Quantitative Extraction of Asphalt Binder from Asphalt Mixtures

ASTM D2172/D2172M – 17e1

4. Significance and Use

4.1 All of these test methods can be used for quantitative determinations of asphalt binder in asphalt mixtures and pavement samples for specification acceptance, service evaluation, control, and research. Each method prescribes the solvent or solvents and any other reagents that can be used in the test method.

NOTE 2—Further testing of the asphalt mixture may be performed by using sieve analysis on the extracted aggregate, Test Method D5444, or recovering the extracted asphalt binder from solution by Test Method D1856, Practice D5404/D5404M, or Practice D7906 for asphalt binder property testing. When recovering the asphalt binder for property testing, all mineral matter should be removed from the effluent.

NOTE 3—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 ensure 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 *Oven,* capable of maintaining the temperature at 110 ± 5 °C [230 ± 9 °F] .....

5.2 *Pan,* large enough that the asphalt mixture can be spread out in a thin layer over the bottom of the pan.....

5.3 *Balance,* readable to 0.1 g, and capable of measuring the mass of sample and container. The balance shall conform to the requirement of Guide D4753, Class GP2.....

5.4 *Analytical Balance,* readable to 0.001 g and capable of measuring the mass of the sample and container.....

5.5 *Electric Hot Plate,* thermostatically controlled, of sufficient dimensions and heat capacity to permit evaporating or refluxing of the solvent.....

5.6 *Small-Mouth Graduate Container,* 1000- or 2000-mL capacity. Optional small-mouth graduate, 100-mL capacity.....

5.7 *Ignition Dish,* 125-mL capacity.....

5.8 *Desiccator,* a container with a lid of sufficient size to hold the ignition dish on a perforated drying rack above the top level of the desiccant. The lid should form a good seal around the top of the container so that air movement between the container and the atmosphere is prevented.....

6. Reagents

6.1 *Purity of Reagents*—Reagent grade chemicals shall be used in all tests.....

Unless otherwise indicated, it is intended that all reagents shall conform to the specifications of the Committee on Analytical Reagents of the American Chemical Society, where such specifications are available. Other grades may be used, provided it is first ascertained that the reagent is of sufficiently high purity to permit its use without lessening the accuracy of the determination.....

NOTE 4—Reagents that have exceeded the expiration date should not be used for asphalt mixtures that require asphalt binder property testing. The use of expired solvents may adversely affect the results of asphalt binder property testing.

6.2 Not all solvents (reagents) are applicable to all of the extraction methods detailed in this standard. Each extraction method identifies the specific solvents that can be used.....

6.3 *Ammonium Carbonate Solution*—Saturated solution of reagent grade ammonium carbonate [$(NH_4)_2CO_3$] .....

6.4 *normal-Propyl Bromide (nPB),* conforming to Specification D6368 **Warning—**See Section 7.....

6.5 *Toluene,* reagent grade. **Warning—**See Section 7.....

6.6 *Trichloroethylene (TCE),* technical grade, Type 1, Federal Specification O-T-634, latest revision. **Warning—**See Section 7.....

6.7 *Methylene Chloride,* reagent grade. **Warning—**See Section 7.....

6.8 *Diatomaceous Silica Filtering Aid,* conforming to Type B of Specification D604.....

6.9 *Ethyl Alcohol,* denatured.....

7. Hazards

7.1 **Warning—**The solvents listed in Section 6 should be used only under a hood or with an effective surface exhaust system in a well-ventilated area, since they are toxic to various degrees.....

Consult the current Threshold Limit Concentration Committee of the American Conference of Governmental Industrial Hygienists for the current threshold limit values.....

8. Sampling

8.1 Obtain samples in accordance with Practice D979/D979M.....

8.2 *Preparation of Test Specimens:*

8.2.1 Separate sample by hand spatula or trowel, then split and reduce sample to required testing size in accordance to AASHTO R47.....

