FLORIDA DEPARTMENT OF TRANSPORTATION
State Materials Office
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Florida Method of Test
for
TESTING OF GROUND TIRE RUBBER

Designation: FM 5-559

1 SCOPE

1.1 This method is used to determine the physical requirements of ground tire rubber for use in asphalt rubber using a Sieve Analysis, Specific Gravity Test, Moisture Content Test, and Metal Contaminants Test.

2 REFERENCED DOCUMENTS

2.1 AASHTO Standards:
M 231 Weighing Devices Used in the Testing of Materials
M 92Wire-Cloth Sieves for Testing Purposes

2.2 ASTM Standards:
D 1511Standard Test Method for Carbon Black-Pellet Size Distribution

3 SIGNIFICANCE AND USE

3.1 These testing procedures are intended to determine compliance of a ground tire rubber sample with specifications for use as an asphalt paving material.

4 SIEVE ANALYSIS

4.1 Summary of Test Method

4.1.1 A weighted sample of ground tire rubber is separated through a nest of sieves for determination of particle size distribution.

5 Apparatus

5.1 Balance - The balance shall conform to the requirements of AASHTO M 231 for the class of general purpose balance required for the principal sample mass of the sample being tested.

5.2 Mechanical sieve shaker - a mechanically operated sieve shaker which imparts a uniform rotary and vertical tapping motion to a stack of 200 mm (8 in.) sieves as described in ASTM D1511. A Ro-tap shaker has been found satisfactory for this purpose.

5.3 Sieves - U.S. Standard sieves or equivalents, conforming to AASHTO M 92.

Sieves included shall be No. 16 (1.18 mm), No. 30 (0.60 mm), No. 50 (0.30 mm), No. 100 (0.15 mm) and No. 200 (0.075 mm).

5.4 Talc - Hydrous Magnesium Silicate, with a maximum of 2% retained on the No. 200 sieve in a washed sieve analysis. A suitable source of talc is item number T2-500 from Fisher Scientific, Inc., phone: (800) 766-7000. Equivalent sources of talc will be acceptable.

6 Procedure

6.1 Clean sieves making sure all particles are removed.

6.2 Place one 25 mm (1 in.) diameter solid rubber ball weighing 20-25 g on each sieve and stack sieves in order of sieve size.

6.3 Weigh 100 ± 2 g of ground tire rubber and record weight to the nearest 0.1 g.

6.4 Weigh 25 ± 0.5 g of talc and record weight to the nearest 0.1 g. Mix the talc thoroughly with ground tire rubber until particle agglomerates are broken and talc is uniformly mixed

6.5 Introduce the mixed rubber-talc sample into the top sieve of the nested stack.

6.6 Place the sieve stack in the sieve shaker and shake the mixed sample for 45 ± 1 minutes.

6.7 Starting with the top sieve and taring the weighing dish to account for its weight, remove the screened fraction and pour the contents into the weighing dish, record the weight to the nearest 0.1 g. Any material adhering to the bottom of a sieve shall be brushed into the next finer sieve. Repeat this step for each sieve.

6.8 The sum of the weights of each fraction shall not be less than the original weight of the rubber sample plus 70% of the talc added, or greater than the original weight of the rubber sample plus 100% of the talc added. Repeat the test if either of these conditions occurs.

7 Calculations

7.1 Calculate percentages passing each sieve to the nearest 0.1% on the basis of the total weight of the initial dry sample.

7.2 To calculate the weight of the contents of the bottom pan, empty its contents on the scale and record. Sum the total weight of the contents of each sieve including the bottom pan and subtract the original weight of the rubber obtained

in 4.3.4. The remainder is considered to be talc and shall be subtracted from the bottom pan contents.

8. MOISTURE CONTENT TEST

8.1 Summary of Test Method

8.1.1 The percentage of evaporable moisture in a ground tire rubber sample is determined by drying.

8.2 Apparatus

8.2.1 Balance - The balance shall conform to the requirements of AASHTO M 231 for the class of general purpose balance required for the principal sample mass of the sample being tested.

8.2.2 Oven - Convection type oven capable of maintaining the temperature surrounding the sample at 60 ± 2°C (140 ± 5°F).

8.2.3 Sample container - a container not affected by heat, and of sufficient volume to contain the sample without danger of spilling.

8.3 Procedure

8.3.1 Weigh the sample of 50 ± 5 g. Record the weight to the nearest 0.01 g. Avoid the loss of moisture to the extent possible.

