PROCTOR COMPACTION TEST

Definition

Compaction in general is the densification of soil by removal of air, which requires mechanical energy.

Introduction

Soil compaction can be a very economical method of soil improvement, and it is often used to make ground suitable for the foundations of roads and buildings. It is also used in the placing of soil fills and in the construction of earth dams to ensure suitable soil properties. The compaction is normally achieved through the input of energy into the soil by impact, kneading, vibration or static means.

The extent of compaction depends on the moisture content of the soil and the compactive effort used. A plot of dry density versus moisture content (Figure 1) indicates that compaction becomes more efficient up to a certain moisture content, after which the efficiency decreases. The maximum dry density is obtained at this optimum moisture content.

Objective

To obtain the moisture content – dry density relationship for a soil and hence to determine the optimum moisture content and maximum dry density.

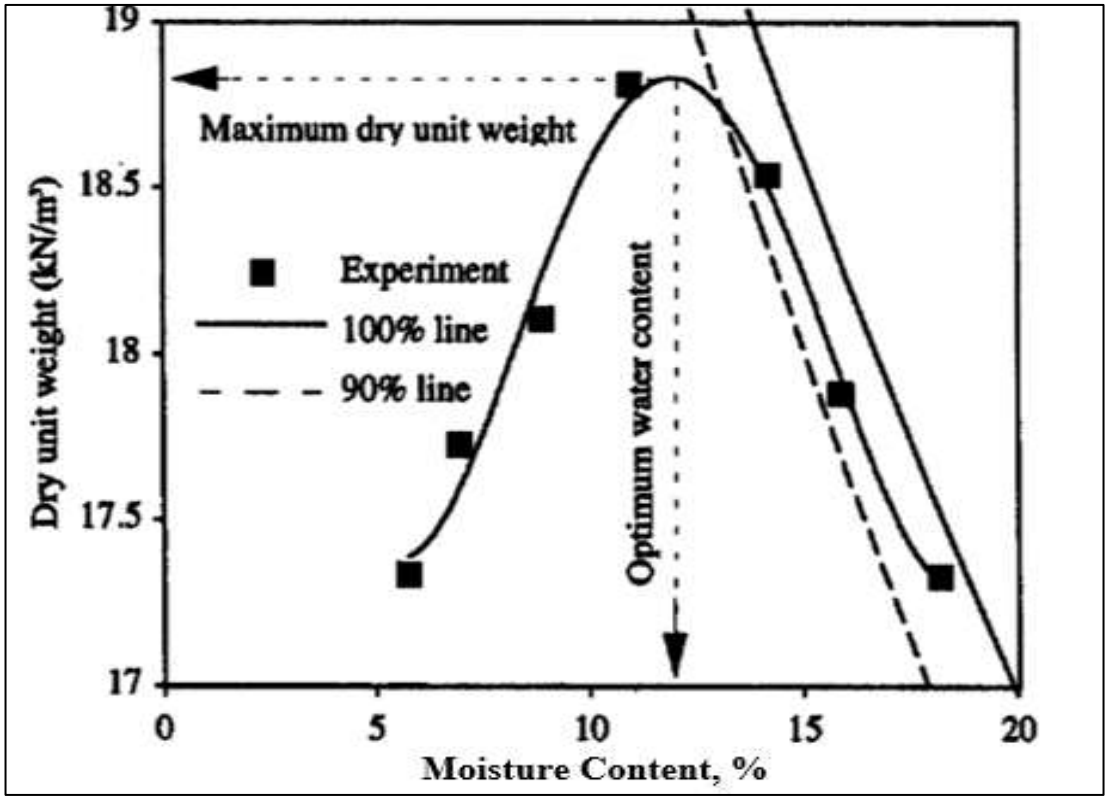

Figure (1)

Standard Compaction Test

Soil is compacted into a mould in 3 equal layers, each layer receiving 25 blows of a hammer of standard weight. The apparatus is shown in (Figure 2) below. The energy (compactive effort) supplied in this test is 595 kJ/m^3. The important dimensions are

Volume of mould	Hammer mass	Drop of hammer
944- 1000 cm^3	2.5 kg	300 mm

Modified Compaction Test

The procedure and equipment is essentially the same as that used for the Standard test except that 5 layers of soil must be used. To provide the increased compactive effort (energy supplied = 2072 kJ/m^3) a heavier hammer and a greater drop height for the hammer are used. The key dimensions for the Modified test are

Volume of mould	Hammer mass	Drop of hammer
944- 1000 cm^3	4.9 kg	450 mm

Equipment

1. Proctor mould with a detachable collar assembly and base plate as shown in Figure (2).
2. Manual rammer weighing 2.5 kg and equipped to provide a height of drop to a free fall of 30 cm.
3. Sample Extruder.
4. A sensitive balance.
5. Straight edge.
6. Squeeze bottle
7. Mixing tools such as mixing pan, spoon, trowel, spatula etc.
8. Moisture cans.
9. Drying Oven.

