Standard Test Method for Determining the Percent Asphalt Required for Coating Aggregates Used in Cold Mix Patching Materials

AASHTO DESIGNATION: TP40-94[1, 2] (Reapproved 1996)

1. Scope

1.1 This method covers the determination of the percent asphalt required for cold mix patching materials based on a coating test.

1.2 This method is applicable to cold mix patching materials that will be stockpiled, subjected to various climatic conditions, and later retrieved for use in roadway patching operations.

1.3 This test may involve hazardous materials, operations, and equipment. This standard does not purport to address all of the safety problems 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 AASHTO Standards:

T2	Sampling Aggregates
T40	Sampling Bituminous Materials
T195	Degree of Particle Coating of Bituminous Aggregate Mixtures
T248	Reducing Field Samples of Aggregate to Testing Size
PP21	Testing and Evaluating Cold Mix Patching Materials

2.2 ASTM Standards

D8	Standard Definition of Terms Relating to Materials for Roads and Pavements
D3665	Random Sampling of Construction Materials

3. Terminology

- Definitions for terms used in this standard may be found in ASTM D8 or a standard unabridged dictionary.

4. Summary of Method

4.1 This standard contains a coating test that determines the residual asphalt content needed for Cold Mix Materials intended for winter and spring roadway patching.

4.2 Samples of the aggregate are dried, mixed with different percentages of the asphalt binder, cured, and the percentage of aggregate coated determined for each mixture. The minimum asphalt binder content yielding 90 percent aggregate coating is determined and this value is designated to be the minimum asphalt binder content based on the coating test.

5. Significant and Use

5.1 Use the residual asphalt content required to yield 90 percent coating of the aggregate, as determined by this standard, to generate information needed for the cold mix design and to evaluate the relative quality of cold mix materials.

5.2 When used in conjunction with other cold mix physical properties, the coating test contributes to the overall cold mix characterization and is one factor for determining cold mix suitability for highway patching under given environmental conditions.

5.3 This standard is applicable to cold mixes manufactured with modified or unmodified asphalt emulsions, cutback asphalts, or combinations.

6. Interferences

[1] This standard is based on SHRP Product H-348.

[2] Approved in October 1994, this provisional standard was first published in March 1995.

6.1 Differences in the residual asphalt binder will affect the coating test values.
6.2 Test procedure variances can affect the values obtained. Careful adherence to the standard procedure will decrease the likelihood of differences caused by departures from test parameters.

7. Apparatus

7.1 Mixing bowl and mixing utensils suitable for mixing 2 kg aggregate samples with asphalt binder materials.

7.2 Oven capable of maintaining temperature of 60 ± 2°C.

7.3 Oven capable of maintaining a temperature of 96 ± 2°C.

7.4 A balance with a capacity of 3 kg or more and sensitive to ± 1.0 g.

7.5 Equipment required for quantifying the degree of aggregate particle coating with asphalt binder residue as specified in T195.

7.6 Containers for drying laboratory samples of aggregate.

8. Materials - A supply of absorbent paper.

9. Standardization

9.1 Verify calibration of the ovens. A standard ASTM thermometer with 0.1°C markings is suitable for verification.

9.2 Verify calibration of the balance. Standardized masses are suitable for verification.

10. Hazards

10.1 Observe standard laboratory safety precautions when preparing and testing cold mix asphalt test specimens.

10.2 Cutback asphalt having a flash point of less than 100°C (212°F) when used in mixtures, shall not be subjected to accelerated curing in the oven with a temperature setting of 100°C (212°F). Use of gas ovens with open flame is prohibited. Any deviation from this requirement will cause a fire or explosion. These requirements are specially applicable to 12.3.2.2.

11. Sampling, Test Specimens, and Test Units

11.1 Obtain field samples in accordance with ASTM D3665.

11.2 Aggregates.

11.2.1 Sample the proposed aggregate source, with the specified gradation which is intended for use, in accordance with T2.

11.2.2 Assure that the field sample complies with the gradation required for cold mix production. Obtain laboratory samples from the field sample by reducing the field sample of aggregate to a series of laboratory test samples(10 recommended) massing 2 ± 0.1 kg each in accordance with T248.

11.3 Asphalt Binder.

11.3.1 Sample Asphalt Binders in accordance with T40.

12. Procedure

12.1 Aggregate.

12.1.1 Place each of the 2 ± 0.1 kg laboratory samples of aggregate into a container suitable for drying.

12.1.2 Place the containers of aggregate in an oven preheated to 60 ± 2°C for drying.

12.1.3 Stir the samples occasionally to prevent formation of lumps.

12.1.4 Dry the samples to a constant mass.

12.1.5 Determine and record the mass, to the nearest 1 g, of each of the aggregate samples after drying is completed.

12.2 Mixing

12.2.1 Place one of the aggregate samples into the mixing container and pour a measured quantity of the asphalt binder, equal to approximately 4.0 percent asphalt residue by mass of the total mix, into the

container with the aggregate. Determine the quantity of binder from the first line of Table 1.

