

**METHODS OF SAMPLING AND TESTING**  
**MT 200-04**  
**DRY PREPARATION OF DISTURBED SOIL AND**  
**SOIL AGGREGATE SAMPLES FOR TEST**  
*(Modified AASHTO T 87)*

**1 Scope:**

- 1.1** This method describes the dry preparation of soil and soil-aggregate samples, as received from the field, for mechanical analysis, physical tests, moisture-density relations test, and other tests as may be desired.

**2 Apparatus:**

- 2.1** *Balance* - A balance sensitive to 0.1 g for samples weighing approximately 110 g or less; for larger samples, the balance shall be sensitive to within 0.1 percent of the sample to be weighed.
- 2.2** *Drying Apparatus* - Any suitable device capable of drying samples at a temperature not exceeding 60 C (140 F),
- 2.3** *Sieves* - A series of sieves of the following sizes: 19.0 mm ( $\frac{3}{4}$  in.), 4.75 mm (No. 4), 2.00 mm (No. 10), 0.425 mm (No. 40) and others as required for preparing the sample for a specific test. The sieves shall conform to MT-405, Sieves for Testing Purposes.

*Note 1 - A 50 mm (2 in.) sieve is required if the sample includes particles retained on the 10.0 mm ( $\frac{3}{4}$  in.) sieve and it is desired that the sample for moisture-density relations (AASHTO T 99 or T 180) contain material between 19.0 mm ( $\frac{3}{4}$  in.) and 4.75 mm (No. 4) sieve size to represent the fraction between 50 and 19.0 mm (2 in. and  $\frac{3}{4}$  in.).*

- 2.4** *Pulverizing Apparatus* - Either a mortar and rubber-covered pestle or a mechanical device consisting of a power-driven rubber-covered muller suitable for breaking up the aggregations of soil particles without reducing the size of the individual grains.

*Note 2 - Other types of apparatus, such as a revolving drum into which the soil sample and rubber-covered rollers are placed and tumbled until soil aggregations are pulverized, are satisfactory if the aggregations of soil particles are broken up without reducing the size of the individual grains.*

- 2.5** *Sample Splitter* - A suitable riffle sampler or sample splitter for proportional splitting of the sample and capable of obtaining representative portions of the sample without appreciable loss of fines. The width of the container used to feed the riffle sample splitter should be equal to the total combined width of the riffle chutes. Proportional splitting of the sample on a canvas cloth is also permitted.

*Note 3 - The procedure for proportional splitting is described in MT 607, Reducing Field Samples of Aggregate to Testing Size.*

**3 Sample Size:**

- 3.1** The amounts of soil material required to perform the individual tests are as follows:
- 3.1.1** *Particle Size Analysis of Soils (AASHTO T 88)*-- For the particle size analysis material passing a 2.00 mm (No. 10) sieve is required in amounts equal to approximately 110 g for sandy soils and approximately 60 g of silty or clayey soils. A sufficient amount of material retained on either the 4.75 mm (No. 4) sieve or 2.00 mm (No. 10) sieve is required (Note 4) to obtain a representative gradation, and depending on the maximum particle size, shall not be less than the amount shown in the following table:

**3 Sample Size: (continued)**

<u>Diameter of Largest Particle, mm (in.)</u>	<u>Approximate Minimum Mass of Portion, kg</u>
9.5 (3/8)	0.5
25.0 (1)	2.0
50 (2)	4.0
75 (3)	5.0

*Note 4 - The material for coarse sieve analysis may be separated by either of two alternate methods, 4.2.1 (2.00 mm sieve) or 4.2.2 (4.75 mm sieve). When only a small percentage of the material will be retained on the 4.75 mm or 2.00 mm sieve, a considerable total weight of sample will be required to provide the minimum quantity shown in the above table; consequently, if the material represented by the sample is not to be used in a base or sub-base course, select borrow, or other item having a requirement for coarse aggregate adherence to the minimum weight requirements in the above table may not be necessary.*

**3.1.2 Specific Gravity (AASHTO T 100)** - For the specific gravity test performed in conjunction with AASHTO T 88, Mechanical Analysis, Soils, Material passing the 2.00 mm (No. 10) sieve is required in the amounts (oven-dry) of at least 25 g when the volumetric flask is used and at least 10 g when the stoppered bottle is used.

