Unit weight

Nielsen, Benjaminn Nordahl; Nielsen, Søren Dam

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Benjaminn Nordahl Nielsen
Søren Dam Nielsen

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by

Benjaminn Nordahl Nielsen
Søren Dam Nielsen

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Preface

This guide deals with the determination of the unit weight of fine grained soil.

The guide is part of a series, which explain the execution of geotechnical classification experiments as carried out at the Geotechnical Engineering Laboratory.

The guide is constructed as follows:

- *Appertaining standards*
- *Definitions*
- *Apparatus*
- *Equipment calibration*
- *Preparing the test sample*
- *Procedure for experiment*
- *Calculation*
- *Reporting*
- *Remarks*
- *Schema for experiment execution*
- *Appendix, if any*

It is recommended that the user of this guide reads the entire guide before the experiment is started.

Numbering of figures in the text is indicated by { }.

Units are indicated by [ ], e.g. [%].

Appertaining standard

The experiment is based on and further described in the standard DS/CEN ISO/TS 17892-2.

Definition

The unit weight of a soil γ (specific load) is force per volume unit:

$\gamma = \rho \cdot g$ [kN/m^3]

ρ Density of the soil [g/cm^3]

g gravitational acceleration = 9,8 [m/sek^2]

The unit weight determined with measuring and weighing of undisturbed, intact samples.

The unit weight of a soil is normally to be found in the interval 15 - 23 kN/m^3.

For soil with large water content, it can be as low as a little over 10 kN/m^3, and for soil sorts with very small void ratio; up to 25 kN/m^3.

Apparatus

Apparatus used in the experiment. Numbers refer to figure 1.

- Intact soil sample in sample tube {1}
- Scale, weighing accuracy 0,1g
- Cutting and trimming tools {2}
- Measuring tape {3}
- Vernier calliper {4}
- Sample extracter {5}

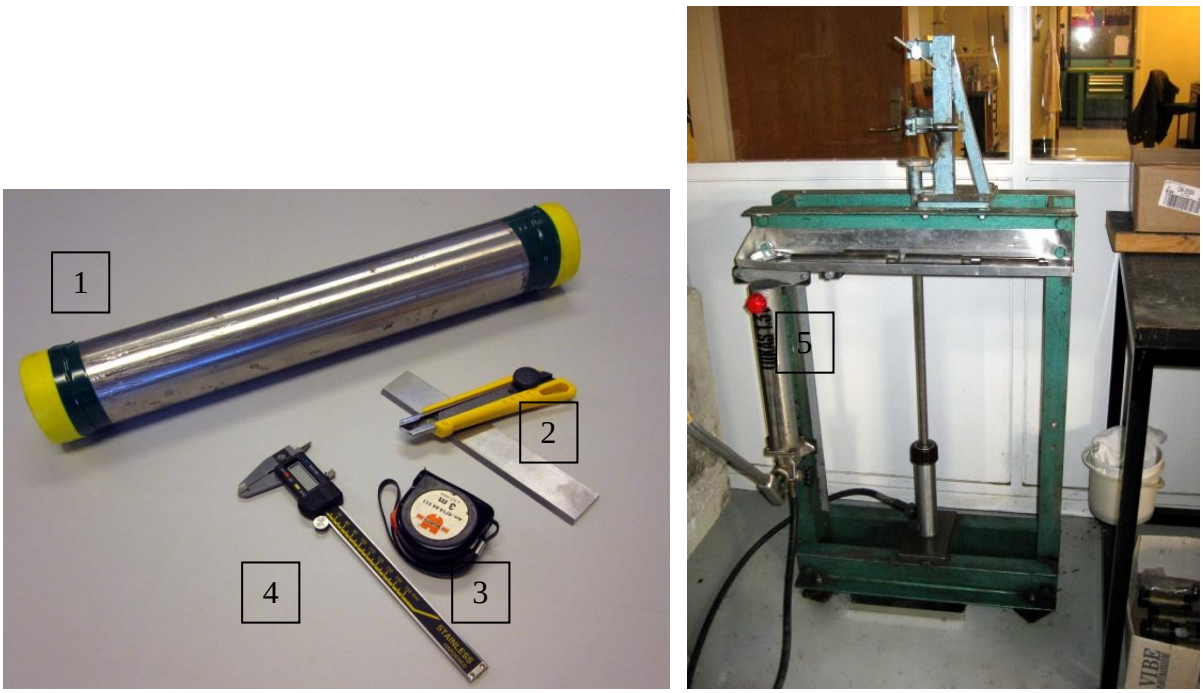

Figure 1: Apparatus for experiment.

Equipment calibration

No equipment needs calibrating.

Preparing test sample

The test sample needs no preparation before experiment.

Procedure for experiment

Method I

The sample tube is brushed clean of exterior soil remnants and dried off thoroughly.

- The undisturbed sample tube is opened and filling bags, wax or other materials used for sealing the cylinder is removed.
- The soil sample remains untouched in the cylinder.
- The brushed cylinder with a soil sample is weighed, ($Cyl + W$).
- The height of the soil sample is measured, *(H).* Measure the height of the cylinder and deduct the height of the empty space in the cylinder if this is not filled, figure 2.
- The soil sample is pressed out with the sample extractor.
- The cylinder is washed and dried thoroughly
- The cylinder is weighed, *(Cyl).*
- The <u>internal</u> diameter of the cylinder is measured *(D)*, figure 3.

