Moisture-Density Relations of Soils or Soil-Aggregate Mixture Using a 10 lb. Rammer and 18 in. Drop

SC T 140

1. Scope

This method of test is intended for determining the relationship between moisture content and density of soils when compacted in a 6 inch diameter mold with a 10 pound rammer dropped from a height of 18 inches.

2. Referenced Documents

2.1 AASHTO Standards
   T 180 Moisture-Density Relations of Soils Using a 4.54-kg (10-lb) Rammer and a 457-mm (18-in.) Drop
   T 265 Laboratory Determination of Moisture Content of Soils

3. Apparatus

3.1 6 inch diameter Proctor mold and 10 pound hammer, ¾ in sieve, No. 4 sieve, balance or electronic scales, metal straightedge, drying oven, mixing tools, drying containers with tight fitting lids.

4. Test Specimens

4.1 Select a representative sample having a mass of approximately 25 pounds. If the material is of a fragile nature such that it may break down when compacted, then a separate sample should be used for each point. Sieve the test specimens over the ¾ inch sieve and weigh the material retained on the ¾ inch sieve. Discard the material retained on the ¾ in sieve and replace it with an equal mass of material passing the ¾ inch sieve and retained on the No. 4 sieve.

5. Procedure

5.1 Determine the weight of a 6 inch diameter proctor mold.

5.2 Place the 6 inch diameter proctor mold (with base plate and collar attached) on a block of concrete of sufficient size to afford a uniform, rigid foundation.

5.3 Thoroughly mix the selected representative sample with sufficient water to bring the moisture content to approximately 4 percentage points below optimum moisture content.

5.4 Form a specimen by compacting the prepared sample in the 6 inch diameter mold in five approximately equal layers to give a total compacted depth of about 5 inches. Prior to compaction, place the loose material into the mold and spread into a layer of uniform thickness. Lightly tamp the material prior to compaction until it is not in a loose or fluffy state, using either a manual compaction rammer or similar device having a face diameter of approximately 2 inches. Following compaction of the first four layers, any soil adjacent to the mold walls that has not been compacted or extends above the compacted surface shall be trimmed using a knife or other suitable device and evenly distributed on the top of the layer. Compact each layer by 56 uniformly distributed blows from the 10 pound rammer dropping free from a height of 18 inches above the elevation of the material.

5.5 Following compaction, remove extension collar, carefully trim the compacted material even with the top of the mold by means of a straightedge. Holes developed in the surface by removal of coarse particles shall be patched with smaller sized material.

5.6 Determine the weight of the mold and compacted specimen to the nearest 5 grams. Divide the mass in grams of the compacted specimen and mold minus the mass of the mold by 453.6 to convert grams to pounds. Divide the mass in pounds by the volume of the mold (0.075 cubic feet) and record the results as the wet density in pounds per cubic foot of compacted material.

5.7 Remove the material from the mold and slice vertically through the center. Take a representative sample of material from one of the cut faces, determine the mass immediately and dry in accordance with AASHTO T 265, Laboratory Determination of Moisture Content of Soils, to determine moisture content, and record the results.

5.8 Thoroughly break up the remainder of the material until it will pass a ¾ inch sieve and 90 percent of the soils aggregations will pass a No. 4 sieve as judged by eye, and add to the remaining portion of the sample being tested. Add water in sufficient amounts to increase the moisture content of the material by approximately two percentage points and repeat the above procedure for each increment of water added.

5.9 Continue this series of determinations until there is either a decrease or no change in the wet unit per cubic foot of the compacted sample.

6. Calculations

6.1 Weight of Mold and Aggregate = 11,198 grams

6.2 Weight of Mold = 6584 grams

6.3 Weight of Aggregate = 6.1 - 6.2=11,198 g - 6584 g   = 4422 grams

6.4 Wet Density of Aggregate =6.3x453.6x0.075   = 130.0 pcf

6.5 Percent Moisture (AASHTO T 265)   = 4.2%

6.6 Dry Density=Wet Density/(100+mc)=130.0pcf/(100+4.2)   = 124.7 pcf

6.7 Plot moisture contents versus dry density for each point and connect with a smooth curve.

6.8 Select the optimum moisture content and maximum dry density values corresponding to the peak of the curve.

7. Report

7.1 Report the optimum moisture content of the aggregate to the nearest 0.1 percent and the maximum dry density to the nearest 0.1 pound per cubic foot. Perform calculations and draw graph on worksheet 6W. Report on Lab Form SO128 or SO129.