**3.1.3 Physical Tests** - For the physical tests, material passing the 0.425 mm (No. 40) sieve is required in the total amount of at least 300 g, allocated approximately as follows:

<u>Test (and AASHTO Designation)</u>	<u>Approx. Mass, g.</u>
Liquid limit (T 89)	100
Plastic limit (T 90)	20
Shrinkage factors (T 92)	30
Field moisture equivalent (T 93)	50
Check the referee tests	100

**3.1.4 Moisture-Density Relations (MT-210)** - For moisture-density relations test, the following approximate amounts of material are required:

<u>Soil Material Passing, Sieve</u>		<u>Approximate Quantity Required</u>		
<u>Method</u>	<u>mm</u>	<u>lb.</u>	<u>kg.</u>	
A . . . . .	4 Mesh	4.75	7	3.2
B . . . . .	4 Mesh	4.75	16	7.3
C . . . . .	3/4 Inch	19.00	12	5.4
D . . . . .	3/4 Inch	19.00	25	11.3

**3.1.5 Other Tests** - For quantity of material required for testing, refer to the specific method of test.

**4 Initial Preparation of Test Samples:**

**4.1** The soils sample as received from the field shall be dried thoroughly in air or the drying apparatus at a temperature not exceeding 60 C (140 F). A representative test sample of the amount required to perform the desired tests (Section 3) shall then be obtained with the sampler, or by splitting or quartering. The aggregations of soil particles shall then be broken up in the pulverizing apparatus in such a way as to avoid reducing the natural size of individual particles.

*Note 5 - Samples dried in an oven or other drying apparatus at a temperature not exceeding 60 C (140 F) are considered to be air dried.*

#### **4 Initial Preparation of Test Samples: (continued)**

**4.2** The portion of the dried sample selected for particle size analysis and physical tests (including specific gravity) shall be weighed and that weight recorded as the weight of total sample uncorrected for hygroscopic moisture. This portion shall then be separated into fractions by one of the following methods:

**4.2.1** *Alternate Methods Using 2.00 mm (No. 10) Sieve* - The dried sample shall be separated into two fractions using a 2.00 mm sieve. The fraction retained on the sieve shall be ground with the pulverizing apparatus until the aggregations of soil particles are broken into separate grains. The ground soil shall then be separated into two fractions using the 2.00 mm sieve.

**4.2.2** *Alternate Method Using 4.75 mm and 2.00 mm (No. 4 and No. 10) Sieves* - The dried sample shall first be separated into two fractions using a 4.75 mm sieve. The fraction retained on this sieve shall be ground with the pulverizing apparatus until the aggregation of soil particles are broken into separate grains, and again separated on the 4.75 mm sieve. The fraction passing the 4.75 mm sieve shall be mixed thoroughly and, by the use of the sampler or by splitting and quartering, a representative portion adequate for the desired tests shall be obtained and weighed. This split-off portion shall then be separated on the 2.00 mm sieve, and processed as in 4.2.1. The material from the split-off fraction that is retained on the 2.00 mm sieve shall be weighed for later use in coarse sieve analysis computations.

#### **5 Test Sample for Particle Size Analysis and Specific Gravity:**

**5.1** The fraction retained on the 2.00 mm (No. 10) sieve in 4.2.1 or that retained on the 4.75 mm (No. 4) sieve in 4.2.2, after the second sieving, shall be set aside for use in sieve analysis of the coarse material.

**5.2** The fraction passing the 2.00 mm (No. 10) sieve in both sieving operations in 4.2.1 or 4.2.2 shall be thoroughly mixed together and, by the use of the sampler or by splitting or quartering, representative portions having approximate weights as follows shall be obtained: (1) for the hydrometer analysis and sieve analysis of the fraction passing the 2.00 mm sieve, 110 g for sandy soil and 60 g for silty or clayey soils; and (2) for specific gravity, 25 g when the volumetric flask is to be used and 10 g when the stoppered bottle is to be used.

#### **6 Test Sample for Physical Tests:**

**6.1** The remaining portion of the material passing the 2.00 mm (No. 10) sieve shall then be separated into two parts by means of a 0.425 mm (N. 40) sieve. The fraction retained on the 0.425 mm (No. 40) sieve shall be ground with the pulverizing apparatus in such a manner as to break up the aggregations without fracturing the individual grains. If the sample contains brittle particles, such as flakes of mica, fragments of sea shells, etc., the pulverizing operation shall be done carefully and with just enough pressure to free the finer material that adheres to the coarser particles. The ground soil shall then be separated into two fractions by means of the 0.425 mm (N. 40) sieve and the material shall be reground as before. When repeated grinding produces only a small quantity of soil passing the No. 40 sieve, the material retained on the No. 40 sieve shall be discarded.

The several fractions passing the No. 40 sieve obtained from the grinding and sieving operations just described shall be thoroughly mixed together and set aside for use in performing the physical tests.

#### **7 Test Sample for the Moisture Density Relations:**

**7.1** The portion of dried soil selected for the moisture-density relations test shall be separated by means of the required sieve as specified in Section 3.1.4. If necessary, the pulverizing apparatus shall be used to break up the soil aggregations retained on this sieve into separate grains. The

ground soil shall then be separated into two fractions using the required sieve.

**7 Test Sample for the Moisture Density Relations: (continued)**

- 7.2** The fraction retained on the sieve after the second sieving shall be saved, if required. The fractions passing the required sieve in both sieve operations shall be thoroughly mixed and used for the moisture-density test.