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Standard Test Method for Thickness or Height of Compacted Bituminous Paving Mixture Specimens[1]

This standard is issued under the fixed designation D 3549; 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] This test method is under the jurisdiction of ASTM Committee D04 on Road and Paving Materials and is the direct responsibility of Subcommittee D04.21 on Specific Gravity and Density of Bituminous Mixes.

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1. Scope

1.1 This test method covers determination of the thickness (or height) of compacted bituminous paving mixture specimens.

1.2 *This standard does not purport to address all of the safety problems, 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:*

D 1188 Test Method for Bulk Specific Gravity and Density of Compacted Bituminous Mixtures Using Paraffin-Coated Specimens[2]

D 2726 Test Method for Bulk Specific Gravity and Density of Non-Absorptive Compacted Bituminous Mixtures ~~Using Saturated Surface-Dry Specimens~~[2]

D 3203 Test Method for Percent Air Voids in Compacted Dense and Open Bituminous Paving Mixtures[2]

D 3666 Specification for Minimum Requirements for Agencies Testing and Inspecting ~~Bituminous~~ Road and Paving Materials[2]

3. Significance and Use

3.1 The thickness of a compacted bituminous paving mixture is often used as a construction check to insure that the proper quantity of materials has been placed on a project and to correct strength measurement on constant diameter specimens with varying heights.

NOTE 1—The equipment and personnel performing this test method can be evaluated by Practice D 3666.

4. Apparatus

4.1 Any of the following apparatus may be used to measure the thickness of test specimens:

NOTE 2—In addition to direct measurement, the thickness of test specimens may be determined as described in 6.3.

4.1.1 A metal tape or rule.

4.1.2 A set of calipers.

4.1.3 A measurement jig or other device, fabricated in such a manner that it is capable of measuring specimen thicknesses in accordance with this procedure.

4.2 Depending upon the requirements of the specifying agency, the units of measurement and subdivisions shall be as follows:

4.2.1 Where inches and fractional portions are specified, the apparatus shall be capable of measuring to 1/16 in.

4.2.2 Where inches and decimal portions are specified, the apparatus shall be capable of measuring to 0.05 in.

4.2.3 Where decimal portions of feet are specified, the apparatus shall be capable of measuring to 0.005 ft.

4.2.4 Where centimetres are specified, the apparatus shall be capable of measuring to 0.10 cm.

5. Test Specimens

5.1 Test specimens shall be laboratory compacted or from compacted bituminous pavements.

[2] *Annual Book of ASTM Standards*, Vol 04.03.

5.2 Pavement test specimens shall be taken with a core drill, diamond or carborundum saw, or by other suitable means.

5.2.1 Thickness measurements shall not be made on any specimen that has been distorted or cracked in removal from the pavement, ~~or~~ laboratory compaction molds, or during storage prior to measuring.

5.2.2 Specimens shall be free of foreign materials such as seal coat, foundation material, soil, paper, or foil.

5.2.3 Where desirable, specimens may be separated from other layers by sawing, shearing or other suitable means, provided a well defined construction plane is achieved.

6. Procedure

6.1 Thickness of specimens with relatively plane horizontal surfaces or layers with well defined, uniform lines of demarcation may be measured with a tape, rule, or calipers in accordance with the following:

6.1.1 Measure the thickness of the specimen or layer using any of the apparatus described in 4.1 to the closest applicable interval described in 4.2. Make thickness measurements approximately perpendicular to the upper plane of the specimen. Measure between upper and lower surfaces, between a well-defined construction demarcation line and either the upper or lower surface, or between two well-defined construction demarcation lines.

6.1.2 Make four measurements at approximately quarter points on the periphery of cores or at the approximate midpoint of each of the four sides of rectangular, sawed specimens. Record the average of these measurements as the thickness of the specimen.

6.2 The average thickness of specimens with relatively plane horizontal surfaces may be measured by means of measurement jig or other suitable device, provided the device yields results consistently within ± 0.05 in. (± 0.13 cm) of those obtained in accordance with 6.1.

6.3 Specimens of dense bituminous paving mixtures (less than 10 % air voids) with uniform vertical boundaries may have the thickness determined by dividing the volume of the specimen by its cross-sectional area in accordance with the following procedure:

NOTE 3—Examples are laboratory-compacted test specimens prepared for Marshall test and pavement cores or specimens cut with diamond core drills or diamond rotary saw blades.