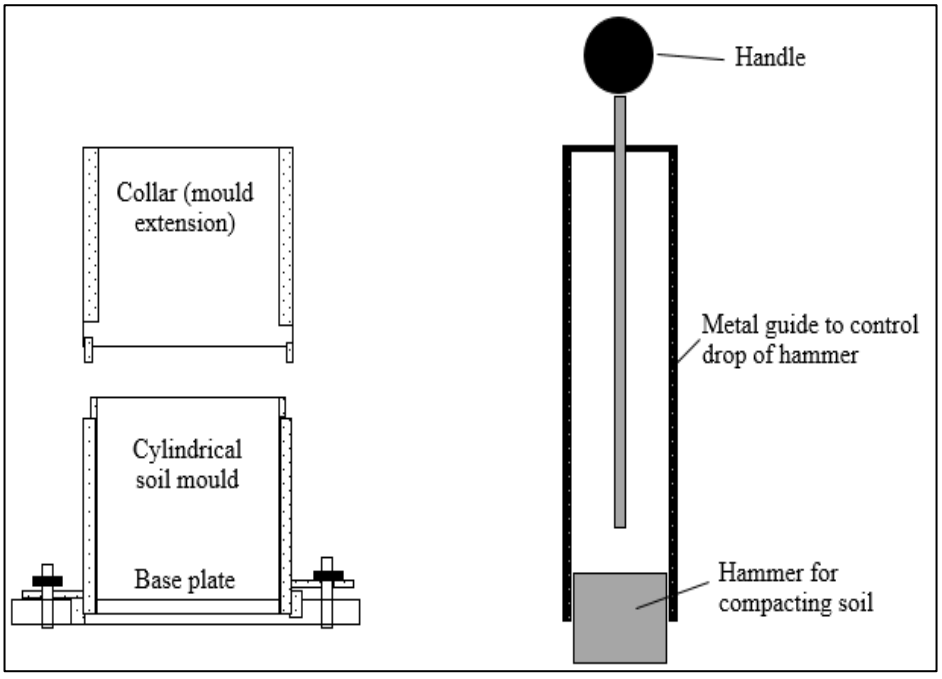

Figure (2) Apparatus for laboratory compaction tests.

Procedure

1. Weigh the empty mould (but without the base and the collar).
2. Measure the diameter and the height of the mould. Assemble the compaction apparatus.
3. Break soil lumps and sieve the soil through a No. 4 sieve.
4. Prepare five soil samples each one weigh 2kg. Add the required amount of water to each sample. Then store each one in a plastic container.
5. Form a 50 to 75 mm layer of soil in the mould, and gently press the soil to smooth its surface
6. Compact the soil with 25 evenly distributed full height blows of the hammer.
7. Repeat the procedure with a second and third layer. After the compaction of the third layer, the surface of the soil must be slightly above the top rim of the mould.
8. Remove the collar and trim off the soil above the top of the mould.
9. Weigh the mould and the sample
10. Remove the soil from the mould and obtain 2 representative samples for moisture content determinations.
11. Keep repeating the compaction process until 5 runs have been made.

Calculations

The dry unit weight (γd) can be computed from $$\gamma_d = \frac{\gamma_t}{1+wc}$$

Where:

γt is wet unit weight of the soil , = $\frac{W}{V}$ (kN/m^3)

W = weight of the wet compacted soil sample

V = volume of soil.

wc =moisture content of the compacted soil

$$wc = \frac{W_w}{W_s} = \frac{W - W_s}{W_s}$$

Ws = weight of the dry soil sample

Ww = weight of water

Discussion

What is the effect of the soil type on the OMC and MDD?

Compaction Test Data Sheet

Name: Signature:
Class: Date: / /

Mold diameter (cm):
Mold Height (cm):
Mold Weight (g)

Moisture Content

Determination No.	1	2	3	4	5
Container No.					
Container weight (g)					
Container & Wet soil (g)					
Container & Dry soil (g)					
Water W_w (g)					
Dry soil W_s (g)					
Moisture content (%)					

Dry Density

Determination No.	1	2	3	4	5
Weight of mould & Compacted soil (g)					
weight of mould (g)					
weight of Compacted soil (g)					
Wet density γt (kN/m^3)					
Dry Density γd (kN/cm^3)					