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# EXAMINATION OF CONNECTION BETWEEN THE CHANGE OF POROSITY AND SHEARING STRESS OF COHESIVE SOILS DUE TO MON-AXIAL LOADS

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To explain the connection between the change of porosity and shearing stress systematical researches were made in our Institute. Different kinds of soil of various contents of moisture were examined.

Of this testing substance proof material was constructed, that is to say three pieces for ten loading gradations. Herewith just a report is made about examinations performed on sandy soil of strong colloidical proportion most frequently found in Krakow's surroundings.

First of all the testing material was in ten gradations axial loaded in Terzaghi's oedometer. The percentage of moisture of the three samples for every loading gradation was established before. The number of porosity for every loading gradation was established according to known methods.

The testing material which became condensed in the oedometer-apparatus was now tested for shearing. For this purpose a particular simple apparatus was constructed:

Fig. 1:
The apparatus consists of two metallic shearing cheeks which when put together enclose a circular aperture into which the cylindrical testing material perfectly fits.
Grinded to a point the shearing cheeks fit close together. Loading one cheek the enclosed proof-material will be tested for shearing.

FIG.1

Fig.2,3,4 are grafical exhibitions showing the connection between condensation and shearing stress at three different contents of moisture. At the beginning the curved lines take a linear course but assume later on a parabolic character. It means

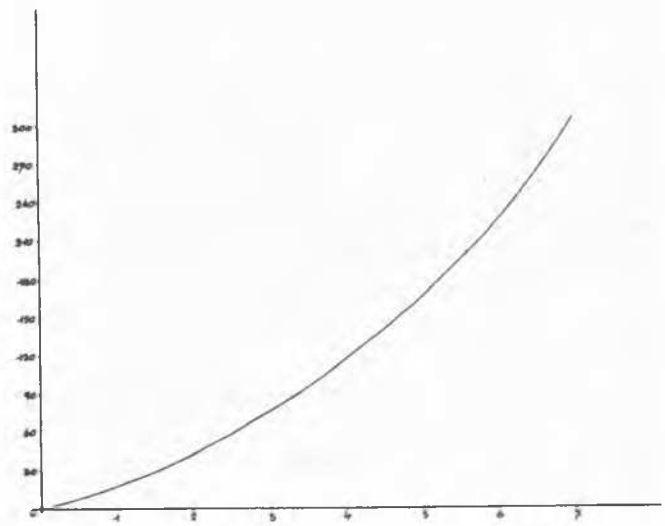

FIG.2

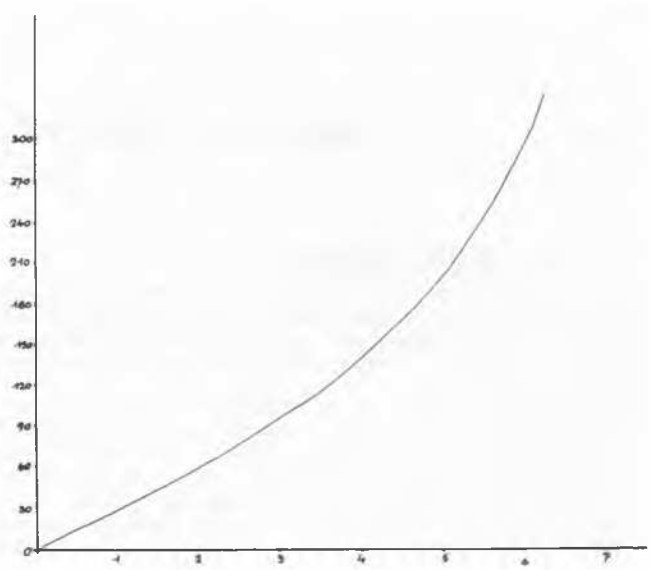

FIG.3

that the shearing stress increases to a larger extent than the contents of moisture.
Comparing the three curved lines, the influence of moisture appears plainly visible. The biggest shearing stress can be observed near the medium contents of moisture. It seems that the optimal contents of moisture are near the medium. Detailed experiments have to be made to establish the optimal contents of moisture.
Taking into consideration the kind of ground, the primar porosity and the contents of moisture the lawful connection between condensation and shearing stress can be mathematical explained through a simple exponential formula with three constant values. To assert a reliable definition of the constant a richer testing material would be needed.