If sample is not able to be separated or split, place sample in a large, flat pan and warm to 110 ± 5 °C [230 ± 9 °F], only heating the mixture until it is pliable enough to separate.....

Split or quarter the material until the mass of material required for test is obtained and determine the mass of the sample, W_1.....

NOTE 5—In some cases, polymer modified mixtures need to be warmed at temperatures higher than 110 °C [230 °F] in order to split or quarter the mix. In all cases, the minimum temperature for the minimum time needed to split the mixture should be used so that any aging to the asphalt binder is minimized.

8.2.2 The size of the test sample shall be governed by the nominal maximum aggregate size of the mixture and shall conform to the mass requirement shown in Table 1 (Note 6) .....

NOTE 6—When the mass of the test specimen exceeds the capacity of the equipment used (for a particular method), the test specimen may be divided into suitable increments, tested, and the masses of each increment combined before calculating the asphalt binder content (Section 14).

8.2.3 If the sample was obtained from the field and contains moisture, oven dry the HMA sample to a constant mass at a temperature of 110 ± 5 °C [230 ± 9 °F] or determine the moisture content of the sample according to Test Method D1461, so that the measured mass loss can be corrected for

moisture.....

Record mass loss as W_2.....

Constant mass is defined as less than 0.05 % loss in mass between consecutive 15-min intervals...

9. Test Method A – Centrifuge Extraction

9.1 *Apparatus:*

9.1.1 In addition to the apparatus listed in Section 5, the following apparatus is required for Test Method A: .....

9.1.1.1 *Extraction Apparatus,* of appropriate size to revolve a bowl of approximate dimensions as shown in Figs. 1 and 2 of the ASTM, which can be controlled by the apparatus at variable speeds up to 3600 r/min.....

The speed may be controlled manually or with a preset speed control.....

The apparatus should be provided with a container for catching the effluent thrown from the bowl and a drain for removing the effluent.....

The apparatus shall be installed in a hood or an effective surface exhaust system to provide ventilation.....

9.1.1.2 *Filter Rings,* felt or paper, to fit the rim of the bowl.....

9.1.1.3 Low-ash paper filter rings may be used in place of the felt filter ring (9.1.1.2) .....

Such filter rings shall consist of low-ash filter paper stock approximately 1.3 mm thick.....

The nominal base weight of the paper shall be 150 ± 14 kg (330 ± 30 lb) for a 500-sheet ream with sheet size approximately 635 by 965 mm (25 by 38 in.) .....

The ash content of the paper shall not exceed 0.2 % (approximately 0.034 g per ring) .....

TABLE 1 Size of Sample

Nominal Maximum Aggregate Size Standard, mm	Sieve Size	Minimum Mass of Sample, kg
4.75	(No. 4)	0.5
9.5	3⁄8 in.	1
12.5	1⁄2 in.	1.5
19.0	3⁄4 in.	2
25.0	1 in.	3
37.5	11⁄2 in.	4

9.2 *Procedure:*

9.2.1 Prepare the sample and determine the moisture content of the material in accordance with Section 8.....

9.2.2 Place a dry sample of 500- to 3000-g test portion into a bowl.....

Alternatively, place a test portion in a bowl that has been previously dried to a constant mass with the filter ring.....

9.2.3 TCE, nPB, or toluene solvents can be used with this extraction method.....

9.2.4 Place the bowl containing the test portion onto the extraction apparatus.....

Cover the test portion in the bowl with solvent and allow sufficient time for the solvent to disintegrate the test portion (not over 1 h) .....

