 Standard Method of Test for Preparing and Determining the Density of Hot-Mix Asphalt (HMA) Specimens by Means of the Superpave Gyratory Compactor[3]

2.3 *Other References:*

ASME B46.1 Surface Texture (Surface Roughness, Waviness, and Lay)[4]
Asphalt Institute MS-2 Mix Design Methods for Asphalt Concrete[5]

3. Terminology

3.1 This test method uses terms as defined by Terminology D8.

3.2 *Definitions of Terms Specific to This Standard:*

3.2.1 *lab mix lab compacted (LMLC) asphalt mixture, n*—asphalt mix samples that are prepared in the laboratory by weighing and blending each constituent then compacting the blended mixture using a laboratory compaction apparatus.

3.2.1.1 *Discussion*—LMLC typically occurs during the asphalt mixture design phase. Laboratory compaction devices such as the Superpave Gyratory Compactor, Marshall Hammer or other laboratory compaction devices may be used.

3.2.2 *plant mix laboratory compacted (PMLC) asphalt mixture, n*—asphalt mixture 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. The asphalt mixture is not permitted to cool substantially and it may be necessary to place the mixture in a laboratory oven to equilibrate the mixture to the compaction temperature before molding. Laboratory compaction devices such as the Superpave Gyratory Compactor, Marshall Hammer or other laboratory compaction devices may be used.

3.2.3 *reheated plant mix lab compacted (RPMLC) asphalt mixture, n*—asphalt mixture 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*—RPMLC are often used for acceptance and verification testing. The reheating time should be as short as possible to obtain uniform temperature to avoid artificially aging the specimens. Asphalt mixture conditioning, reheat temperature, and reheat time should be defined in the applicable specification. Laboratory compaction devices such as the Superpave Gyratory Compactor, Marshall Hammer, or other laboratory compaction devices may be used.

4. Significance and Use

4.1 This test method is used to prepare specimens for determining the volumetric and physical properties of compacted asphalt mix.

4.2 This test method is useful for monitoring the density of test specimens during the compaction process. This test method is suited for the laboratory design, field control of asphalt mix, forensics, imaging, and visualization of compacted asphalt mix.

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 standard are cautioned that compliance with Specification D3666 alone does not completely assure reliable results. Reliable results depend on many factors; following the suggestions of Specification D3666 or some similar acceptable guideline provides a means of evaluating and controlling some of those factors.

5. Apparatus

5.1 *Superpave Gyratory Compactor*—An electromechanical, electro-hydraulic, or electro-pneumatic compactor comprised of the following system components: *(1)* reaction frame, and drive system, *(2)* loading system, loading ram, and pressure indicator, and *(3)* recording system for height measurement and number of gyrations.

5.1.1 The reaction frame shall provide a structure against which the compaction pressure can be applied when compacting specimens.

5.1.2 The compactor shall be designed to gyrate the mold at a constant angle of gyration during the compaction process. An internal angle of gyration of 20.25 ± 0.35 mrad (1.16 ± 0.02°) as determined by Test Method D7115 shall be utilized.

NOTE 2—Research has shown external angle (measurement between the external mold wall and the frame of the compactor) to be different from the internal angle (measurement between internal mold wall and top and bottom plate). The difference between these measurements varies for different types of compactors. Some discrepancies in relative density have been resolved by use of the internal angle. If the external angle is chosen for operation the recommendation is to use an external angle of 21.82 ± 0.435 mrad (1.25 ± 0.02°).

5.1.3 The gyration drive system shall be capable of gyrating the specimen at a rate of 30.0 ± 0.5 revolutions per minute. The system shall be capable of gyrating the specimen 250 gyrations.

5.1.4 The loading system, ram, and force indicator shall be capable of providing and measuring a constant vertical force to provide an applied pressure of 600 ± 60 kPa during the first five gyrations, and 600 ± 18 kPa during the remainder of the compaction process. The applied pressure is defined as the applied force divided by the area of the nominal mold diameter (150 mm).

NOTE 3—The report on the ruggedness evaluation of AASHTO TP4 (T312)[6] indicated that the pressure tolerance of ±18 kPa resulted in significantly different values of bulk specific gravity of the compacted specimens (G_{mb}) in some cases. However, since the pressure is directly set at 600 kPa, the tolerance of ±18 kPa should apply only to the ability of the SGC to maintain vertical pressure during compaction. To minimize potential errors caused by pressure, operators should take care during verification of calibration to assure that the specified pressure has been attained.

[4] Available from American Society of Mechanical Engineers (ASME), ASME International Headquarters, Two Park Ave., New York, NY 10016-5990, http://www.asme.org.

[5] Available from Asphalt Institute, 2696 Research Park Dr., Lexington, KY 40511, http://www.asphaltinstitute.org.

[6] The Superpave Gyratory Compactor, McGennis, R; Kennedy, TW; Anderson, VL; Perdomo, D, Journal of the Association of Asphalt Paving Technologists Vol: 66