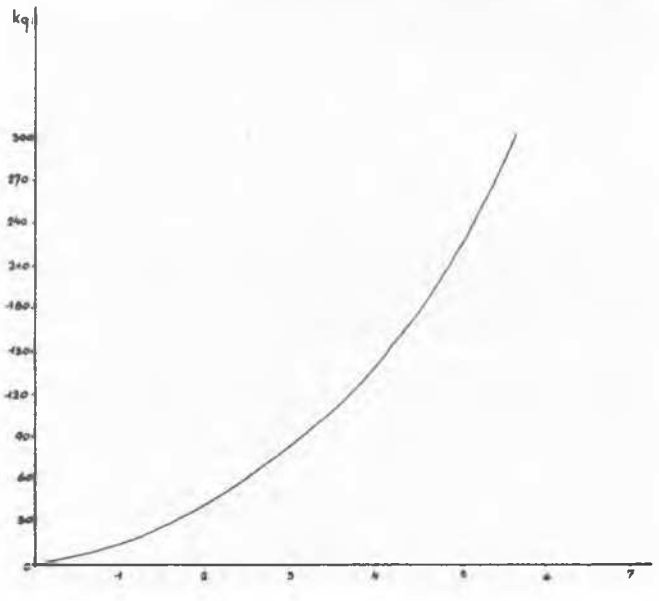

FIG.4

The practical value of these experiments exists therein, that the bearing capacity of a pile can easily be established thanks to the above described examinations. In ramming a pile into the ground, the same conditions result in the ground as we saw in our above described researches. It is easily comprehensible that under a rammed pile a condensation occurs underground. Although this condensation generally is not axial, conditions in deeper ground come more and more close to the axial. Adding to that the strong condensation at the surface of the pile nearly occurs in deeper ground in the same way as it does in the oedometer apparatus. With the aid of a pile the ground is cut through similar to the stamping of metal and by simultaneous condensation tested for shearing stress. The work which occurs in ramming the pile is the result of the condensation- and shearing-work. To state the real bearing-power (transverse strength) of the pile it is necessary to analyse this condensation- and shearing-work. It is also necessary to take into consideration the contents of moisture of the soil, that is to say not the casual but the most unfavourable one which may occur.

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## SOIL FRICTION COEFFICIENT AS A FUNCTION OF WATER CONTENT

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### 1. SCOPE OF INVESTIGATIONS

The earth structures which are of interest to road building specialists (subgrades, earth fills, dirt roads) are not ordinarily saturated with water, but their pores are more or less filled with air.

On the other hand, knowledge of the cohesion and of the angle of internal friction of these soils presents a great interest. However, these characteristics, as determined by Casagrande's method, i.e. with the pores initially saturated with water and left saturated during the shearing test, correspond to a condition found only exceptionally in road construction.

Therefore, it was logical to wonder how the cohesion and the angle of internal friction vary as a function of the water content. To solve this problem, it was necessary to determine the shearing strength of a number of mixtures with different water contents, for various pressures, and to find the water content of the rupture zone at the time of shearing. Then, the curve of shearing strength vs. water content for various pressures had to be drawn, to arrive at the relation between shearing strength and pressure for various water contents, in other words, the value of these coefficients had to be computed.

### 2. APPARATUS

It was deemed advisable to perform shearing tests by translation as well as by torsion on confined samples. Other tests are under way with the triaxial apparatus (with lateral strain).

For the former tests, the apparatus shown on Fig. 1 (photograph) was used. Its detail is shown on Fig. 2.

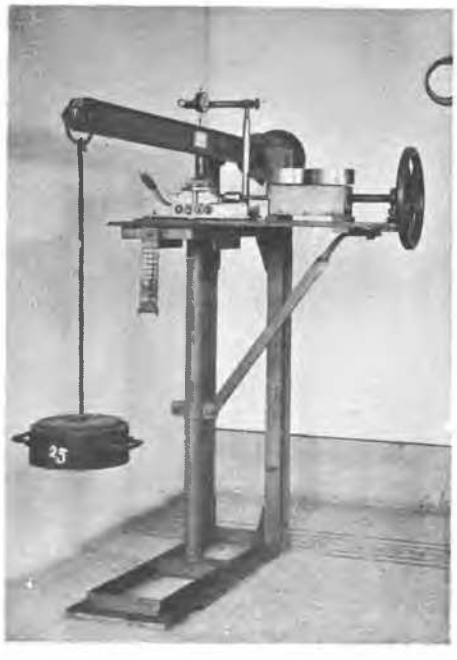

FIG.1