October 19, 2004 Matls. IM 331
Supersedes April 20, 2004

MECHANICAL ANALYSIS OF EXTRACTED AGGREGATE

SCOPE

This method of test covers the procedure for the determination of the particle size distribution of the fine and coarse aggregate extracted from bituminous mixtures. The apparatus and procedure are similar to Test Method No. Iowa 217, Method of Test for Mechanical Analysis of Extracted Aggregate.

PROCEDURE

A. Apparatus

1. Sieves - 12 in. (300 mm) diameter round sieves with square openings mounted on metal frames with woven wire cloth conforming to AASHTO Designation M92. The suitable sieve sizes are selected to furnish the information required by the specifications covering the material to be tested. Normally sieves of the following sizes are used: 1 in. (25 mm), 3/4 in. (19 mm), 1/2 in. (12.5 mm), 3/8 in. (9.5 mm), No. 4 (4.75 mm), No. 8 (2.36 mm), No. 16 (1.18 mm), No. 30 (600 µm), No. 50 (300 µm), No. 100 (150 µm), No. 200 (75 µm) and an 8 in. (200 mm) diameter No. 200 (75 µm) wash sieve.

2. A balance having a capacity of at least 3500 grams and accurate to 0.5 gram.

3. An oven capable of maintaining a uniform temperature of 275°F ± 9°F (135 ± 5°C) or a drying stove.

4. A round wash pan of sufficient size to allow a vigorous rotary agitation while washing the sample without any loss of sample.

5. "Ro-Tap" mechanical sieve shaker with electrical timer.

6. Fiber bristle sieve-cleaning brush (similar to stencil brush or cropped paint brush).

B. Sample

1. Use the entire sample of aggregate from which the bituminous material has been extracted (Matls. IM 330, Vacuum Extraction of Bitumen in Paving Mixtures).

C. Test Procedure

1. After drying and weighing the extracted aggregate as described in Matls. IM 330, place the sample in the round wash pan, cover with water. Add a sufficient amount of wetting agent to assure a thorough separation of material finer than the No. 200 (75 µm) sieve size from the coarser particles.

NOTE: Wetting agents may include alcohol, or any dispersing agent such as Calgon, Joy, or other detergent, or a soap, which will promote the separation of fine material.

2. Agitate the sample by a vigorous rotary motion of the pan. When the aggregate can be heard to scour the bottom of the pan the rotary motion is correct. Care must be used during the vigorous agitation to prevent the loss of any material from the wash pan. The agitation may also be done by stirring the sample with a large spoon.

   NOTE: The extracted aggregate particles are coated with an oil film, which holds the fine material. Rigid adherence to the washing procedure is essential for obtaining reproducible results on the amount of material passing the No. 200 (75 µm) sieve.

3. If flakes of crusty material are present, they must be broken up by kneading the sample with your fingers. Use water and thoroughly wash all clinging material from your fingers back into the sample. Agitate the sample for 5 to 10 seconds and pour the wash water from the sample through the No. 200 (75 µm) wash sieve.

4. Repeat the above steps of the washing operation until the wash water appears clear. If during the washing the sieve becomes clogged, vibrating or lightly tapping it's side will keep the mesh open.

5. Thoroughly rinse and wash back into the sample any material, which has been washed out and is retained on the No. 200 (75 µm) wash sieve. Allow the sample to settle from the water and drain as much as possible by carefully pouring off the water through the wash sieve to prevent accidental loss of any material.

6. Dry the sample to a constant weight (mass) by either drying it in the oven at 275°F ± 9°F (135°C ± 5°C), or on the drying stove at a low temperature.

   NOTE: Extreme care must be used in drying the aggregate sample with the drying stove. Drying with high heat could fracture the aggregate particles, thus affecting the grading.

7. After drying and cooling, determine the washed weight (mass) to the nearest 0.5 gram. Enter the difference between the original dry weight (mass) and the washed dry weight (mass) as material passing the No. 200 (75 µm) sieve.

8. Place the sample on the nest of coarse sieves 1 in. (25 mm), 3/4 in. (19 mm), 1/2 in. (12.5 mm), 3/8 in. (9.5 mm), No. 4 (4.75 mm) and sieve pan. Shake in the "Ro-Tap" for at least 5 minutes or agitate vigorously by hand action. Either of the methods used must be sieved to completion (not more than 0.5 percent by weight (mass) of the total sample passes any sieve after 1 minute of sieving).

9. Place the material that passed the No. 4 (4.75 mm) sieve in the previous operation on the nest of fine sieves No. 8 (2.36 mm), No. 16 (1.18 mm), No. 30 (600 µm), No. 50 (300 µm), No. 100 (150 µm), No. 200 (75 µm) and a sieve pan. Shake in the "Ro-Tap" for at least 8 minutes or until completion (not more than 0.5 percent by weight of the portion of the sample that passed the No. 4 (75 µm) sieve, passes any sieve after 1 minute of sieving).

