Slope Stability

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Exercise 8b

DESIGN OF A MITIGATION WORK

The goal of this exercise is to perform a stability analysis for a slope in partially saturated conditions adopting the commercial software GeoStudio 2018 - SLOPE/W and SEEP/W modules. After that, a mitigation work (drainage gallery) for improving the stability of the considered slope has to be designed. Detailed information related to the use of the SLOPE/W and SEEP/W modules were proposed in the previous exercises.

1.1 Exercise description

The slope reported in Figure 1 is considered; the geometry and the soil properties are summarized in Table 1. Table 1 provides also the volumetric saturated water content ($\theta_{sat}=V_{w,sat}/V$ with $V_{w,sat}$ volume of water when the soil is saturated and V total volume), the AEV (air entry value of the soil= negative relative pore water pressure starting from which the degree of saturation decreases) and the saturatad hydraulic conductivity k_{sat} (=the hydraulic conductivity of the saturated soil). Consider the material above the water table as saturated by capillarity and verify the correctness of this assumption by analyzing the pore water pressure values in the domain of interest and comparing them with the air entry value (AEV) provided in Table 1.

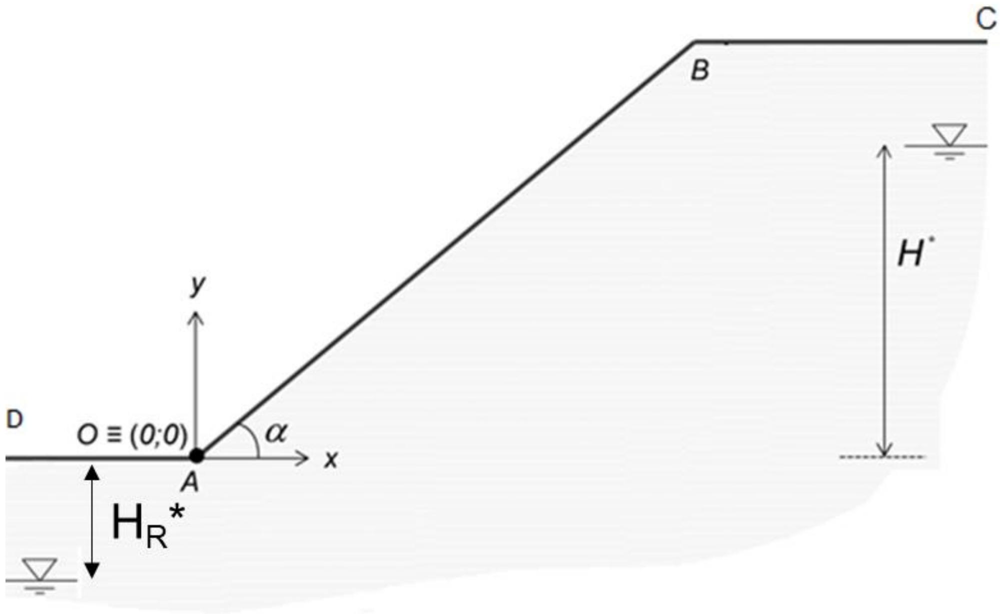

Figure 1: Slope geometry.

Table 1: geometry and soil properties of the slope reported in Figure 1.

γ_{sat} (kN/m^3)	θ_{sat} (-)	*AEV (kPa)*	k_{sat} (m/s)	H^* (m)	H_R^* (m)	φ' (°)	c' (kPa)
21.0	0.35	160	10^{-7}	13.0	-14.0	27.0	8.0

The main points defining the slope geometry are the following:

A (0;0), B (40;21), C (60;21), D (-32;0)

The hydraulic boundary conditions to be defined are given in Figure 2.

