



Standard Test Procedures Manual

Section: ASPHALT MIXES

Subject: ASPHALT CONTENT BY CENTRIFUGE
EXTRACTION

1. SCOPE

1.1. Description of Test

The method described is a procedure used to determine the asphalt content of asphalt-aggregate mixtures.

1.2. Application of Test

The asphalt content of asphalt-aggregate mixtures as determined by the described test method is used for product acceptance, quality assurance, process quality control and research activities.

1.3. Units of Measure

The asphalt content is expressed as a percent by dry weight of extracted aggregate corrected for asphalt mix moisture content and extractor error.

2. APPARATUS AND MATERIALS

2.1. Equipment

Centrifuge extractor with a bowl approximating that shown in Figure 1 of ASTM D 2172 - Standard Test Methods for Quantitative Extraction of Bitumen Paving Mixtures. The extractor will be capable of accepting between 500 g and 2000 g of asphalt mix. The extractor must be capable of rotating the bowl at controlled variable speeds up to 3600 rpm.

The apparatus should be equipped with explosion proof features and installed in a fume hood or an effective surface exhaust system to provide ventilation.

Tachometer to check rpm of extractor bowl.

Paper or felt filter rings to be placed on the rim of the bowl and beneath the bowl lid.

Scale capable of weighing to 2500 g at a 0.1 g accuracy.

Heating equipment such as electric stove.

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Thermometer capable of measuring temperature between 50° C and 150° C.

250 ml cup or beaker.

Torque wrench capable of producing 35 N.m of torque.

Hand Tools - spatula, small brush, scoop, large pan for collection of a representative asphalt mix sample, pan for test sample.

Container for collection of asphalt laden solvent thrown from the bowl during extraction.

2.2. Materials

Solvents - suggested materials are chloroethene or trichloroethylene.

2.3. Sample To Be Tested

Obtain representative samples of the asphalt-aggregate mixture. Asphalt mix samples will be collected in accordance with STP 103 - SAMPLING ASPHALT MIXES. Asphalt concrete samples will be collected in accordance with STP 204-5 ASPHALT CONCRETE SAMPLES OBTAINED BY CORING.

2.4. Data Required

Sample information including date, time, sample number, sampling location, sampled by, tested by, contract number, control section, contractor, asphalt type, aggregate type, extractor make, model and serial number.

3. PROCEDURE

3.1. Equipment Preparation

Ensure extractor bowl, hand tools and sample containers are cleaned of all residual asphalt and aggregate materials and dry before commencing the test.

Check extractor rpm to ensure that a maximum of 3600 rpm is being achieved.

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3.2. Sample Preparation

Collect representative samples as described in section 2.3 above. Sample size will depend on the extractor bowl size. Larger samples will give more accurate results. Weigh the asphalt mix and record as "weight of asphalt mix".

A sample of asphalt mix is required to determine the moisture content of the asphalt mix. Sample size and preparation are described in STP 204-1, MOISTURE CONTENT BY OVEN DRYING.

3.3. Test Procedure

Turn ventilation equipment on and adjust for maximum suction from the extractor and enclosure.

Spread the asphalt mix sample evenly in the bowl. Cover the sample with the specified solvent. Rotate the bowl back and forth gently by hand to distribute solvent and asphalt mix evenly in the bowl.

Place two filter rings on the bowl rim and secure the bowl cover plate on top of the filter papers. Tighten the cover using a torque wrench up to a maximum torque of 17 N*m. Ensure that for all subsequent extractions the bowl cover plate is tightened with the same torque.

Allow the material to soak for 5 minutes before the first centrifuge is begun.

Begin centrifuging slowly, increasing bowl speed slowly to a maximum of 3600 rpm. When the asphalt-solvent effluent stops flowing from the extractor, turn off the motor, slow and stop the bowl using the braking mechanism.

Add approximately 250 ml of solvent to the bowl and repeat the above described procedure. The procedure should be repeated until the extracted effluent has a light yellow straw colour. This is usually accomplished in 4 to 6 washings.

