ASTM

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Standard Test Method for
Calculating Percent Asphalt Absorption by the Aggregate in an Asphalt Pavement Mixture[1]

This standard is issued under the fixed designation D 4469; 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 provides equations for calculating percent asphalt absorption by the aggregate in an asphalt paving mixture, expressed as percent of the oven-dry mass of the aggregate in the paving mixture. This calculation is based on measured values for components and properties of an oven-dry asphalt paving mixture.

1.2 *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:*
C 127 Test Method for Specific Gravity and Absorption of Coarse Aggregate[2]
C 128 Test Method for Specific Gravity and Absorption of Fine Aggregate[2]
C 136 Test Method for Sieve Analysis of Fine and Coarse Aggregates[2]
D 1559 Test Method for Resistance to Plastic Flow of Bituminous Mixtures Using Marshall Apparatus[3]
D 1560 Test Method for Resistance to Deformation and Cohesion of Bituminous Mixtures by Means of Hveem Apparatus[3]
D 2041 Test Method for Theoretical Maximum Specific Gravity of Bituminous Paving Mixtures[3]
D 2172 Test Methods for Quantitative Extraction of Bitumen from Bituminous Paving Mixtures[3]
D 3289 Test Method for Specific Gravity or Density of Semi-Solid and Solid Bituminous Materials by Nickel Crucible[3]

3. Summary of Test Method

3.1 The percent asphalt absorption for an oven-dry paving mixture (expressed as percent of the oven dry mass of the total aggregate in the paving mixture) can be calculated by means of equations in which measured values for the theoretical maximum specific gravity of an oven-dry paving mixture, its asphalt content (expressed either as percent of the total mass of a sample of oven-dry paving mixture, or as percent of the mass of oven-dry aggregate in a sample of oven-dry paving mixture), the apparent specific gravity of the asphalt and the weighted average ASTM bulk specific gravity of the oven-dry total aggregate in the paving mixture (Note 1), has been substituted.

NOTE 1—Whenever it is referred to in this test method, the phrase, "weighted average ASTM oven-dry bulk specific gravity of the aggregate," refers to the weighted average of the ASTM oven-dry bulk specific gravities of the coarse and fine aggregates as determined by Test Methods C 127 and C 128. The fine aggregate ordinarily includes the mineral dust portion of the fine aggregate that passes the No. 200 sieve. The weighted average ASTM oven-dry bulk specific gravity of the total aggregate is to be calculated by means of the equation given in the calculation section of Test Method C 127.

4. Significance and Use

4.1 The amount of asphalt absorbed by the aggregate contributes little or nothing to the durability of an asphalt pavement in service other than possibly providing greater resistance to stripping in the presence of water.

4.2 Percent asphalt absorption can be an indicator of changes that may occur in plant mix production during construction.

4.3 The calculated percent asphalt absorption can be used for calculating percent air voids during paving mixture design.

5. Procedure

5.1 Determine percent asphalt absorption by the aggregate in a paving mixture for a sample of oven-dried paving mixture that is prepared in a laboratory, taken from a pavement, or obtained for quality control during construction.

5.2 Establish percent asphalt absorption by the aggregate in a sample of oven-dried paving mixture from values for the sample that have been obtained in accordance with the following ASTM test methods:

5.2.1 Test Method D 2041, theoretical maximum specific gravity of the sample of oven-dry paving mixture.

5.2.2 Test Methods D 2172, asphalt content. For samples of paving mixture obtained for quality control during construction, or taken from a pavement, determine the asphalt content

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of each sample by Test Methods D 2172. For samples of hot-mixed asphalt paving mixture prepared in the laboratory with oven-dried aggregate according to Test Methods D 1559 and D 1560, use the asphalt content that was added during the preparation of the paving mixture.

5.2.3 Test Method D 3289, the apparent specific gravity of the asphalt in the sample of paving mixture.

5.2.4 Test Methods C 127 and C 128, the respective ASTM dry bulk specific gravities of the coarse and fine aggregates in the sample of paving mixture.