NOTE 4—Specimens cut from the pavement with hand-held or power-operated chisels should be trimmed by abrasion or diamond sawing to remove any distorted areas prior to measuring.

6.3.1 Determine the area in square centimetres of a horizontal plane through the specimen approximately equidistant from the upper and lower surface and approximately perpendicular to the vertical sides of the specimen.

6.3.2 Determine the volume in cubic centimetres of the specimen by either Test Method D 1188 or Test Method D 2726.

NOTE 5—In referring to Test Methods D 1188 or D 2726,

$$\text{Volume} = \frac{D - E - (D - A)/F}{1} \text{ or } \frac{B - C}{1} \quad (1)$$

where the denominator is the density of water in g/cm ^{3} or mg/m^3, which for the purpose of this test is considered to be unity.

6.3.3 Calculate the average thickness of the specimen as follows:

$$\text{Thickness, cm} = \frac{\text{volume (cm}^3\text{)}}{\text{area (cm}^2\text{)}} \quad (2)$$

7. Report

7.1 Report the thickness (or height) of the specimen as the average thickness determined by any of the procedures described in 6.1 through 6.3. Report to the closest applicable interval described in 4.2.

7.2 Indicate on the report which of the three procedures was used to determine the thickness, that is, measurement by tape, rule, or calipers (6.1), measurement jig (6.2), or calculated from volume/area (6.3).

8. Precision

8.1 ~~*Precision*—No measurement precision data is presently available for this test method.~~

~~NOTE 6—Table 1 is a summary of data from studies reported by more than twelve user agencies and is presented here for information only. Documenting data are on file at ASTM Headquarters.~~

English Units

8.2 *SI Units*

8.3 *Bias*—Since there is no accepted reference material suitable for determining the bias for this test method, no statement on bias is given.

Test and Type Index	Standard Deviation, Inches (1s)	Acceptable Range of Two Test Results, Inches (d2s)
Diameter Measurements[A]		
Single-operator precision	0.007	0.021
Multilaboratory precision	0.010	0.027
Height Measurements[B]		
Single-operator precision		
Marshall SMA[C]	0.009	0.026
Gyratory	0.004	0.011
Cores	0.023	0.064
Multilaboratory precision		
Marshall SMA	0.013	0.037
Gyratory	0.016	0.047
Cores	0.044	0.125

[A] Fifteen operators, using a range of measurement devices (excluding jigs) measured the diameter of 5 samples (2 cores, 2 gyratory compacted samples, and 1 Marshall-compacted stone matrix asphalt mix).
[B] Twenty operators, using a range of measurement devices (excluding jigs) measured the heights of the same samples.
[C] SMA: Stone Matrix Asphalt.

Test and Type Index	Standard Deviation, mm (1s)	Acceptable Range of Two Test Results, mm (d2s)
Diameter Measurements[A]		
Single-operator precision	0.178	0.503
Multilaboratory precision	0.254	0.718
Height Measurements[B]		
Single-operator precision		
Marshall SMA[C]	0.229	0.648
Gyratory	0.102	0.288
Cores	0.584	1.652
Multilaboratory precision		
Marshall SMA	0.330	0.933
Gyratory	0.406	1.148
Cores	1.118	3.162

[A] Fifteen operators, using a range of measurement devices (excluding jigs) measured the diameter of 5 samples (2 cores, 2 gyratory compacted samples, and 1 Marshall-compacted stone matrix asphalt mix).
[B] Twenty operators, using a range of measurement devices (excluding jigs) measured the heights of the same samples.
[C] SMA: Stone Matrix Asphalt.

APPENDIX

(Nonmandatory Information)

X1. BITUMINOUS PAVEMENT THICKNESS VARIABILITY DATA

TABLE X1.1 Bituminous Pavement Thickness Variability
Grouped Data from a Number of Reports

Thickness Range, in.	Standard Deviation	Coefficient of Variation, %
1.0 to 1.9	0.21	14.7
2.0 to 2.9	0.29	13.0
3.0 to 3.9	0.37	11.3
4.0 to 4.9	0.53	12.5
6.0	0.75	12.5