After the final wash, remove the filler screw and cover plate. Remove the filters carefully, clean the extracted aggregate from the filter papers and bowl and place in a clean pan.

The recommended drying procedure is to place the extracted aggregate in an oven at a controlled temperature of 120° C and dry to a constant weight. Establish the required drying time by weighing after repeated heating and cooling until the weight is constant. To prevent burning of the mineral particles, do not heat the aggregate above 120° C.

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In a field quality control setting, the extracted aggregate may be dried on a hot plate or stove burner element. The method is more subject to burning of the mineral particles and is a less desirable method.

After cooling, weigh the dried aggregate to the nearest 0.1 g. Dry aggregate may absorb moisture from the air. Determine the mass of the extracted aggregate immediately upon cooling to ambient temperature. Record the weight of the dry extracted aggregate to the nearest 0.1 g.

4. RESULTS AND CALCULATIONS

4.1. Collection of Test Results

The following data is required:

- Weight of asphalt mix before extraction to the nearest 0.1 g
- Weight of dried aggregate after extraction to the nearest 0.1 g
- Moisture content of the asphalt mix as determined by STP 204-1, MOISTURE CONTENT BY OVEN DRYING
- Extractor correction as determined by STP 204-23, EXTRACTION AND MOISTURE CORRECTIONS

4.2. Calculations

Uncorrected Asphalt Content = $\frac{(\text{wt. of asphalt mix} - \text{wt. of dry agg.}) \times 100}{\text{wt. of dry aggregate}}$
(Calculated to the nearest .01%)

Corrected Asphalt Content = Uncorrected Asphalt Content (%) - Moisture Content (%) \pm Extractor Error (%)

NOTE: 1) The corrected asphalt content should be rounded to the nearest 0.1%.

2) Refer to STP 204-23 "Extraction and Moisture Corrections" to determine the proper type of extractor correction to be used.

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5. CALIBRATIONS AND REPEATABILITY

5.1. Equipment Calibration

Periodical checking of extractor rpm should be conducted.

Each time extractor or operators are changed, a new extraction correction should be done. The extractor correction test should have the same number of washings as used in the actual extracted sample.

Extraction corrections should also be done for each asphalt mix design or approved job mix formula.

5.2. Tolerances and Repeatability

Tolerances for repeatability and reproducibility are specified below:

Single Operator: two tests on the same sample should not vary by more than
 $\pm .1\%$

Multiple Operator: two tests on the same sample shall not vary by more than
 $\pm .2\%$

5.3. Sources of Error

Incomplete washing of the asphalt from the mix.

Non-consistent torques applied to the bowl cover plate.

Loss of mineral aggregate particles when transferring from extractor bowl and filter papers to pan.

Not doing moisture and extraction corrections.

Not meeting the specified rpm requirements on the extractor.

Overheating the aggregate during drying.

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6. ADDITIONAL INFORMATION

6.1. Sample Retention

The extracted aggregate may be retained for gradation analysis using STP 204-4, SIEVE ANALYSIS.

6.2. Safety

Provide good ventilation as solvent fumes may be injurious to your health. Propane stoves should not be used in laboratories where chloroethene and trichloroethylene solvents are being used.

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STP 204-2

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APPROVAL SHEET

New Revision X Date of Previous Document 92-12-10
Effective Date: 94-12-21

Description of Revision (Reason for Revision):

Removed requirement of applying 17 N*m torque to the extractor lid. Referred to it as a maximum torque.
Added note to ensure that the same torque be applied for all extractions

Review/Implementation Process:

Reviewed by the End Product Specification Committee and Technical Standards and Policies Branch.

Other Manuals/Policies Affected:

Nil

Follow Up/Training Required:

Nil

Comments/Concerns/Implications (Budget/Environment/Stakeholders):

Prepared by D. MacLeod 94-09-20
Date

Recommended by D. MacLeod 94-09-20
Materials Standards Engineer Date

Approval Recommended by R.A. Widger 94-12-20
Senior Materials Engineer Date

Approved by A.R. Gerbrandt 94-12-21
Dir., Technical Standards & Policies Br. Date

Electronic File Updated 95-01-31

Update Mailed -