Geotechnik im Bauwesen
Geotechnical Engineering
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Short report

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Abstract

Geotechnical engineering considers hydraulic heave to be one of the most dangerous failure mechanisms. This is because hydraulic heave occurs without significant announcement. However, in many cases extremely simplified calculation methods are used, which do not take into account the geometry of the building pit, the thickness of the aquifer and the three-dimensional seepage flow in corner areas, and therefore can lead to unsafe results.

Within the framework of the research project the state of the art is summarized. In the following, simplified calculation methods established in standards, recommendations and related literature are described in detail.

Required embedded lengths for safety against hydraulic heave are determined via analyses of flow nets obtained by numerical simulations. In doing so, the geometrical proportions and the thickness of the aquifer, as well as the seepage flow in corner areas for three-dimensional states, are considered.

In the case of two-dimensional conditions a variation of the unit weight plus a differentiation between favourable and unfavourable soil conditions are carried out. As a result of numerous calculations dimensionless design charts are generated, which enable to determine the required embedded length, including a factor of safety in accordance with DIN 1054. In addition, it is possible to determine the required embedded length via an interpolation function for any unit weight.

Furthermore, for three-dimensional conditions the ratio of width to length of the building pit is variegated. As a result design charts are generated which allow to determine the required embedded length, separately for corner, front side and long side respectively. The first monitoring calculations have demonstrated that the interpolation function found for the Two-dimensional case is also an applicable approximation for the three-dimensional state. Hence determined embedded lengths for different unit weights can be used as input values for own calculations. Supplementary based on calculations recommendations are enunciated, how to design an expedient stepping of the embedded length along the building pit walls by using the generated dimensioning charts.

By means of model calculations the application of the design charts is demonstrated and it is clarified how different and partly unsafe the results of several simplified calculation methods are.