EXPERIMENT 6

COMPACTION TEST

Purpose:

This laboratory test is performed to determine the relationship between the moisture content and the dry density of a soil for a specified compactive effort.

moisture content and the dry density of a soil for a specified compactive effort. The compactive effort is the amount of mechanical energy that is applied to the soil mass. Several different methods are used to compact soil in the field, and some examples include tamping, kneading, vibration, and static load compaction. This laboratory will employ the tamping or impact compaction method using the type of equipment and methodology developed by R. R. Proctor in 1933, therefore, the test is also known as the Proctor test.

Theory:

Two types of compaction tests are routinely performed: (1) The Standard Proctor Test, and (2) The Modified Proctor Test. Each of these tests can be performed in three different methods as outlined in the attached Table 1. In the Standard Proctor Test, the soil is compacted by a 5.5 lb hammer falling a distance of one foot into a soil

filled mold. The mold is filled with three equal layers of soil, and each layer is subjected to 25 drops of the hammer. The Modified Proctor Test is identical to the Standard Proctor Test except it employs a 10 lb hammer falling a distance of 18 inches and uses five equal layers of soil
instead of three. There are two types of compaction molds used for testing.

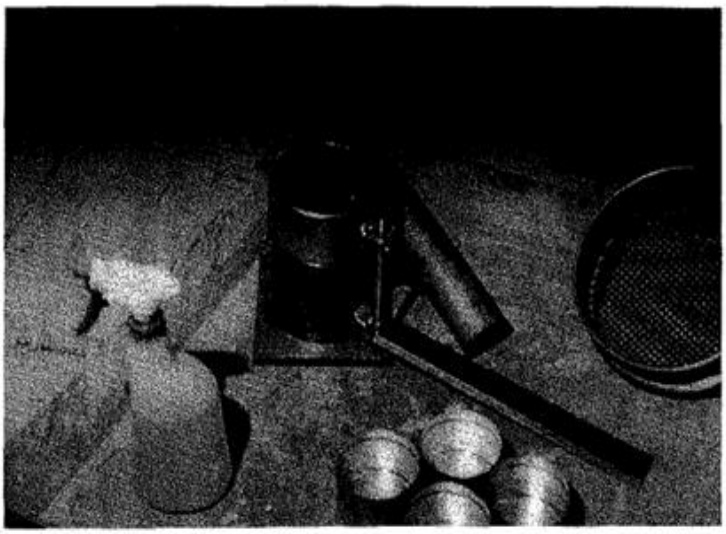
For construction of highways, airports, and other structures, it is often necessary to compact soil to improve its strength. Proctor (1933) developed a laboratory compaction test procedure to determine the maximum dry unit weight of compaction of soils which can be used for
specification of field compaction. This test is referred to as the' *standard Proctor compaction test* and is based on the compaction of the soil fraction passing No, 4 U.S. sieve.

Equipment

1. Compaction mold
2. No.4 U.S. sieve
3. Standard Proctor hammer (5.5lb)
4. Balance sensitive up to 0.01 lb
5. Balance sensitive up to 0.1 g
6. Large flat pan
7. Jack
8. Steel straight edge
9. Moisture cans
10. Drying oven
11. Plastic squeeze bottle with water

Figure 6-1 shows the equipment required for the compaction test with the exception of the jack, the balances, and the oven,

Figure 6-1. Equipment for Proctor compaction test.



Proctor Compaction:

Mold and Hammer

A schematic diagram of the Proctor compaction mold, which is 4 in. (101.6mrn)in diameter and 4.584 in. (116.4) in height, is shown in Fig. 12-2a. There is a base plate

and an extension . that can be attached to the top and bottom of the mold, respectively. The inside of the mold is Iho ft3 (943;9 cm3).

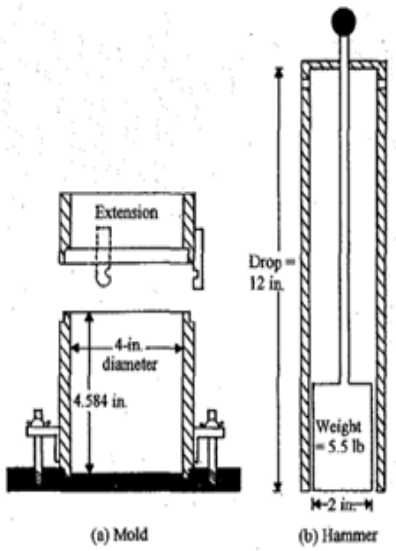


Figure 6-2. Standard Proctor mold and hammer.

