

Geotechnical design challenge

Our aim is to evaluate current practices and to promote exchanges. Above all, we want to encourage young engineers to develop and refine their "engineering judgment".

The following assignment is based on an instrumented excavation. The challenge participants' answers will be compared with real measurement values collected from said excavation. The winning answers will be those with the results closest to the experimental values measured.

The 3 participants with the best answers will receive a free 3-year membership of our GS association. In addition, an iPad will be raffled among all participants.

Deadline for challenge participants to submit their answers: 15.01.2024. We recommend that participants leave their contact details on the form, so that we can contact the winners.

Exercises:

This challenge tackles the difficulties of the construction of excavation pits, focusing on the stability of retaining structures and the prediction of deformations at their edges.

The following questions apply to a retaining wall made of strutted sheet piling. Assuming that, once the final excavation (- 5 m) is completed, the basin near the excavation is filled with water to a height of 1 m, please answer the following questions:

Main question subject to assessment:

1. What deformation can be expected at the top end of the retaining wall at ground level (+ 0.00 m) after the completion of the excavation to a depth of 5 m (final excavation level) ? What would the deformation be, after the water basin has been filled with 1 m of water? Notice: The measurements were taken using inclinometers, placed directly by the struts.

Additional questions not considered in the evaluation:

2. What normal force in the struts (strut spacing $a = 2.4$ m) can be expected at the end of the excavation (-5 m), after the water basin has been filled with 1 m of water?
3. What is the maximum earth pressure measured on the earth-side at the final excavation level of 5 m (pressure levels were measured at 0.75, 1.25, 2.25, 3.25, 4.25, 5.25, 5.75 below ground level) after the water basin has been filled with 1 m of water?

The choice of procedure used to obtain the results is free and can be indicated succinctly. It can be based on estimates, simplified considerations, calculations using conventional or numerical methods. As an indicative guideline, the problem should be solved in a relatively short time (around 15 to 60 minutes).

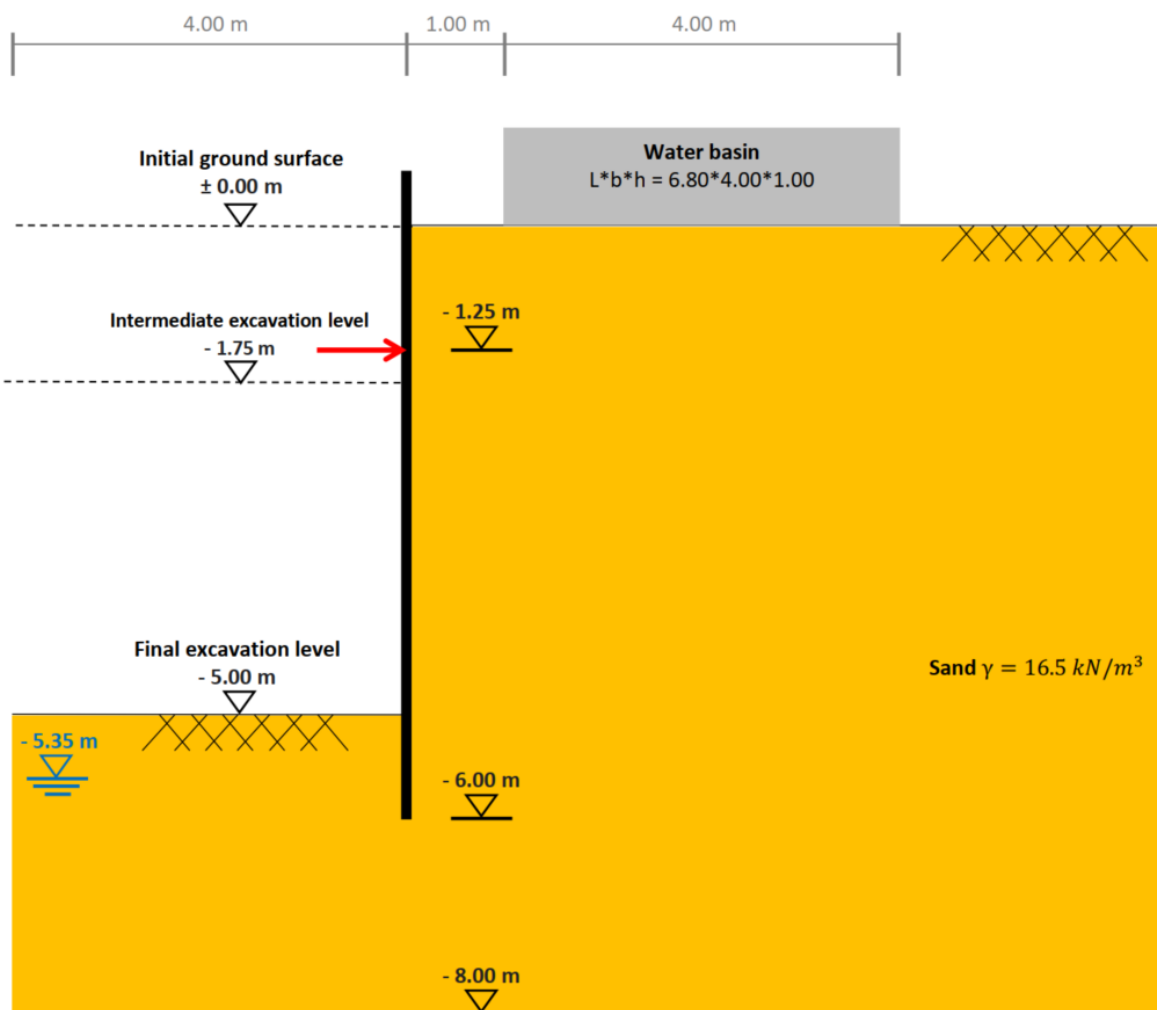
Statement Basis:

The retaining wall made up of sheet piles (PU-8) is located near a water basin. After excavating to a depth of 1.75 meters, a longarine is placed at a height of 1,25 m below ground level using HEB240 S235 profiles. Then KRUPP Gi-SV-380 struts (A = 3890 mm²) spaced 2.40 meters apart are installed and prestressed to a force of 11 kN. They have a stiffening function for the sheet pile wall and are pressed up against another rigid, non-displaceable wall, situated 3,50 meters away. The excavation is then continued to a final depth of 5 meters.

The water basin is only a temporary fixture and is built out of a soft construction. The load created by the water basin and the water can be considered as uniformly distributed. The water basin is only filled, once the final excavation has been completed.

The soil consists of densely compacted sand. Below is the grain size distribution curve for the relevant soil.

The groundwater level is located at a depth of 5.35 meters below the ground surface.



Grain size distribution curve for the considered foundation soil:

