

**Standard Method of Test for
Field Method of Determining Moisture-Density Relations of
Soils**

SCDOT Designation: SC-T-25 (9/15)

1. SCOPE

- 1.1. This method of test outlines the field procedure for determining the relation between the moisture content and density of soils.
- 1.2. This standard may involve hazardous materials, operations and equipment. This standard does not purport to address all of the safety problems associated with its use. It is the responsibility of the user of this standard to consult and establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.

2. REFERENCED DOCUMENTS

- 2.1. SC-T-22, SC-T-23, AASHTO M 231

3. SUMMARY OF TEST METHOD

- 3.1. A soil sample is compacted in a mold having a capacity of 1/30 of a cubic foot and having an internal diameter of 4 inches. The soil in the mold is compacted in three layers with 25 blows per layer from a 5.5-pound rammer dropped from a height of 12 inches. The moisture content of the sample is raised and the procedure is repeated until the maximum density and optimum moisture content are determined.

4. SIGNIFICANCE AND USE

- 4.1. The maximum dry density and optimum moisture content of a sample of soil can be obtained quickly in the field.

5. APPARATUS

- 5.1. 4-inch diameter proctor mold and 5.5-pound hammer, No. 4 sieve for Method A or 3/4-inch sieve for Method C, balance or electronic scales with sufficient capacity that are readable to 0.1 percent of the sample mass, or better, and conform to the requirements of AASHTO M 231, metal straightedge.

6. TEST SPECIMENS

- 6.1. If the soil is damp when received, dry it until it becomes friable under a trowel. Drying may be in air or by use of a method such that the temperature does not exceed 60°C. Then, break up any lumps in such a manner as to avoid reducing the natural size of individual particles.

- 6.2. For Method A, screen an adequate quantity of representative pulverized soil over the No. 4 sieve. Discard the coarse material, if any, retained on the No. 4 sieve. Select a representative sample, weighing approximately 7 pounds or more.
- 6.3. For Method C, prepare the sample as for Method A except that the soil shall be screened over a $\frac{3}{4}$ -inch sieve and the material larger than $\frac{3}{4}$ inch discarded. A 12-pound representative sample shall be selected.

7. PROCEDURE

7.1. Method A:

- 7.1.1. Thoroughly mix the selected representative sample with sufficient water to dampen it to approximately 4 percentage points below optimum moisture content.
- 7.1.2. Form a specimen by compacting the prepared soil in the 4-inch mold (with collar attached) in 3 equal layers to give a total compacted depth of about 5 inches. Compact each layer by 25 uniformly distributed blows from the hammer dropping free from a height of 12 inches above the elevation of the soil. During compaction, the mold shall rest on a uniform, rigid foundation such as provided by a cube of concrete. Following compaction, remove the extension collar, carefully trim the compacted soil even with the top of the mold by means of a straightedge and weigh. Multiply the weight of the compacted specimen and mold, minus the weight of the mold, by a constant which will be furnished by the Office of Materials and Research; and record the result as the wet unit weight per cubic foot of the compacted soil.
- 7.1.3. Remove the material from the mold and slice vertically through the center. Take a representative sample of the material from one of the cut faces, weight immediately, and then determine the moisture content of the soil by SC-T-22 or SC-T-23.
- 7.1.4. Thoroughly break up the remainder of the material until it will pass a No. 4 sieve as judged by eye. Add water in sufficient quantity to increase the moisture content of the sample by 1 or 2 percentage points, and repeat the above procedure for each increment of moisture added. Continue this series of determinations until the wet unit weight per cubic foot either decreases or there is no change in wet unit weight per cubic foot.

7.2. Method C:

- 7.2.1. The procedure is the same as that for Method A with the following exceptions:
- 7.2.2. Determine the moisture content by SC-T-23. Per the discretion of the RCE, SC-T-22 may be used for the determination of moisture content for Cement Modified Recycled Base.
- 7.2.3. Thoroughly break up the soil until it will pass a $\frac{3}{4}$ -inch sieve and 90% of the soil aggregations will pass the No. 4 sieve as judged by eye.

8. CALCULATIONS

- 8.1. Calculate the moisture content and the dry unit weight of the soil as compacted for each trial. The dry unit weight, in pounds per cubic foot of compacted soil, is computed by using the following equation:

$$\gamma_{\text{DRY}} = \left(\frac{\gamma_{\text{WET}}}{W + 100} \right) \times 100$$

Where: γ_{DRY} = dry unit weight, in pcf of compacted soil
 γ_{WET} = wet unit weight, in pcf of compacted soil
W = percentage of moisture in the specimen

- 8.2. After calculating the moisture content and corresponding dry unit weight (density) for each of the soil samples, plot the dry unit weights per cubic foot as ordinates and corresponding moisture contents as abscissas. Connect the plotted points so as to produce a smooth curve.
- 8.3. The moisture content corresponding to the peak of the curve is termed the “optimum moisture content” of the soil. The dry unit weight per cubic foot of the soil at optimum moisture content is termed the “maximum dry density” under the above compaction.

9. REPORT

- 9.1. Report the optimum moisture content of the soil to the nearest 0.1 percent and the maximum dry density to the nearest 0.1 pound per cubic foot. Use SCDOT Form 200.01 – Field Density Test Report (Nuclear Gauge), SCDOT Form 200.02 – Percent Compaction by Nuclear Gauge, and SCDOT Form 200.03 – Percent Compaction by Nuclear Gauge-Direct Read Gauge.