Procedure:

1. Obtain about 10 lb (4.5 kg) of air-dry soil on which the compaction test is to be conducted. Break all the soil lumps.
2. Sieve the soil on a No.4 U.S. sieve. Collect all of the minus-4 material in a large pan. This should be about 6lb (2.7 kg) or more. .
3. Add enough water to the minus-4 material and mix it in thoroughly to bring the moisture content up to about ~.
4. Determine the weight of the Proctor mold + base plate (not the extension), WI' (lb).
5. Now attach the extension to the top of the mold.
6. 'Pour the moist soil into the mold in *three* equal layers. Each layer should be compacted uniformly by the standard Proctor hammer 25 *times* before the next layer of loose soil is poured into the mold.

Note: The layers of loose soil that are being poured into the mold should be such that,

at the end of the three-layer compaction, the soil should extend *slightly above* the top of the rim of the compaction mold.

7. . Remove the top attachment from the mold. Be careful not to break off any of the compacted soil inside the mold while removing the top attachment.

8.' Using a straight edge, trim the excess soil above the mold (Fig. 6-3). Now the top of the compacted soil will be even with the top of the mold.

9. Determine the weight of the mold + base plate +- compacted moist soil in the mold, *W2* (lb).

10. Remove the base plate from the mold. Using a jack, extrude the compa<;ted soil cylinder from the mold.

11. Take a moisture can and determine its mass, *W3* (g).

12. From the moist soil extruded in Step 10, coliect a moisture sample in the moisture can (Step II) and determine the mass of the can + moist soil, *W4* (g).

13. Place the moisture can with the moist soil in the oven to dry to a constant weight.

14. Break the rest of the compacted soil (to No.4 size) by hand and mix it with the leftover

moist soil in the pan. Add more water and mix it to raise the moisture content

by about 2% .

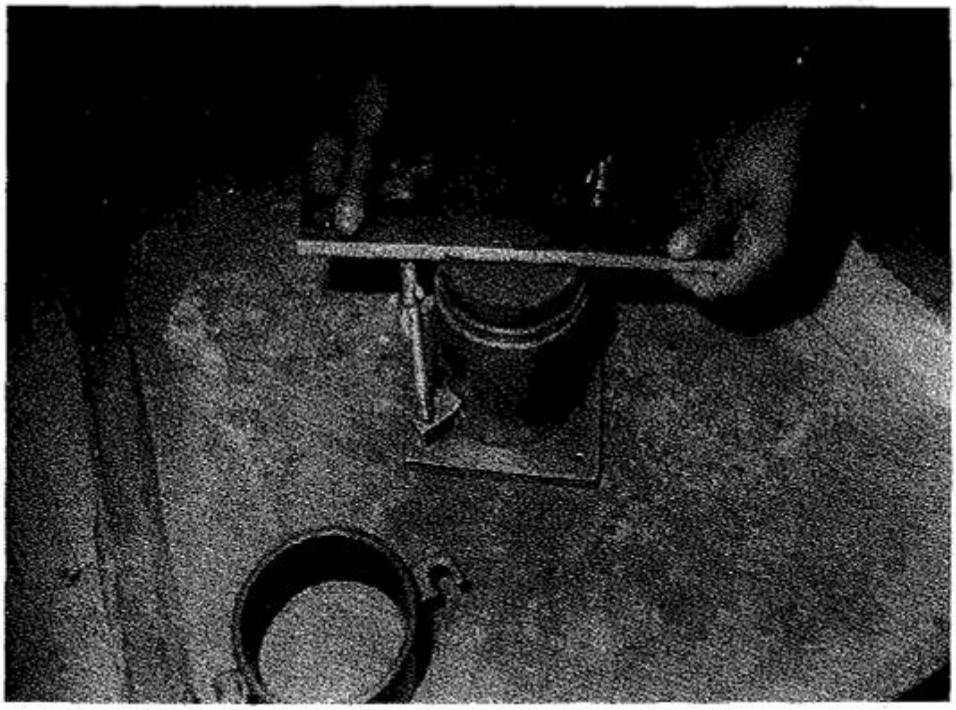


Figure 6-3. Excess soil being trimmed (Step 8).

15. Repeat Steps 6 through 12. In this process, the weight of the mold + base plate + moist soil *(W* ~ will first increase with the increase in moisture content and then decrease.

Continue the test until at least two successive down readings are obtained.

16. The next day, determine the mass of the moisture cans + soil samples, *W5* (g) (from Step 13).