8.3.2 Dry the sample thoroughly at 60 ± 2°C (140 ± 5°F) in the sample container by means of the convection oven exercising care to avoid loss of any particles. Very rapid heating may cause some particles to explode, resulting in loss of particles.

8.3.3 Remove the sample and container at 30 minute intervals and weigh to the nearest 0.01 g.

8.3.4 The sample is thoroughly dry when two consecutive measurements result in less than 0.1 g additional loss in weight. Weigh the dried sample to the nearest 0.1 g after it has cooled to room temperature.

8.4 Calculations

8.4.1 Calculate total moisture content as follows:

$$P = ((W - D) / D * 100$$

Where:

P = Total moisture content of sample, %
W = Mass of the original sample, g
D = Mass of the dried sample, g

9. SPECIFIC GRAVITY TEST

9.1 Summary of Test Method

9.1.2 The specific gravity of the sample is determined by weighing the rubber in air, and while immersed in an alcohol filled pycnometer.

9.2 Apparatus

9.2.1 Balance - The balance shall conform to the requirements of AASHTO M 231- for the class of general purpose balance required for the principal sample mass of the sample being tested.

9.2.2 Pycnometer - A flask or other suitable container which can be accurately calibrated and to which the ground tire rubber sample can be readily introduced. The volume of the container filled to the calibration mark shall be at least 50% greater than the space required to accommodate the test sample.

9.2.3 Water bath - Capable of maintaining a constant temperature 25 ± 0.5°C (77 ± 1°F).

9.2.4 Ethyl Alcohol - Type for which its density is less than that of the rubber sample.

9.3 Procedure

9.3.1 Weigh the pycnometer filled to the calibration mark with alcohol at 25 ± 0.5°C (77 ± 1°F).

9.3.2 Weight 50 ± 1 g of ground tire rubber sample and record the weight to the nearest 0.1 g.

9.3.3 Place the weighed rubber sample into an empty pycnometer, then fill the pycnometer with alcohol to the calibration mark.

9.3.4 Remove any entrapped air by gently agitating the sample. Do not invert the sample.

9.3.5 Readjust the level of the alcohol in the pycnometer to the calibration mark, if necessary.

9.3.6 Place the pycnometer with alcohol and rubber into the constant temperature water bath and allow the temperature to stabilize at 25 ± 0.5°C (77 ± 1°F).

9.3.7 After the pycnometer with rubber and alcohol has stabilized at 25 ± 0.5°C (77 ± 1°F), remove the pycnometer and dry off the outside surface.

9.3.8 Weigh the pycnometer with rubber and alcohol at 25 ± 0.5°C (77 ± 1°F), and record the weight to the nearest 0.1 g.

9.4 Calculations

9.4.1 Calculate the specific gravity as follows:

$$SG = ((0.9971 * Wa) * D) / (Wa - (Wb - Wc)$$

Where:

SG = Specific gravity of sample
Wa = Mass of original sample, g
Wb = Mass of pycnometer filled with rubber and alcohol, g
Wc = Mass of pycnometer filled with alcohol, g
D = Density of alcohol, g / cc

10. METAL CONTAMINANTS TEST

10.1 Summary of Test Method

10.1.1 The percentage of iron metal material contained in the ground tire rubber sample is determined by passing a magnet over the sample.

10.2 Apparatus

10.2.1 Balance - The balance shall conform to the requirements of AASHTO M 231 for the class of general purpose balance required for the principal sample mass of the sample being tested.

10.2.2 Magnet - The magnet with sufficient strength to attract small metallic particles from within the rubber sample.

10.3 Procedure

10.3.1 Weigh 100 ± 1 g of ground tire rubber sample and record the weight to the nearest 0.1 g.

10.3.2 Spread the sample evenly to approximately 12 mm (0.5 in.) thick over a flat surface.

10.3.3 Pass a magnet over the sample at approximately 25 mm (1 in.) above the sample surface.

10.3.4 Move the magnet in a circular pattern over the entire surface of the sample. Stir sample and repeat passing magnet over sample surface, ensuring that all metal particles are removed.

10.3.5 Weigh the remainder of the ground tire rubber sample to the nearest 0.1 g.

10.4 Calculations

10.4.1 Calculate the total metal content in the sample as follows:

$$P = ((Ws-Wr) / Wr) * 100$$

Where:

P = Metal content of sample, %
Ws = Mass of original sample, g
Wr = Mass of remaining sample, g