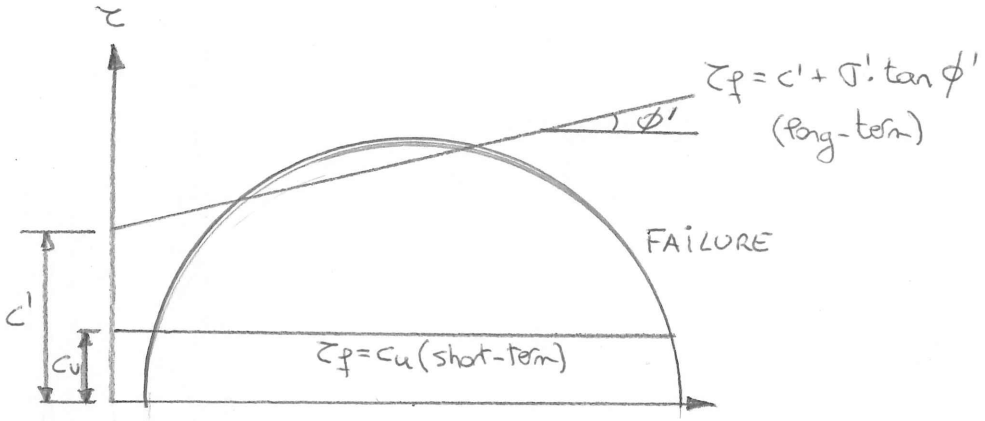
THEORETICAL QUESTIONS

(1)



(2) $L = 60\ mm \Rightarrow A = 60^2 = 3600\ mm^2$

$$\sigma_{v_1} = \frac{20 \cdot 9.8}{3600} \cdot 10^3 = 54.44\ kPa \quad ; \quad \tau_{f_1} = \frac{0.1330}{3600} \cdot 10^6 = 36.94\ kPa$$

$$\sigma_{v_2} = \frac{30 \cdot 9.8}{3600} \cdot 10^3 = 81.67\ kPa \quad ; \quad \tau_{f_2} = \frac{0.2077}{3600} \cdot 10^6 = 57.69\ kPa$$

$$\sigma_{v_3} = \frac{45 \cdot 9.8}{3600} \cdot 10^3 = 122.50\ kPa \quad ; \quad \tau_{f_3} = \frac{0.2911}{3600} \cdot 10^6 = 80.86\ kPa$$

$$\phi \approx \arctan \frac{\tau_{f_3} - \tau_{f_1}}{\sigma_{v_3} - \sigma_{v_1}} = \arctan \frac{80.86 - 36.94}{122.50 - 54.44} = 32.8^\circ$$

(next page)