12.2.2 Mix the aggregate and binder until the binder is thoroughly dispersed throughout the mixture.

12.2.3 Line a curing container with absorbent paper and spread the mixture into the lined container.

12.3 Curing

12.3.1 Emulsions.

12.3.1.1 Place the lined container and mixture in an oven which has been preheated to 96 ± 2°C. Cure the mix in the oven until all water(and solvents, if present) have evaporated.

12.3.1.2 Alternatively, the lined container and mixture may be cured at room temperature. When this option is used, cure the mix until all water(and solvents, if present) have evaporated.

12.3.2 Cutbacks.

12.3.2.1 Place the lined container and mixture under a fume hood and cure at room temperature. Cure the mix until all solvents(and water if present) have evaporated.

12.3.2.2 Alternatively, if the flashpoint of the cutback allows, the curing process may be accelerated by placing the lined container and mixture in an oven which has been preheated to 96 ± 2°C. Cure the mix in the oven until all solvents(and water, if present) have evaporated because of the hazard noted in 10.2, when the cutback flashpoint is 100°C or less, do not use this alternate.

12.4 Coating percent.

12.4.1 When the mixture is cured, determine and record the percentage of aggregate covered with residual asphalt in accordance with the applicable Sections of ASTM T195.

12.5 Place the second aggregate sample into the mixing container and pour a measured quantity of the asphalt binder, equal to approximately 4.5 percent asphalt residue by mass of the total mix, into the container with the aggregate. Determine this quantity of binder from line 2 of Table 1. Process the sample as indicated in Sections 12.2.2 through 12.4.1.

12.6 Process each of the remaining laboratory aggregate samples in accordance with Section 12.5, modified to increase the asphalt residue percentage by ½ percent for each subsequent sample. Determine these quantities of binder from line 3 etc. of Table 1. If a mixture becomes rich at any asphalt content because of excessive asphalt, do not mix samples with any higher residual asphalt content.

13. Calculations

13.1 Enter, in Table 1, line R, the residual asphalt factor, in percent, determined from specification tests performed on the binder used for the coating test.

13.2 Calculate the binder(emulsion or cutback) percentage used for each sample mix and enter in Table 1, Column B.

13.3 Enter the mass of aggregate(g) used for each mix sample in Table 1, Column C and Table 2, Column C.

13.4 Calculate the aggregate mass plus the target residual asphalt mass (total g) and enter in Table 1, Column D.

13.5 Calculate the total binder mass in grams to be added to each sample mix and enter in Table 1, Column E, and in Table 2, Column B.

13.6 Enter the residual asphalt target content from Table 1, Column A, into Table 2, Column A for the number of mix samples processed to completion.

13.7 Calculate the residual asphalt percent by mass of final mix(aggregate + Residual asphalt), and enter in Table 2, Column D.

13.8 Enter the percent coating values for each mix sample, as determined in Section 12.4, into Table 2, Column E.

13.9 Determine, by inspection of Columns D and E in Table 2, the lowest residual asphalt percent at which the coating value is 90 percent or greater and enter that value in line F.

13.10 Determine, by inspection of Column B in Table 1, the percent of total binder that corresponds to the value entered on line F, and enter on line G.

14. Report

14.1 Report the following information as a minimum.

14.1.1 Source of aggregate samples.

14.1.2 Aggregate gradation.

14.1.3 Source of binder sample.

14.1.4 Type of binder(emulsion, cutback, etc.)

14.1.5 Table 2 including line F and G(or all data included therein).

15. Precision and Bias

15.1 Precision - The research required to develop precision values has not been conducted.

15.2 Bias - The research required to establish the bias of this method has not been conducted.

16. Keywords - Cold mix asphalt; aggregate coating test; cold mix design test.

Table 1. Laboratory Worksheet Data.

Binder residual factor from specification testing: _____(R percent)

(A) Residual Asphalt Content Target Percent	(B) Binder Content Percent (A/R)	(C) Aggregate Mass g	(D) Aggregate Mass + Residual Asphalt Mass g (C×A)+C	(E) Binder Mass-g (D × B)
4.0				
4.5				
5.0				
5.5				
6.0				
6.5				
7.0				
7.5				
8.0				

Table 2. Report on Coating Test.

(A) Residual Asphalt Content Target Percent	(B) Binder Mass Added to Sample g-from Table 1 Column E	(C) Aggregate Mass g	(D) Resid. Asphalt Percent by Mass of Final Mix-g $\frac{R \times B}{(R \times B)+C}$	(E) Percent Aggregate Particle Coating
4.0				
4.5				
5.0				
5.5				
6.0				
6.5				
7.0				
7.5				
8.0				

Minimum percent residual asphalt for 90 percent or greater coating (derived from Column 4 and 5, Table 2): _____(F)

Minimum percent total binder material corresponding to F (obtained from Table 1, Column 2):_____(G)