Dry and determine the mass of the filter ring and fit it around the edge of the bowl.....
Position lid on the bowl and tighten setscrew. Clamp the cover on the bowl tightly and place a beaker under the drain to collect the effluent.....
9.2.5 Start the centrifuge revolving slowly and gradually increase the speed to a maximum of 3600 r/min or until solvent ceases to flow from the drain.....
Allow the machine to stop, add 200 mL of solvent and repeat the procedure.....
Use sufficient solvent additions (not less than three) so that the extract is not darker than a light straw color.....
Collect the effluent and the washings in a graduate container.....
NOTE 7—Additions of solvent greater than 200 mL may be used as appropriate for the size of the sample.
9.2.6 *Drying Procedures:*
9.2.6.1 Remove lid from centrifuge bowl, leaving bowl, sample and filter in place.....
Allow the extracted aggregate to air dry for 15 to 30 min in the ventilated hood.....
Place bowl, filter ring, and extracted sample into an exhaust oven at 110 ± 5 °C [230 ± 9 °F] for 1 to 2 h to evaporate remaining solvent.....
Cool bowl, filter ring, and extracted aggregate and if felt filter rings are used, brush off mineral matter adhering to the surface of the ring and add to the extracted aggregate.....
The mass of the extracted aggregate, W_3, is equal to the mass of the aggregate in the bowl plus the increase in mass of the filter rings. Report mass measurements to the nearest 0.1 g.....
9.2.6.2 Use the following alternative procedure when low-ash filter rings are used: .....
Place the aggregate and filter rings in a clean metal pan.....
Dry as specified above.....
Carefully fold the dried filter ring and stand it on the aggregate.....
Burn the filter ring by igniting with a Bunsen burner or match.....
Determine the mass of the extracted aggregate in the pan, W_3. Report mass measurements to the nearest 0.1 g.....
9.2.6.3 Since dry aggregate absorbs moisture when exposed to air containing moisture, determine the mass of the extracted aggregate immediately after cooling to a suitable temperature.....
9.2.7 Determine the amount of mineral matter in the extract by any of the test methods in Section 13.....
9.2.8 Calculate the asphalt binder content as described in Section 14.....

10. Test Method B – Reflux Extractor

10.1 *Apparatus:*
10.1.1 In addition to the apparatus listed in Section 5, the following apparatus is required for Test Method B: .....
10.1.1.1 *Extraction Apparatus,* similar to that shown in Fig.3 of the ASTM.....
10.1.1.2 *Glass Jar,* cylindrical, plain, made of heat-resistant glass.....
The jar shall be free of cracks, scratches, or other evidence of flaws that might cause breakage during heating.....

10.1.1.3 *Cylindrical Metal Frames,* one or two.....

The lower frame shall have legs of sufficient length to support the frame, including the apex of the metal cone and paper cone liner above the solvent level.....

When two frames are used, the upper frame shall have legs of sufficient length to support the metal cone and paper cone liner at or above the top rim of the lower frame.....

The legs of the upper frame shall fit securely in the top rim of the lower frame.....

A bail handle may be provided on the inside of the top rim of each frame for convenient handling

The metal used in fabricating the frames shall be essentially inactive to the solvents used in the test method.....

10.1.1.4 *Condenser,* fabricated with a truncated hemispherical condensing surface and a truncated conical top. Other suitable geometric shapes may also be used provided they accomplish the condensing and flow functions intended.....

The material used in fabricating the condenser shall be essentially unreactive to water and to the solvent used and shall be provided with suitable water inlet and outlet.....

10.1.1.5 *Filter Paper,* medium grade, fast-filtering.....

The diameter of the paper shall be such that when folded in accordance with the directions given below, it shall completely line the metal cones in the frames (see Fig. 4 of the ASTM) .....

10.1.1.6 *Heat Resistant-Coated Wire Mesh,* approximately 3 mm [0.1 in.] thick for use as insulation between the glass jar and hot plate.....

10.1.1.7 *Electric Hot Plate,* thermostatically controlled, of sufficient dimensions and heat capacity to permit refluxing of the solvent as described in 10.2.2.5.....

10.2 *Procedure:*

10.2.1 Prepare a test portion for moisture determination and extraction in accordance with the procedure described in Section 8.....

