



School of Engineering

COURSEWORK BRIEFING SHEET

COURSE MODULE: CIVE 420 - Advanced Geomechanics

ASSIGNMENT TITLE: Design and analysis of shallow foundations

Discipline: Year 4 – MEng, MSc

Lecturer responsible: Dr Xue Zhang

Date set: Friday 23 October 2020

Submission date: 11:59 pm Sun 22 November 2020

Penalty Scheme for late submission: University Standard Scheme.

Aims:

At the end of the project a student should be able to:

- Determine material parameters based on triaxial test data
- Use numerical analysis tools exemplified by OptumG2 for stability analysis.
- Present your work (calculations and text) in report format to a professional standard.

You are required to determine the material parameters of the classical elastic-perfectly plastic Mohr-Coulomb model for dry sands using the provided data (see the attached Excel file) from triaxial tests (Figure 1). The tests were performed with $\sigma_r = 100$ and 200 kPa, respectively. The $F-\alpha$ failure envelope for the shallow foundation shown in Figure 2 is estimated using the limit analysis with the calculated material parameters.

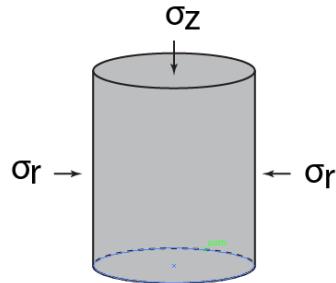


Figure 1 Triaxial Test

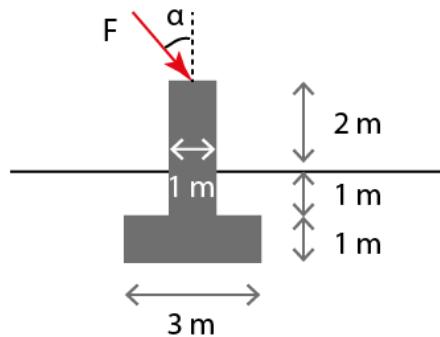


Figure 2 Shallow foundation subjected to vertical and horizontal forces

1. Draw the $p-\varepsilon_p$ curve and the $q-\varepsilon_q$ curve for both cases and determine the material parameters K and G [15%];
2. Determine Young's modulus and Poisson's rate [10%];
3. Determine the value of M for the Mohr Coulomb model based on the data and calculate the friction angle [10%];
4. Draw the Mohr's circle for the stress state when the material fails for $\sigma_r = 100$ and 200 kPa and determine the friction angle based on the $\tau-\sigma$ figure [15%];
5. Determine the $F-\alpha$ failure envelope for the problem shown in Figure 2, show the different failure modes, and discuss the pro and con of using limit analysis method for the stability analysis of the concerned problem. (The unit weight of sands is 18 kN/m³ and the weight of the foundation is neglected) [50%].