10. Clean the retained material out of the sieves for weighing, so that a minimum of material is retained in the sieve by clinging to the mesh. Particles may be removed most readily from a sieve by inverting the sieve over a pan and tapping the sieve and/or pushing (without force) the particles out of the mesh into the pan. Care should be exercised in cleaning the sieves to not damage the wire mesh by bending or breaking the wires. A brush should be used for cleaning the No. 16 (1.18 mm), No. 30 (600 µm) and No. 50 (300 µm) sieves. Do not use a brush or any external force to attempt to clean the No. 100 or No. 200 (150 µm or 75 µm) sieves. If clogging of the mesh occurs on these finer sieves, they should be returned to the Central Laboratory for cleaning.

11. Record the weight (mass) of the material retained on each sieve and the pan. The combined weight (mass) of the material retained on all sieves and in the pan must equal the dried weight (mass) after washing within 0.5 percent.

D. Calculation

1. Determine the weight (mass) of aggregate passing the No. 200 (75 µm) sieve by adding the weight (mass) of material retained in the pan by dry sieving to the weight (mass) lost by washing.

2. Record the percentages retained on each sieve to the nearest 0.1 percent. If this total does not add up to 100.0 percent, the sieves having the larger percentages retained must be prorated to due so.

3. Calculate the percent passing to the nearest 0.1 as follows:

   a. Subtract the percent retained on the largest sieve size used from 100.0 to obtain percent passing this sieve.

   b. To obtain the percent passing on subsequent sieves, the percent retained on the sieve is subtracted from the percent passing the previous one.

   c. The amount of material passing the No. 200 (75 µm) sieve is the combined weight (mass) of the amounts washed through the No. 200 (75 µm) wash sieve and the amount retained in the pan after dry sieving. Divide this combined weight (mass) by the original dry weight (mass) of the sample to determine the percent passing the No. 200 (75 µm) sieve. This must equal the calculated percent passing as obtained in Step 2.

E. Reporting

1. The percent passing each sieve is rounded off and reported to two significant figures.

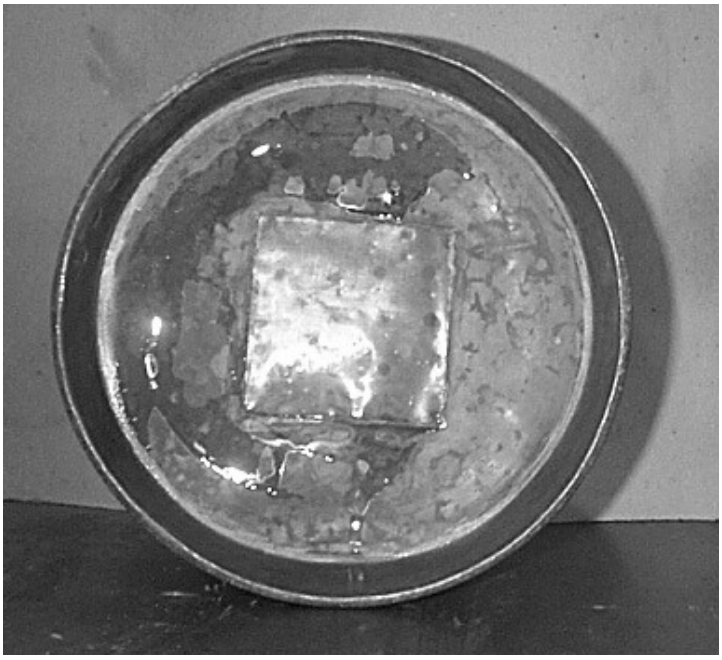

Figure 1. No. 200 (75 µm) Wash Sieve

Figure 2. Fine Sieves

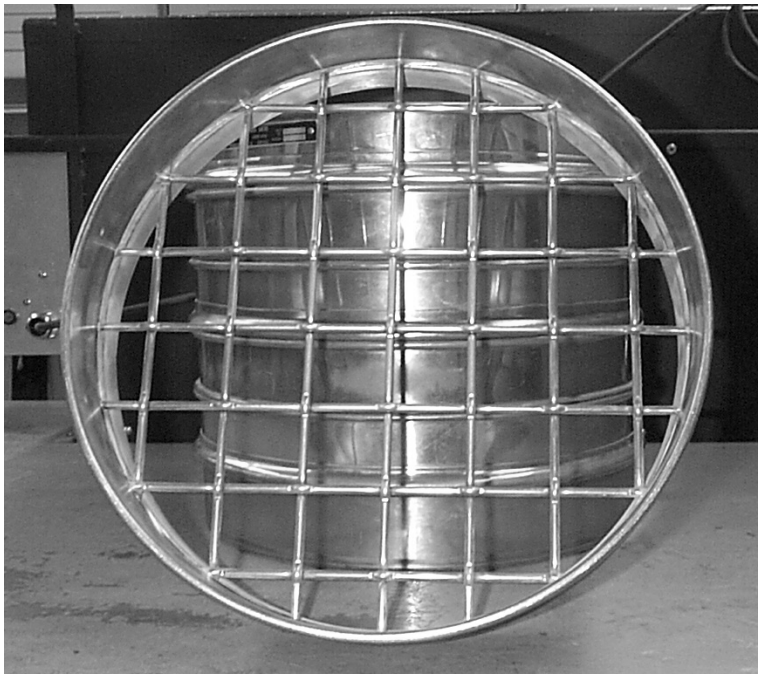

Figure 3. Coarse Sieves

Figure 4. Coarse Sieves Mounted in "Ro-Tap" Shaker