10.2.2 *Extraction:*

10.2.2.1 Dry and determine the mass of one sheet of filter paper for each frame to be used.....

Fold each paper on its diameter, fold the ends over, and spread it open to form a proper size to fit inside the metal cones.....

10.2.2.2 Determine the mass of each frame with its filter paper liner to the nearest 0.5 g. Record the mass, identifying each frame by number.....

10.2.2.3 Place the test portion in the frame or frames.....

If two frames are used, distribute the test portion approximately equally between the two.....

The top of the test portion must be below the upper edge of the paper liner.....

Determine the mass of each loaded frame separately to the nearest 0.5 g. Again, record the mass

10.2.2.4 TCE, nPB, or toluene solvent can be used with this extraction method.....

10.2.2.5 Pour the solvent into the glass cylinder and place the bottom frame into it.....

The solvent level should be below the apex of the one in the (lower) frame.....

If two frames are used, place the upper frame in the lower frame, fitting its legs into the holes in the upper rim of the lower frame.....

NOTE 8—Sufficiently denatured ethyl alcohol may be poured over the test portion(s) to wet the filter paper.

10.2.2.6 Place the thermal insulating pad on the hot plate and then the cylinder on the pad.....
Cover the condenser.....
Circulate a gentle, steady stream of cool water through the condenser.....
Adjust the temperature of the hot plate so that the solvent will boil gently and a steady stream of condensed solvent flows into the cone.....
If necessary, adjust the temperature of the hot plate to maintain the solvent stream at a rate necessary to keep the test portions in the cone(s) completely covered with condensed solvent.....
Take care not to allow condensed solvent to overflow the filter cone(s) .....
Continue the refluxing until the solvent flowing from the lower cone is light straw color (when viewed against a white background) .....
At this point, turn off the hot plate and allow the apparatus to cool with the water running in the condenser.....
When boiling has ceased and the cylinder is cool enough to handle, turn off the condenser and remove from the cylinder.....
10.2.2.7 Remove the frame assembly from the cylinder. Allow to dry in air (hood) and dry to constant mass in an oven at 110 ± 5 °C [230 ± 9 °F] .....
10.2.3 Determine the amount of mineral matter in the extract by any of the test methods in Section 13.....
10.2.4 Calculate the asphalt binder content as described in Section 14.....

11. Test Method C – Vacuum Extractor

11.1 *Apparatus:*
11.1.1 In addition to the apparatus listed in Section 5, the following apparatus is required for Test Method C: .....
11.1.1.1 *Vacuum Extractor,* complete with vacuum pump, gasket, rubber tubing, filter paper, support plate, and funnel ring, similar to that shown in Fig. 5 of the ASTM.....
11.1.1.2 *Filter Paper,* medium grade, fast-filtering, 330 mm [13 in.] in diameter.....
11.1.1.3 *Stainless Steel Beaker,* having a capacity of approximately 8 L.....
11.1.1.4 *Erlenmeyer Flasks,* glass, two, having a capacity of 4000 mL each.....
11.1.1.5 *Erlenmeyer Flask,* glass, having a capacity of 1000 mL.....
11.1.1.6 *Graduate,* glass, having a capacity of 500 mL.....
11.1.1.7 *Dial Thermometer,* having a range from 10 to 80 °C [50 to 180 °F] .....
11.1.1.8 *Watch Glass,* having a 100-mm [4-in.] diameter.....
11.1.2 *Miscellaneous Equipment*—Wash bottle, large mixing spatula, stiff-bristled brush, and metal tongs.....
11.2 *Procedure:*
11.2.1 Prepare the sample and determine the moisture content of the material in accordance with Section 8.....
11.2.2 TCE, nPB, toluene, or methylene chloride solvent can be used with this extraction method.
NOTE 9—Denatured ethyl alcohol can be used to facilitate the filtering of the asphalt sample.