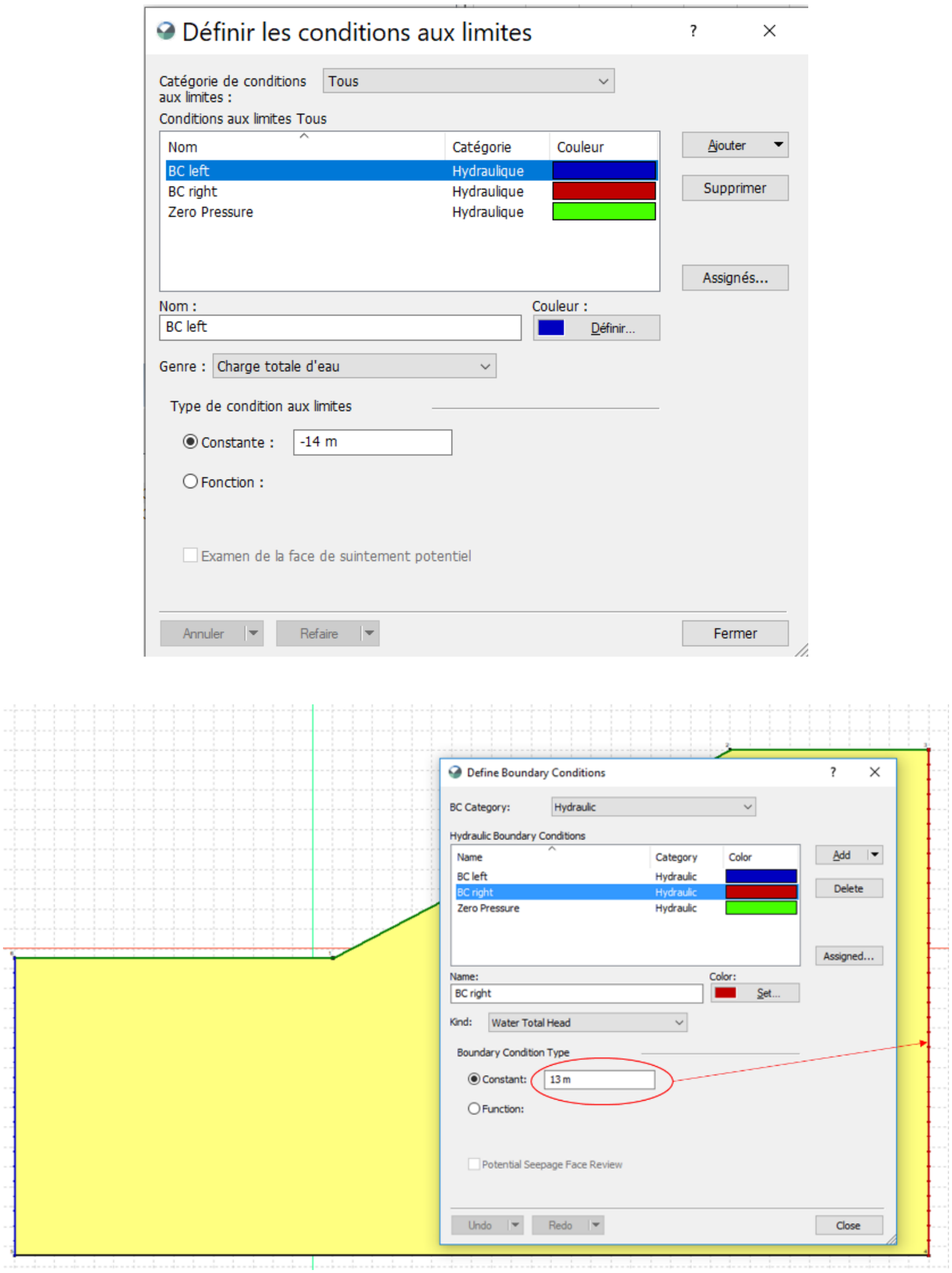

Figure 2: The hydraulic boundary conditions to be applied.

Perform a seepage analysis of the considered slope in steady state conditions (please refer to the previous exercise 6); then perform a stability analysis according to the simplified Bishop method.

Design a drainage gallery with a circular cross section (diameter of 2.0 m for allowing inspections) to increase the stability of the slope (chose its appropriate location) ensuring a factor of safety F > 1.30.

1.2 Drainage gallery

In order to draw the drainage gallery, click "Draw → Draw region → Circular"; the following window will appear:

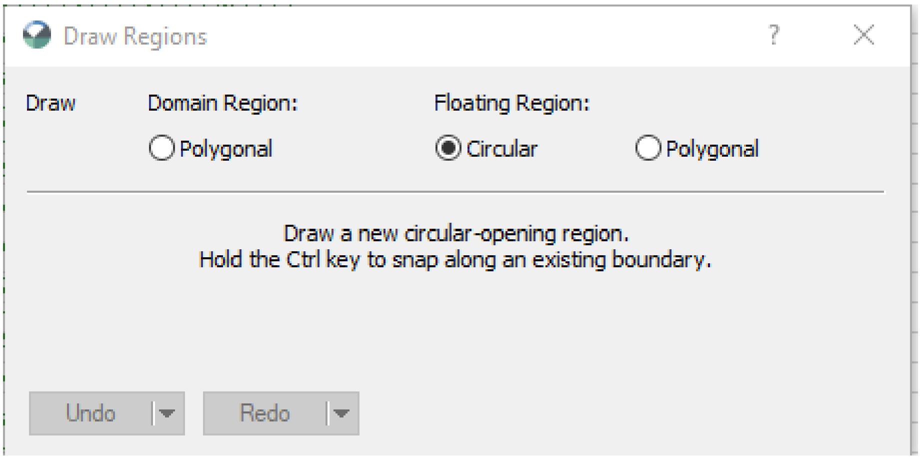

Figure 3: The Draw regions window.

With the first click it is possible to draw the center of the circle, with the second one the radius. Your drainage gallery will be automatically created.

Appropriate hydraulic boundary conditions for the gallery have also to be defined. For this purpose, in the SEEP/W interface, click "Draw → Boundary conditions". Apply a pressure boundary condition p = 0 m to the gallery.