5.2.5 Test Method C 136, to establish the percentages of coarse and fine aggregates employed for or recovered from the sample of paving mixture, and thereby enable the weighted average ASTM oven-dry bulk specific gravity for the total aggregate in the sample of paving mixture to be calculated (using the equation given in the calculation section of Test Method C 127).

6. Calculation

6.1 *Paving Mixtures for Which Asphalt Content is Expressed as Percent by Mass of the Total Mix in a Sample of Oven-Dry Paving Mixture*:

6.1.1 When the values for the various items in 5.2 become available, calculate the asphalt absorption as percent of the oven-dry mass of the total aggregate in the sample of ovendry paving mixture, by substituting the relevant values in the following equation:

$$Aac = 100\left[\frac{P_{tac}}{100 - P_{tac}} + \frac{G_{ac}}{G_{ag}} - \frac{100G_{ac}}{(100 - P_{tac})G_{tm}}\right] \quad (1)$$

where:
Aac = absorbed asphalt as percent by mass of the oven-dry aggregate.
P_{tac} = asphalt content as percent by mass of the total mix in the sample of oven-dry paving mixture.
G_{ac} = apparent specific gravity of the asphalt in the paving mixture sample.
G_{ag} = weighted average ASTM oven-dry bulk specific gravity of the total aggregate in the sample of paving mixture.
G_{tm} = theoretical maximum specific gravity of the sample of oven-dry paving mixture.

6.2 *Paving Mixtures for Which Asphalt Content is Expressed as Percent of the Mass of the Oven-Dry Total Aggregate in a Sample of Oven-Dry Paving Mixture*.

6.2.1 When the values for the various items in 5.2 become available, calculate the asphalt absorption as percent of the oven-dry mass of the aggregate in the sample of oven-dry paving mixture by substituting the relevant values in the following equation:

$$Aac = 100\left[\frac{P_{aac}}{100} + \frac{G_{ac}}{G_{ag}} - \frac{(100 + P_{aac})(G_{ac})}{100\,G_{tm}}\right] \quad (2)$$

where:
P_{aac} = asphalt content as percent of the mass of the oven-dry total aggregate in a sample of oven-dry paving mixture.
and = the other symbols have the significance designated for them in 6.1.1.

NOTE 2—The calculated percent asphalt absorption increases with an increase in theoretical maximum specific gravity of a paving mixture, increases with an increase in its asphalt content, decreases with an increase in the apparent specific gravity of the asphalt, and decreases with an increase in the total aggregate's weighted average ASTM oven-dry bulk specific gravity.

7. Report

7.1 Report asphalt absorption as percent of the oven-dry mass of the total aggregate in the sample of oven-dry paving mixture to the nearest 0.1 %.

7.2 Report the value for each of the four variables that are included either in Eq 1 or Eq 2 as follows:

7.2.1 Theoretical maximum specific gravity of the ovendry sample of paving mixture.

7.2.2 Asphalt content as percent of the mass of the oven dry sample of paving mixture, Eq 1, or asphalt content as percent of the mass of the oven-dry total aggregate in a sample of oven-dry paving mixture, Eq 2.

7.2.3 Apparent specific gravity of the asphalt in the sample of paving mixture.

7.2.4 Weighted average ASTM oven-dry bulk specific gravity for the total aggregate in the sample of paving mixture.

8. Precision and Bias

8.1 Both Eq 1 and Eq 2 for calculating asphalt absorption as percent of the mass of oven-dry aggregate in a sample of oven-dry paving mixture are mathematically exact.

8.2 The precision of the reported value for percent asphalt absorption depends on the accuracy of the value measured for each of the four variables that are included in either Eq 1 or Eq 2. Errors in these measured values can have a major influence on the value for percent asphalt absorption. The influence of these errors on the calculated value for percent asphalt absorption is illustrated by the data in X1.2.1 in Appendix X1.

8.3 The precision and bias of the referenced standards may be found by referring to each individual standard.

9. Keywords

9.1 aggregate-asphalt absorption; asphalt absorption; asphalt mixture