Quantitative Extraction of Asphalt Binder from Asphalt Mixtures

11.2.3 *Initial Sample Preparation:*
11.2.3.1 Place the extraction test portion into the tared stainless steel beaker, or alternatively, an ultrasonic cleaning tank, and determine the mass to the nearest 0.1 g.....
11.2.3.2 If the test portion is above 54 °C [130 °F], allow sample to cool to a temperature less than 54 °C [130 °F] .....
When sufficiently cool, pour 200 mL of denatured alcohol over the specimen.....
Add approximately 700 mL of solvent and stir until the asphalt is visually in solution.....
11.2.4 *Filter Preparation:*
11.2.4.1 Place a dry, tared filter paper on the vacuum extractor, taking care to center the filter, and tighten the wing nuts finger tight.....
11.2.5 *Additional Steps for Preparing Extraction of Slow-Filtering Asphalt Mixtures:*
11.2.5.1 Weigh 50 g of oven-dried diatomaceous silica filtering aid into a 1000-mL Erlenmeyer flask and add 500 mL of methylene chloride.....
Swirl until the diatomaceous silica is completely in suspension.....
NOTE 10—Fifty (50) g of diatomaceous silica may not be sufficient for all mixes. Some labs have indicated that as the percent passing the 0.075-mm (No. 200) sieve increases, so does the required amount of filtering aid. Good results have been obtained by increasing the amount of diatomaceous silica by 50 g for every 1 % increase in the percent passing the 0.075-mm (No. 200) sieve above 2 %.
11.2.5.2 Immediately pour the diatomaceous silica and solvent over the filter.....
Start the vacuum pump and let it run until the pad formed by the diatomaceous silica is surface dry and begins to crack slightly.....
11.2.5.3 Place the watch glass in the extractor and gently pour the solvent from the test portion over it.....
Remove the watch glass with tongs and wash with the wash bottle.....
Add the rest of the sample and proceed with 11.2.6.....
11.2.6 *Extraction:*
11.2.6.1 Start the vacuum pump and decant the solvent from the beaker into the extractor, taking care not to transfer the aggregate from the beaker to the extractor.....
Stop the vacuum when all solvent has been removed.....
11.2.6.2 Add another 700 mL of solvent to the sample container and stir.....
11.2.6.3 Repeat 11.2.6.1 and 11.2.6.2 until the solution is a light straw color and the aggregate is visually clean.....
After the last wash, gently pour the entire sample into the extractor and thoroughly rinse all aggregate particles from the sample container.....
Carefully spread the aggregate evenly over the filter.....
11.2.6.4 Operate the vacuum pump for a few minutes after the last wash to aid in drying the test portion.....
Scrape the aggregate away from the side of the funnel ring toward the center of the filter to avoid loss when the ring is removed.....
Remove the ring and brush the clinging aggregate into the drying pan.....
Then pick up the filter paper and aggregate by holding the paper on opposite sides and raising it straight up. Place the test portion in the tared pan and brush the clinging aggregate from the filter into the pan.....

11.2.6.5 Dry the extracted aggregate and filter to a constant mass in an oven at 110 ± 5 °C [230 ± 9 °F] .....

11.2.6.6 Determine the mass of the filter and aggregate in the pan and record.....

Subtract the mass of the filter and pan to determine the mass of the extracted aggregate.....

11.2.7 Determine the amount of mineral matter in the extract by any of the test methods in Section 13.....

11.2.8 Calculate the asphalt binder content as described in Section 14.....

12. Test Method D – Extraction Kettle

12.1 *Apparatus:*

12.1.1 In addition to the apparatus listed in Section 5, the following apparatus is required for Test Method D: .....

12.1.1.1 *Extraction Apparatus (*Fig. 6 of the ASTM*),* consisting of an extraction kettle of metal or borosilicate glass, fitted with a perforated basket and a condenser top.....

The underside of the condenser shall be covered with numerous rounded knobs to distribute the condensed solvent uniformly over the surface of the sample.....

