

Abstract

The open-cast brown coal mining in Northwestern Bohemia produces vast amounts of a lumpy clayey material dredged from the overlying sedimentary layers and deposited into large landfills (clay fills). The clay fills are typical for their double porosity (inside and between lumps), which, when related to the absence of artificial compaction, results in their open and metastable structure. Their structural transition from a coarse-graded (lumpy) material into a fine-graded material (reconstituted clay) is influenced by time, degree of saturation, and stress.

The structural transition of Bílina Clay Fill, induced by applied stress, is studied by two scaled-down physical models. Their isotropic compressibility and hydraulic conductivity are tested in a large triaxial cell under increasing stress. A series of standard laboratory tests in a small triaxial cell and oedometer on reconstituted and undisturbed samples provides the limiting characteristic values to the possible behavior of the models.

The results showed that the hydraulic conductivity of a saturated clay fill non-linearly decreases as the macrovoids close, approaching the hydraulic conductivity of a reconstituted soil at 540 kPa of the vertical effective stress. Then the macrovoids are filled with the reconstituted soil only, and the trend becomes linear. On the other hand, the compressibility is at lower stresses (on a semi-logarithmic scale) linear. Up to the vertical effective stress in a range between 4 and 4.6 MPa, the clay fill behaves as a slightly overconsolidated soil due to the presence of lumps. Then it reaches the compressibility of a reconstituted soil.