

Project – Part 2 – 09.10.2025 (due on 19.12.2025)

Evaluation and design of a geotechnical project using finite element method

Problem statement

As a geotechnical engineer, you are tasked with conducting a detailed assessment of the soil conditions for an upcoming geotechnical project. The assessment includes a series of triaxial tests that were done on samples taken from soil cores extracted on site. You will analyse the results provided by the lab and determine the key soil parameters necessary for the design process. The data and parameters you establish at this phase will be critical for the geotechnical design in subsequent phases of the project.

In this phase, you will determine the strength parameters of the soil using the perfectly plastic failure criteria of Mohr-Coulomb and Drucker-Prager.

2. Plastic parameters determination

Using the experimental results from the previous phase determine the parameters for the Mohr-Coulomb (MC) and Drucker-Prager (DP) models.

1. Determine the values of the effective principal stresses σ'_1 and σ'_3 at the ultimate state.
2. Calculate the corresponding stresses τ_{max} and σ'_m , and the invariants $\sqrt{J_{2D}}$ and J_1 for each test
3. Plot the obtained results and identify the parameters of the following failure criteria (specify the equation of each model):
 - i. Mohr-Coulomb (only compression) – plane ($\tau_{max} - \sigma'_m$): c' and φ'
 - ii. Drucker-Prager – plane ($\sqrt{J_{2D}}$ and J_1): α , k , c' and φ'