

Method of Test for
BITUMEN CONTENT OF PAVING MIXTURES BY CENTRIFUGE
DOTD Designation: TR 308M/308-97

I. Scope

- A. This method is designed to determine the percentage of bitumen in bituminous mixtures by centrifuge. DOTD TR 323 may be used as an alternate to this method.
- B. **Reference Procedures**
1. DOTD TR 108, Splitting and Quartering Samples
 2. DOTD TR 314, Ash content of Asphaltic Concrete Mixture Solvent Obtained by Reflux or Centrifuge Extraction
 3. DOTD TR 323, Determining the Asphalt Content of Asphaltic Mixtures by the Ignition Method
 4. AASHTO T 164, Quantitative Extraction of Bitumen from Bituminous Paving Mixtures

II. Apparatus

- A. Centrifuge extractor and filter rings to fit rim of bowl.
- B. Balance - having a capacity of 2000 g and sensitive to 0.1 g.
- C. Oven - capable of maintaining a temperature of $135 \pm 5^\circ\text{C}$ ($275 \pm 9^\circ\text{F}$).
- D. Hot plate - the use of hot plate drying in the field is allowed where ovens are not available or practical. Open flame hot plates shall be equipped with a suitable shield to evenly disperse the heat and to avoid direct contact of the flame with the drying pan.
- E. Miscellaneous tools - pans, spatula, brushes, etc.
- F. Solvent - inhibited 1,1,1-trichloroethane or suitable biodegradable solvent.
- G. Worksheet - Asphaltic Concrete Plant Report, DOTD Form No. 03-22-3085.

Note 1: *A suitable biodegradable solvent which is residue free may be used as an alternate. The use of an alternate solvent may require additional wash cycles.*

III. Health Precautions

The solvent listed above is to be used under a hood or with an effective surface exhaust system. Material Safety Data Sheets (MSDS) shall be maintained at locations where employees handle hazardous materials. Extreme caution is to be exercised when testing this material due to the high temperature involved.

The solvent used is toxic and should only be used with proper ventilation. In no event is it used to clean hands. The solvent should be stored away from all testing equipment to prevent corrosion damage.

IV. Preparation of Sample

- A. If the sample is not sufficiently soft to separate with a trowel or spatula, heat at a temperature of $135 \pm 5^\circ\text{C}$ ($275 \pm 9^\circ\text{F}$) until it can be handled and quartered. For mixtures containing liquid asphalts and for cutbacks and emulsified asphalt used in cold mixtures, remove their fluxing agents to determine the asphalt content. Do this by heating the mixture slowly to evaporate the fluxing agents. Take care not to under heat the mixture, thereby, not removing all of the fluxing agent, nor overheat it, causing the asphalt to oxidize. In mixtures where a rapid curing cutback asphalt is used, take care not to overheat the mixture causing the inflammable fluxing agent to catch fire and burn.

Note 2: *Exercise extreme caution when using a hot plate to ensure adherence to the above condition.*

- B. Reduce the sample size to the mass desired by quartering in accordance with DOTD TR 108, Method B.
1. Do not use absorbent materials as a quartering surface.
 2. Do not attempt to select samples of an exact pre-determined mass.
- C. Determine the mass of the test sample to the nearest 0.1 g to one of the following sizes:

1. (a) Hot mix (hard rock aggregate) 900- 1100 g
- (b) Hot mix (lightweight aggregate) 630-770 g
2. (a) Cold mix (hard rock aggregate) 900-1100 g
- (b) Cold mix (lightweight aggregate) 630-770 g
3. Sand asphalt 300-400 g

V. Procedure

- A. Dry and determine the mass of the filter ring to the nearest 0.1 g. Perform the drying operation by placing the filter ring on a gallon can or other metal container on a hot plate or gas burner. Do not scorch the filter ring or bring it in direct contact with the heat source.
- B. Distribute the prepared sample uniformly in the extractor bowl. Pour in enough solvent to cover the sample; place the filter ring on the rim of the bowl with the smooth side up, position the bowl cover and tighten firmly. Do not remove the top of the bowl between washings for any reason. Then place the bowl and content in the centrifuge.
- C. Allow approximately 10 to 15 minutes for the solvent to disintegrate the sample. Start the machine slowly to allow the material to distribute itself uniformly in the bowl, then increase the speed until a thin stream of asphalt and solvent flows from the spout. Never run the machine faster than is necessary to expel the asphalt and solvent. When the flow from the spout stops, stop the machine and recharge with solvent.
- D. Continue the washing procedure until the solvent flowing from the machine is clear, but never use less than three washings.
- E. Upon completion of washing remove the bowl from the centrifuge and transfer its contents to a pan. Brush the fine material from the filter ring and bowl rim into the bowl or pan.
- F. Dry the filter ring in accordance with subsection V.A. Dry the extracted sample to constant mass at a temperature of $135 \pm 5^\circ\text{C}$ ($275 \pm 9^\circ\text{F}$). Do not overheat the material when a hot plate is used.

Note 3: *Constant mass for drying purposes is defined as less than 0.1% mass loss between successive mass determinations no less than 5 minutes apart.*

- G. Determine the mass of the filter ring and extracted sample to the nearest 0.1 g.

Note 4: *Determine the mass of the extracted sample and filter ring at the temperature as close as possible to the temperature at which the original sample mass was determined.*

Note 5: *Examine the bowl and cover for scratches, dents, bends or any malformation that would allow the fine aggregate to escape between the bowl and the bowl cover.*

VI. Calculations

- A. Calculate the amount of asphalt extracted from the mix to the nearest 0.1% by using the following formula:

$$\text{Asphalt \%} = \frac{Q - (R + V + U)}{Q} \times 100$$

where:

- Q = wt of mix (with AC), g
- R = wt of dry agg. (minus AC), g
- V = correction factor equal to the amount of mineral matter (ash) in the solvent, g
- U = gain in filter wt, g
- 100 = constant

Note 6: *The district laboratory shall determine the correction factor (X) in accordance with DOTD TR 314 at intervals or whenever there is a change in the source of material or extractor equipment.*

example:

- Q = 1006.3
- R = 958.2
- V = 0.2
- U = 1.2

$$\begin{aligned}\text{Asphalt \%} &= \frac{1006.3 - (958.2 + 0.2 + 1.2)}{1006.3} \times 100 \\ &= \frac{1006.3 - 959.6}{1006.3} \times 100 \\ &= \frac{46.7}{1006.3} \times 100 \\ &= 0.04640 \times 100 \\ &= 4.640 \\ \text{Asphalt \%} &= 4.6\end{aligned}$$

VII. Report

The percentage of asphalt shall be reported to the nearest 0.1%

VIII. Normal Test Reporting Time

The normal test reporting time is 2 hours.