DIBt - research project

Investigations on material transport from chemical grouting slabs of excavation pits

Abstract:

For the *allgemeine bauaufsichtliche Zulassung* ('national technical approval') of chemical grouting slabs of excavation pits it is necessary to derive transfer functions to transmit laboratory test results to reality. In previous research initiatives parameter and boundary conditions of a transport simulation with respect to the release of pollutants in the groundwater originated from an underwater concrete slab were established. The results were summarised in the approval guideline "Grundsätze zur Bewertung der Auswirkungen von Bauprodukten auf Boden und Grundwasser" of the Deutsches Institut für Bautechnik (DIBt). As a supplement to these principles a test concept is under development by DIBt in cooperation with the Länderarbeitsgemeinschaft Wasser (LAWA). This test concept specified the model principles and parameters for the assessment of grouting material which are used in the saturated zone.

In the framework of the present research project the following parameters were verified in the groundwater transport models:

- hydraulic gradient
- permeability
- dimensions and shape of the excavation pit
- installation sequence with respect to the direction of the groundwater flow

Thus, the robustness of the transport simulations and the influence of parameter variations on the overall assessment were investigated and recommendations for further groundwater transport modelling were given.

The computations showed that analysis and subsequent rating on the basis of the DIBt defined basis variation lead to lower concentrations than theoretically expected even at unfavourable boundary conditions. Furthermore, the results show that besides time and spatial averaged computations of the concentration at the location of judgement or computations of maximum values of concentration also the analysis at – sometimes multiple – transport levels should be used for the judgement of a specific product. This is due to the fact that those levels also include the possibly influenced outflow of a construction project. The results show that costly spatial averaging techniques at multiple points of measurement can be omitted if the position of a representative model measurement location is predefined.

Furthermore, to quantifying the influence of soil injections using sodium aluminate on mobilisation of humic substances in the Berlin underground an injection agent with sodium aluminate as reaction material was investigated in percolation tests with humus-rich sandy soils (according to E DIN 19631:2015-08).The result shows very clear the influence of sodium aluminate and the content of humic substances. The more organic carbon is present in the sand the less increase of pH-value and conductivity is detected compared to elution water. Simultaneous an increase of TOC and DOC concentration was demonstrated. Chemical grouting leads to a change in the chemistry between the contact area of injection product and the surrounding soils. This caused an increased solubility and release of humic substances and the groundwater becomes discolored to dark brown.

Effects on mobilisation of aluminum were also observed, but due to the higher sorption capacity of humus-rich soils mobilisation of aluminium was lower than expected, because humic acids are able to build up insoluble compounds with aluminium.