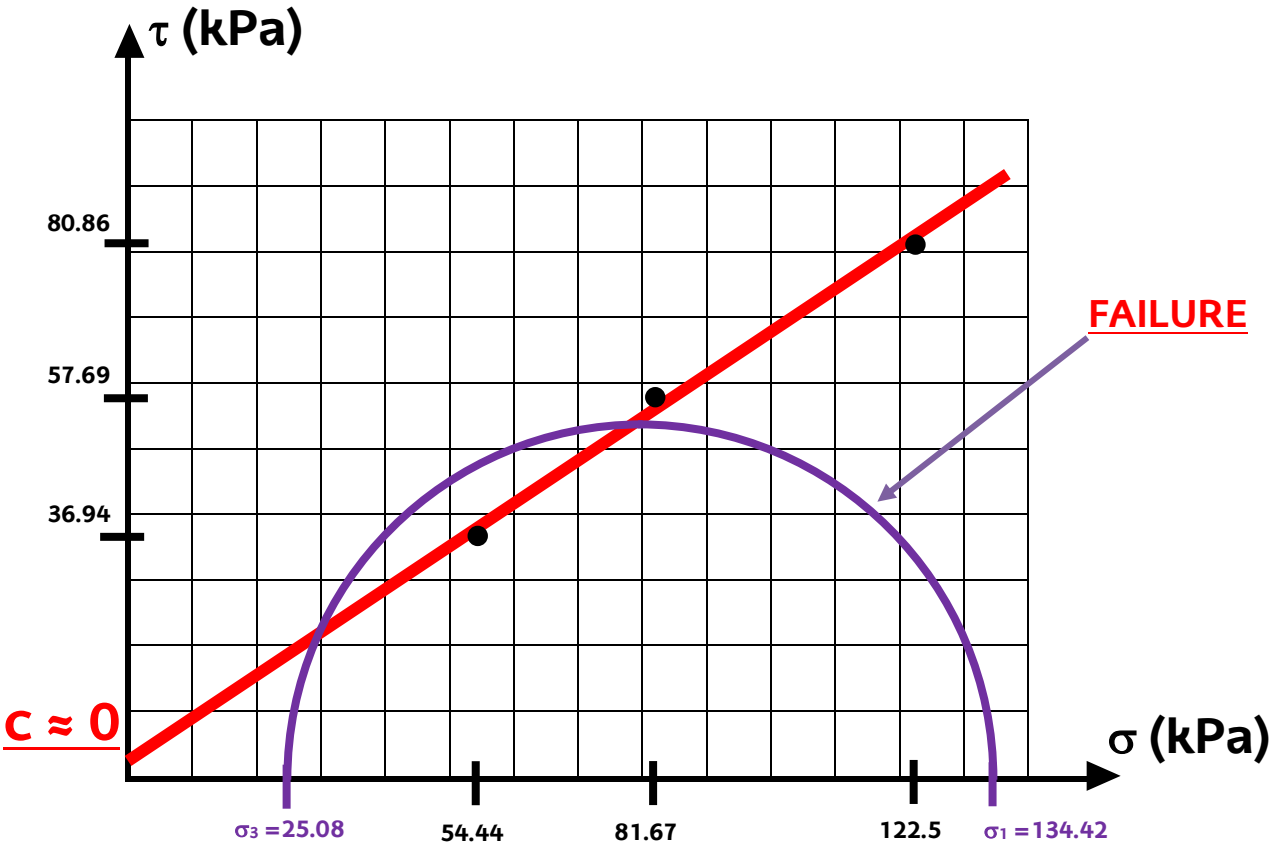
QUESTION 2 (charts)

In order to determine the shear strength parameters of a soil constituted by medium sands, a direct shear test has been conducted. Three tests have been completed on three different samples of the same soil, which have been put into a 60-mm square shear box.

The masses used to apply the vertical forces have been 20 kg, 30 kg and 45 kg, while the horizontal forces necessary to reach the failure in each test have been 0.1330 kN, 0.2077 kN and 0.2911 kN, respectively.

Determine the shear strength parameters of this soil using the chart below.

On this soil, a construction is to be done that will give rise, at the most dangerous point, to a Mohr's circle having the following principal stresses σ_1 = 130.42 kPa and σ_3 = 25.08 kPa. Explain whether the soil will fail, using again the chart below.