The suspension of the basket shall be arranged to support the basket 13 mm [0.5 in.] above the bottom of the kettle, for immersion of test portion in the solvent, and at least 75 mm [3 in.] above the bottom of the kettle for refluxing (see Note 8) .....

12.1.1.2 *Cloth Filter Sacks,* with an elastic hem for lining the basket.....

12.2 *Procedure:*

12.2.1 Prepare test portions for moisture determination and extraction in accordance with the procedure described in Section 8.....

12.2.2 *Moisture*—Determine the moisture content of the mixtures in accordance with the test method described in Section 8.....

12.2.3 *Extraction:*

12.2.3.1 Insert a filter sack in the extraction basket and determine the mass with the tare pan to determine the total tare weight.....

Place the test portion (Note 6) in the filter sack and determine the total mass.....

Calculate the mass of the test portion.....

12.2.3.2 Attach the suspension rod to the loaded basket and set the assembly into the extraction kettle.....

Pour approximately 600 mL of solvent (6.3, 6.4, or 6.7) over the test portion. Set the condenser cover in place on the kettle.....

Provide a flow of cold water through the condenser lid.....

Raise the basket to immersion level, for example 13 mm [0.5 in.] above the bottom of kettle, by inserting the support pin through the upper hole of the suspension rod.....

Place the extractor on the hot plate and adjust the heating rate so that solvent is maintained at a gentle boil, avoiding vigorous boiling which might wash fines over sides of basket.....

12.2.3.3 Continue heating with the test portion in immersion position for 15 to 30 min and then raise the basket to refluxing level.....

Increase the heat and maintain active boiling until solvent dripping from the basket appears light straw color when viewed against a white background.....
If a stainless steel kettle is used, lift out the basket and the condenser cover assembly for examination of the solvent.....
12.2.3.4 Remove the extractor from the hot plate and allow to cool for several minutes.....
Lift out the basket and condenser assembly.....
Cover the kettle, remove the filter sack, distribute its contents onto the tared pan in which the mass of the test portion was originally determined.....
Place the filter sack on top of the recovered aggregate. Dry on a steam bath and then in an oven at 110 ± 5 °C [230 ± 9 °F] to constant mass.....
Transfer the extraction to a 1000-mL graduate. Wash the extractor clean with solvent and add the washings to the extract.....
12.2.3.5 Determine the mineral matter in the extract in accordance with any of the procedures in Section 13.....
12.2.3.6 Calculate the percent asphalt binder in the test portion in accordance with the procedure described in Section 14.....

13. Determination of Mineral Matter

13.1 Corrections for mineral matter may be omitted when this test method is used only for control of asphalt mixture binder content during construction (plant control) .....
13.2 *Ashing Method:* .....
13.2.1 Record the volume of the total extract in the graduate (9.2.4 for centrifuge method, 10.2.3 for reflux method, or 11.2.4 for vacuum method) .....
Determine the mass of an ignition dish to the nearest 0.001 g.....
Agitate the extract thoroughly and immediately measure approximately 100 mL into the ignition dish
Evaporate to dryness on a steam bath or hot plate.....
Ash residue at a dull red heat 500 to 600 °C [932 to 1112 °F], cool, and add 5 mL of saturated ammonium carbonate solution per gram of ash.....
Digest at room temperature for 1 h.....
Dry in an oven at 110 ± 5 °C [230 ± 9 °F] to constant mass, cool in a desiccator, and determine the mass to the nearest 0.001 g.....
13.2.2 Calculate the mass of mineral matter in the total volume of extract, W_4, as follows: .....

$$W_4 = G[V_1/(V_1 - V_2)] \quad (1)$$

where:

G = ash in aliquot, g,
V_1 = total volume, mL, and
V_2 = volume after removing aliquot, mL.