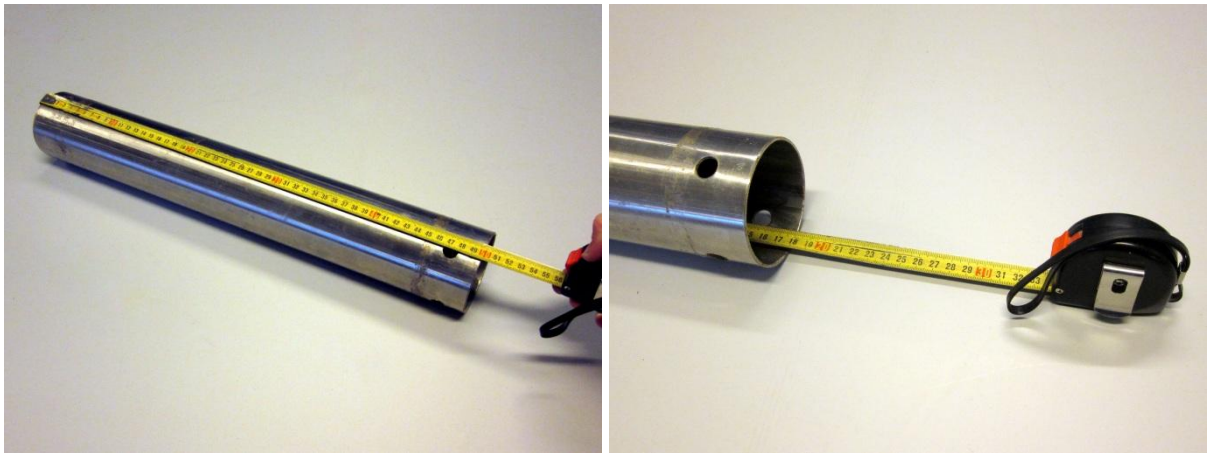

Figure 2: Measurements of cylinder and the empty space in the cylinder, respectively.

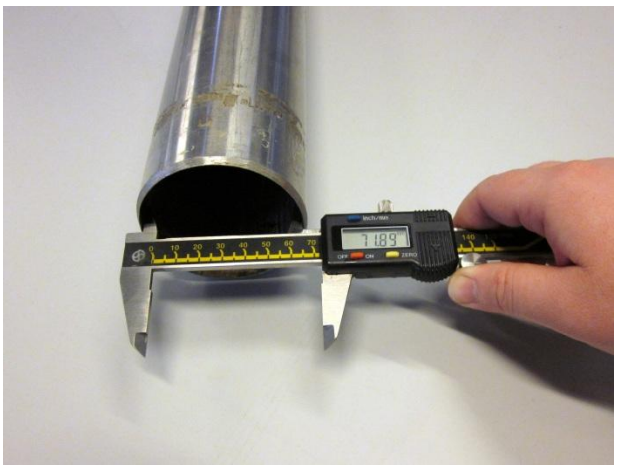

Figure 3: The internal diameter is measured with a vernier calliper.

Method II

After the cylinder has been opened, the soil sample is pressed out with the sample extractor and the ends are shaped levelled.

- A small part of the soil sample is hereafter pressed down in a volume weight cylinder with known weight (Cyl) and internal volume (V).
- The soil sample is trimmed along the end plates of the volume weight cylinder.
- The volume weight cylinder with a soil sample is weighed ($Cyl + W$).

Calculations

Weight of soil sample (W):

$$W = (Cyl + W) - Cyl$$

Volume of soil sample (V):

$$V = \frac{\pi}{4} \cdot D^2 \cdot H$$

Volume weight of the soil can be calculated with:

$$\gamma = \frac{W}{V} \cdot g\left[kN / m^3\right]$$

Reporting

State which method has been used.

Volume weight is indicated by 1 decimal.

Remarks

Shaping of soil sample must be done so evaporation is minimized. This can be ensured by, first of all, conducting the experiment in a cooled room and making sure the executing of the experiment is done quickly.

It is important that intact tube samples are sufficiently sealed and kept cooled until they are used. A storage temperature of 8 – 10°C is recommended.

Method I is usually used with intact tube samples.

If it is layered soil, method II is used, and the volume weight is determined for each layer.

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Unit weight

Case			Case no.
Examined	to	Lab. no.	Boring no.
Controlled d.	Approved d	Level	Appendix no.

Used method: ___I ___II

UNIT WEIGHT

Sample	No					
Cylinder	No					
Cyl. + *W*	g					
Cyl.	g					
Sample weight *W*	g					
Tube length	cm					
Empty space length	cm					
Sample length	cm					
Sample diameter	cm					
Sample volume *V*	cm^3					
$\rho = \frac{W}{V}$	g/cm^3					
$\gamma = \frac{W}{V} \cdot g$	kN/m^3					

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