

ALDOT-371-90
RAPID METHOD TO DETERMINE THE GRADATION OF
ASPHALT PAVING MIXTURES USING BIODEGRADABLE EXTRACTANT

1. Scope

- 1.1. This method is used routinely for determining the gradation of hot-mixed paving mixtures using a biodegradable extractant process.

2. Referenced Documents

- 2.1. AASHTO M 92, Standard Specification for Wire-Cloth Sieves for Testing Purposes
- 2.2. AASHTO M 231, Standard Specification for Weighing Devices Used in the Testing of Materials
- 2.3. AASHTO T 30, Mechanical Analysis of Extracted Aggregate
- 2.4. AASHTO T 164, Quantitative Extraction of Asphalt Binder from Hot Mix Asphalt
- 2.5. AASHTO T 168, Standard Method of Test for Sampling Bituminous Paving Mixtures
- 2.6. ASTM E29, Indicating Which Places of Figures Are to Be Considered Significant in Specified Limiting Values
- 2.7. ALDOT-354, Asphalt Content of Hot-Mix Asphalt by the Nuclear Method
- 2.8. Materials Sources and Devices with Special Acceptance Requirements (MSDSAR) List II-19

3. Apparatus

- 3.1. Apparatus as required in ALDOT-354.
- 3.2. Pan, approximately 12 in x 8 in x 1 in deep (300 mm x 200 mm x 25 mm) deep or 10 qt, (L) rounded plastic pail.
- 3.3. Balance: AASHTO M 231, Class D.
- 3.4. Solvent: Biodegradable, high flash, non-toxic asphalt extractant. Solvent shall be from the approved MSDSAR List II-19.
- 3.5. Oven: Capable of maintaining a uniform temperature of $230 \pm 9^{\circ}\text{F}$ ($110 \pm 5^{\circ}\text{C}$).
- 3.6. Sieves: As required by the gradation specifications and meeting the requirements of AASHTO M 92.
- 3.7. Liquid detergent (powder detergents are not permitted), optional.

4. Procedure

- 4.1. Secure a representative sample of the asphalt mixture in accordance with AASHTO T 168.
- 4.2. Determine the percent asphalt and moisture in accordance with ALDOT-354.
- 4.3. Select an extraction test sample of the size as required in Table 1, AASHTO T 164. Record mass to the nearest 0.1 g.
- 4.4. Place the extraction sample in pan or pail and cover with extractant. Gently agitate the sample frequently with a spatula or trowel allowing sufficient time (20-30 minutes for virgin mixtures, 45 min. - one hour for recycle mixtures) for the extractant to dissolve the asphalt from the aggregate.
- 4.5. Decant extractant, pouring over a No. 8 (2.36mm) sieve nested over a No. 200 (75 μ m) sieve, continue decanting with water until wash water is clear.

Note: Care must be taken while agitating and decanting to prevent loss of particles.
- 4.6. Dry sample to constant mass in an oven at a temperature of $230 \pm 9^{\circ}\text{F}$ ($110 \pm 5^{\circ}\text{C}$).
- 4.7. Screen the sample in accordance with AASHTO T 30 over sieves required by the job mix formula and weigh the accumulative material retained on each sieve to the nearest gram.

5. Calculations

- 5.1. Calculate total extracted weight of mineral aggregate as follows:

$$W_1 = W_s (1 - AC - W_m)$$

Where:

W_1 = total extracted weight of mineral aggregate in grams.

W_s = total sample weight in grams (AC and aggregate).

AC = asphalt content expressed as a decimal number.

W_m = Moisture in mix expressed as a decimal number.

- 5.2. The accumulative weights of material retained on each sieve from subsection 3.7 shall be converted to percentage by dividing by the weight of total aggregate (W_1) as obtained in subsection 4.1, and multiplying by 100.

6. Reporting

- 6.1. The results of the sieve analysis shall be reported as total percentages passing each sieve. Percentages shall be reported to the nearest whole number in accordance with ASTM E-29 except for the percentage passing the No.200 (75 μ m) sieve which shall be reported to the nearest 0.1 percent.

7. Product Evaluation

- 7.1. For product evaluation, Sections 4 through 6 shall be amended as follows:
 - 7.1.1. Prepare an asphalt-aggregate mixture to the gradation and asphalt binder content as given below:
 - 7.1.1.1. The aggregate shall be a limestone aggregate ALDOT Size 8910.
 - 7.1.1.2. Obtain two 1200 g samples. Run AASHTO T 30 on one sample, to determine the control gradation.
 - 7.1.1.3. The second aggregate sample shall be mixed with PG 76-22 liquid asphalt at an asphalt content of 5.5%.
 - 7.1.1.4. After mixing, the asphalt sample shall be aged in the oven at 230°F overnight.
 - 7.1.2. Perform steps in Section 4.2 through 4.6.
 - 7.1.3. Screen the sample in accordance with AASHTO T 30 over the sieves used in determining the control gradation in Section 7.1.1.2.
 - 7.1.4. Calculate the extracted weights as given in Section 5. Asphalt binder content shall be as given in Section 7.1.3.
 - 7.1.5. The results of the sieve analysis shall be reported as total percentages passing each sieve to the nearest 0.1%.
 - 7.1.6. The results of the sieve analysis shall be compared to the control gradation as determined in Section 7.1.1.2.
 - 7.1.7. The results shall compare to within the tolerances given in Table 2 of AASHTO T-30 for a single-operator precision.