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INFLUENCE OF CONSOLIDATION CONDITIONS ON SOIL PHYSICAL PARAMETERS

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ABSTRACT

The basic assumptions defining the methodology of testing soil strength parameters have been known for almost 250 years, however, obtaining reliable and unequivocal parameters values for geotechnical calculations is still a difficult issue. The main problem is the fact that soil strength parameters are not a material constant, and their values depend on the methodology of the research. Numerical calculations carried out on the most advanced numerical programs depend on input data. Correctly performed engineering calculations should take into account the conditions that reflect the real ones occurring. Authors present changes in the physical parameters of plastic soil samples from the near-surface landslide zone under various consolidation conditions. Physical characteristics such as bulk density, porosity, humidity or degree of plasticity have a direct impact on the strength of the soil. Inadequate selection of consolidation conditions during the determination of strength parameters may cause their changes and affect the results of further engineering calculations. Analyzes were carried out on samples of plastic clays with undisturbed structure.

The main purpose of the work is to draw attention to the selection of the appropriate research methodology, which has a key impact on the physical and strength parameters used in further stages of engineering calculations.

MATERIAL

For the purposes of the poster, a number of tests were carried out in an oedometer and physical characteristics of samples originating from soft-plastic layers of a landslide in southern Poland. Soft-plastic silty clays (IL> 0.5) located in the surface layers were used as the research material. Samples were collected using Schelby-type push-in samplers to maintain the natural structure and moisture of the soil.

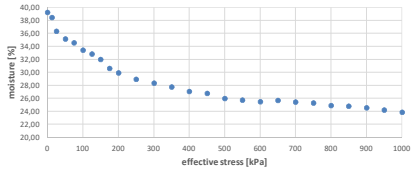

Fig. 1 Moisture changes depending on the effective stress

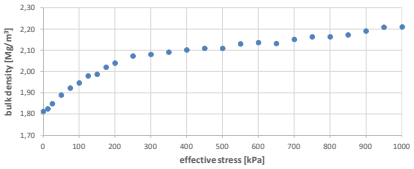

Fig. 2 Bulk density changes depending on the effective stress

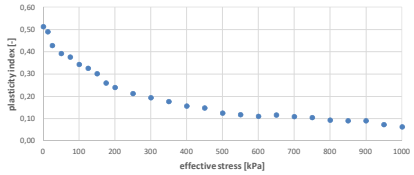

Fig. 3 Plasticity index changes depending on the effective stress

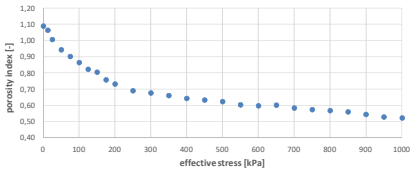

Fig. 4 Porosity index changes depending on the effective stress

METHODOLOGY

Main tests were performed in an oedometer. The results allowed for the determination of changes in physical parameters and the consolidation time. 25 oedometric tests were performed in the range of 0-1000 kPa. Each sample was initially consolidated at a stress of 12.5 kPa to standardize the initial state of each test. The initial consolidation for stress lasted 44 hours until the period of full stabilization of the strain, with the condition of no deformation of 0.005 mm in 4 hours being met. Then, further stresses were applied in accordance with the above description. The implementation time of each test is approximately 72 hours, until the sample deformations fully stabilize, understood as full dissipation of pore pressure. After completing each test, the physical parameters were determined (Fig. 1 – Fig.4)

CONCLUSIONS

Referring to changes in the values of physical parameters, it can be noticed how much the tested sample changes its properties during the determination of parameters depending on the test conditions. The value of the plasticity degree [IL] for the layer from which the test samples were taken ranged from 0.51 to 0.54. In the case of sample consolidation at a stress of 50 kPa, the plasticity degree value changed from 0.51 to 0.39, which means a transition from a soft-plastic to a plastic state. For a stress of 200 kPa, the sample entered a hard-plastic state of consistency. The value of the bulk density of the original sample is 1.68 Mg/m3, while for a stress of 200 kPa it is 2.04 Mg/m3. Physical parameters of the samples undergo significant changes depending on the adopted consolidation stress. Pressure dissipation during consolidation affects changes in soil consistency.

For the tested samples, when selecting the consolidation stress values of 50, 100 and 200 kPa, the initially soft-plastic soil changed its consistency state to a plastic state (at a stress of 50 and 100 kPa) and a hard-plastic state (at a stress of 200 kPa). In materials that are well permeable, such as silt, the scope of changes may be much greater. Differences in parameter values range from about 20% in the case of bulk density up to nearly 50% in the case of their humidity.