13.3 *Centrifuge Method:* .....
13.3.1 For this test method use any suitable high-speed (3000 *g* or higher) centrifuge of the continuous-flow type.....

13.3.2 Determine the mass of a clean empty centrifuge cup (or bowl) to 0.01 g and place in the centrifuge.....

Position a container at the appropriate spout to catch the effluent from the centrifuging operation

13.3.3 Transfer all of the extract to an appropriate (feed) container suitably equipped with a feed control (valve or clamp, etc.) .....

To ensure quantitative transfer of the extract to the feed container, the receptacle containing the extract should be washed several times with small amounts of clean solvent and the washings added to the feed container.....

Start the centrifuge and allow to reach a constant operational speed (for example, 9000 r/min for the SMM type and 20 000+ r⁄min for the Sharples type) .....

13.3.4 Open the feed line and feed the extract into the centrifuge at a rate of 100 to 150 mL/min.

After all the extract has passed through the centrifuge, wash the feed mechanism (with centrifuge still running) with several increments of clean solvent, allowing each increment to run through the centrifuge until the effluent is essentially colorless.....

13.3.5 Allow the centrifuge to stop and remove the cup (or bowl) .....

Clean the outside with fresh solvent.....

Allow the residual solvent to evaporate in a hood and then dry the container in an oven controlled at 110 ± 5 °C [230 ± 9 °F] .....

Cool the container and again determine the mass immediately to the nearest 0.01 g.....

The increase in mass is the mass of mineral matter, W_4, in the extract.....

13.4 *Volumetric Method:* .....

13.4.1 Place the extract in a previously tared and calibrated flask.....

Place the flask in a controlled-temperature bath controlled to 60.1 °C [0.2 °F], and allow the contents to reach the temperature at which the flask was calibrated.....

When the desired temperature has been reached, fill the flask with solvent which has been kept at the same temperature. Bring the level of the liquid in the flask up to the neck, insert the stopper, making sure the liquid overflows the capillary, and remove from the bath.....

Wipe the flask dry, determine the mass to the nearest 0.1 g, and record this mass as the mass of flask plus extract.....

13.4.2 If a controlled-temperature water bath is not used, measure the temperature of the extract and make necessary corrections to the volume of the flask and density of asphalt and the solvent.....

Quantitative Extraction of Asphalt Binder from Asphalt Mixtures

13.4.3 Calculate the volume of asphalt and fines in the extract as follows: .....

$$V_1 = V_2 - \frac{(M_1 - M_2)}{(G1)} \quad (2)$$

where:
V_1 = volume of asphalt and fines in the extract,
V_2 = volume of the flask,
M_1 = mass of the contents of the flask,
M_2 = mass of the asphalt and fines in the extract = mass of the total samples minus the mass of the extracted aggregate, and
G_1 = specific gravity of the solvent determined to the nearest 0.001 in accordance with Test Methods D2111.

13.4.4 Calculate the mass of fines in the extract as follows: .....

$$M_3 = K\,(M_2 - G_3 V_1) \quad (3)$$

where:
M_3 = mass of fines in the extract,
G_2 = specific gravity of fines as determined in accordance with Test Method C128,
G_3 = specific gravity of asphalts as determined in accordance with Test Method D70,
$K = \frac{G_2}{G_2 - G_3}$,
V_1 = as given in 13.4.3, and
M_2 = as given in 13.4.3.

14. Calculation of Asphalt Binder Content

14.1 Calculate the percent asphalt binder content in the test portion as follows: .....

$$\text{Asphalt binder content, \%} = [((W_1 - W_2) - (W_3 + W_4)) / (W_1 - W_2)] \times 100 \quad (4)$$

where:
W_1 = mass of test portion,
W_2 = mass of water in the test portion,
W_3 = mass of the extracted mineral aggregate, and
W_4 = mass of the mineral matter in the extract.
NOTE 11—When ashless filter rings are not used, add the increase in mass of the felt filter ring to W_4.

Comments