Geotechnik im Bauwesen
Geotechnical Engineering
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Forschungsvorhaben: „Sicherheitsnachweise für den Hydraulischen Grundbruch - Erweiterung für den räumlichen Fall und für geschichteten sowie anisotropen Boden“

(„ Safety against Hydraulic Heave – Three-dimensional Enhancement and Stratified as well as Anisotropic Soil“)

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Abstract

Results of the former research project „Safety against Hydraulic Heave" have pointed out the necessity of a three-dimensional view if the required embedded length for the safety against hydraulic heave has to be determined.

Thus within the framework of the actual research project numerous investigations on the safety against hydraulic heave have been carried out at the Chair of Geotechnical Engineering at RWTH Aachen University, which consider the three-dimensional seepage flow conditions in building pits.

For this purpose a module for a Finite-Element-Program was developed in cooperation with the research-partner Institute of Hydraulic Engineering and Water Resources Management at RWTH Aachen University. With this module it was possible to partly automate the iterative determination of the required embedded length

By means of this module first of all homogenous and isotropic soil has been investigated. Based on these results dimensionless design charts have been generated by which the required embedded length can be determined quite simply considering the soil conditions and the geometrical boundary conditions. In addition to the design charts an interpolation function has been set up. By this function the required embedded length can be determined for any value of the unity weight of submerged soil on the basis of the embedded length for the reference unity weight γ'_{ref} = 11 kN/m³.

Furthermore the investigations have been extended to layered and anisotropic soil as in both cases the safety against hydraulic heave can be reduced. With the acquired results, recommendations and approximation equations have been developed which enable to estimate the required embedded length for these conditions.

At last investigations have been carried out how to adapt the embedded length of the sheeting to the spatial seepage flow conditions. These spatial conditions require different embedded lengths, e.g. in corner areas deeper sheeting is required. Hence calculations have been carried out with steps along the sidewalls based on the several determined embedded lengths for the corner and the sides. Altogether three approaches have been developed by which on the basis of the results of the design charts building pits can be designed safe and adapted to the seepage flow at the same time.