QUESTION 3

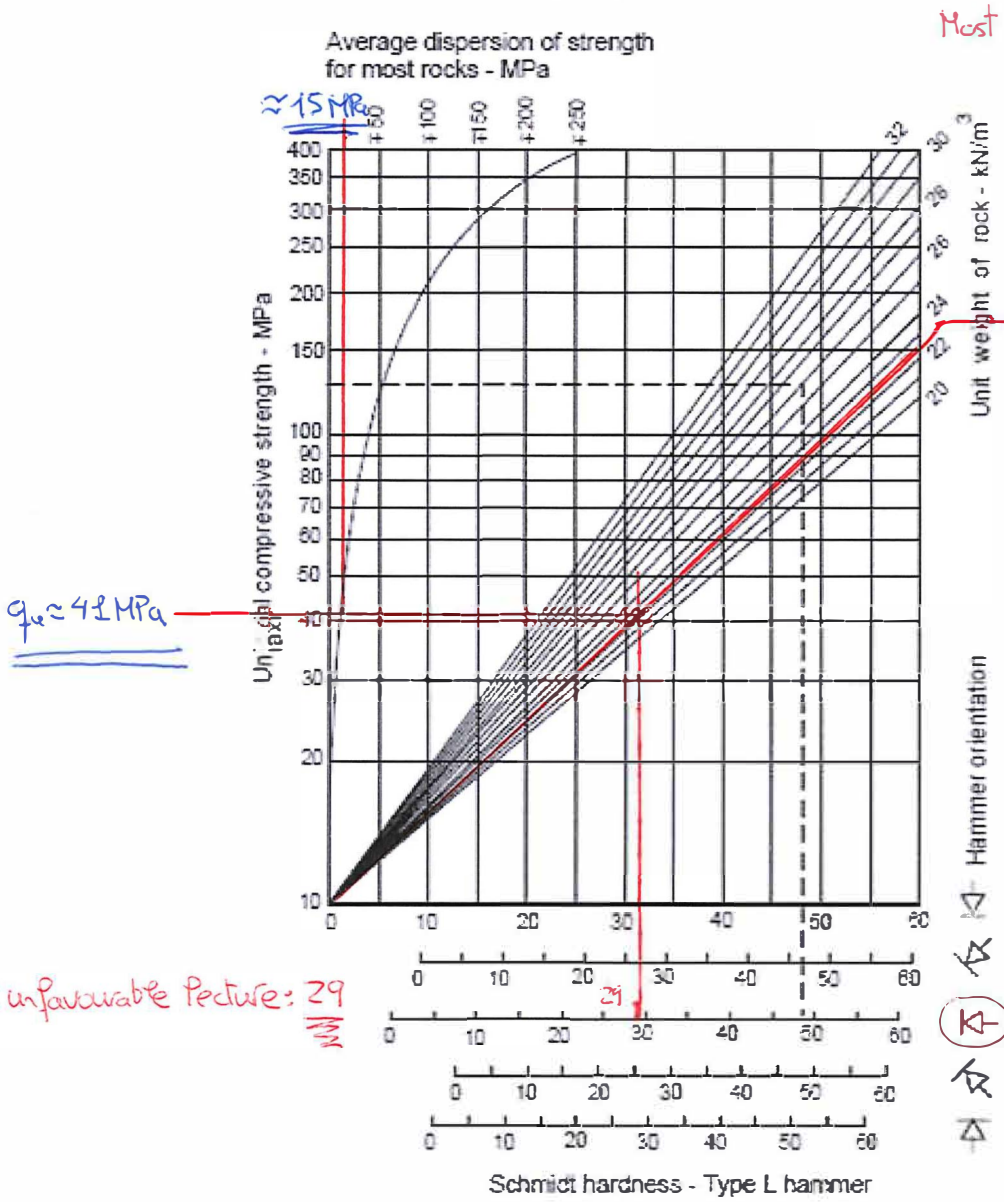
From a construction site, a rock fragment of a sandstone has been taken to the laboratory. According to the bibliography, mass density of sandstones ranges from 2.3 to 2.6 g/cm^3. In order to estimate the uniaxial compressive strength of that rock, the Schmidt hammer (sclerometer) has been used (see chart below). Then, after applying the hammer in horizontal position, the following lectures have been obtained: 30, 32, 38, 31, 37, 29, 34, 35, 36, 42, 31, 39, 35, 33, 32, 32, 33, 38, 31, 30, 33, 36, 35, 30. Estimate the uniaxial compressive strength and the corresponding average dispersion of the sandstone. Indicate all the necessary steps.

Most unfavourable density: 2.3 g/cm^3

Unit weight:

$\gamma = \rho \cdot g = 2.3 \cdot 9.8 =$

$= 22.54 \frac{kN}{m^3}$



THIS CHART IS PROVIDED BY CONTROLS GROUP (Rock classification hammer) www.controls-group.com

ANSWER: $q_u = 41 \pm 15$ (MPa)

QUESTION 4

Four (4) rock core samples from an intact rock have been used to complete four (4) triaxial compression tests. The following results were obtained (principal stresses at failure):

Test I: σ_1 = 400 MPa, σ_3 = 0 MPa

Test II: σ_1 = 640 MPa, σ_3 = 51 MPa

Test III: σ_1 = 905 MPa, σ_3 = 110 MPa

Test IV: σ_1 = 1.700 MPa, σ_3 = 360 MPa

On the chart below, plot the failure line corresponding to the Hoek-Brown criterion.