OCW

Universidad del País Vasco Euskal Herriko Unibertsitatea

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FUNDAMENTALS OF GEOTECHNICAL ENGINEERING

# SELF-EVALUATION
# Learning outcomes 1 and 3

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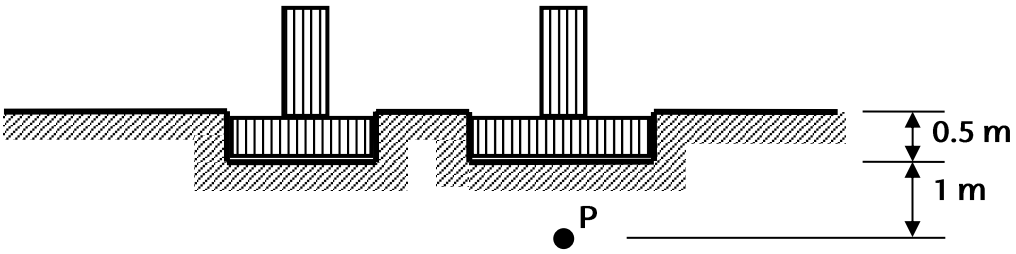
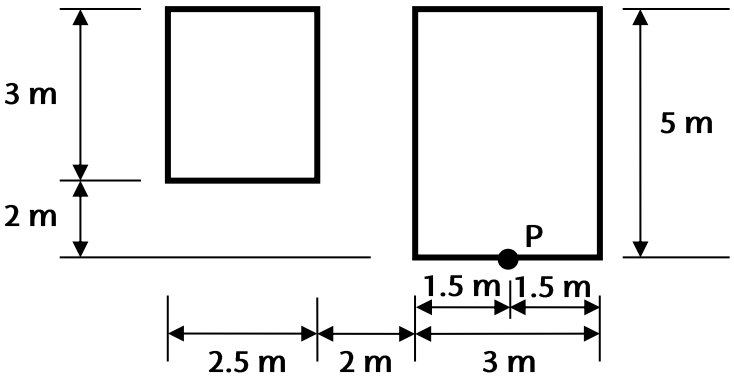
# THEORETICAL QUESTIONS

## QUESTION 1

Two individual footings are carrying the following uniform loads: $q_{left}$ = 100 kN/m$^2$ and $q_{right}$ = 80 kN/m$^2$, as it is shown in the figure. Calculate the vertical stress increment at point P, taking into consideration only the left footing.

Additional information: bulk unit weight of soil = 18.0 kN/m$^3$.

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## QUESTION 2

Indicate the steps to follow and the expressions to use, if it is necessary to calculate stress at a point in a soil due to the self weight of soil exclusively.

## QUESTION 3

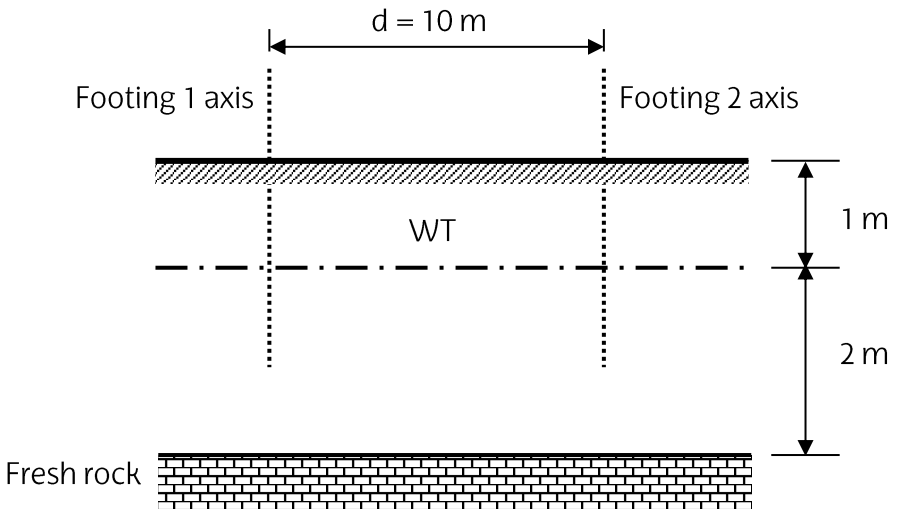
In a consolidation test, several types of curves are obtained. Draw those curves showing their names, axis titles and scales.

## QUESTION 4

In the following figure, it is shown a soil profile where a small building is to be constructed. It will be a framed structure with partition walls resting on individual footings. The total settlement under each footing has been estimated as follows:

Total settlement of footing 1 = 19 mm; total settlement of footing 2 = 31 mm

Verify whether these settlements are allowable or not, according to the limits indicated in the national and international standards. All the corresponding limits should be verified.



## EXERCISE

The piers of a viaduct are resting on individual footings, that carry a uniform load q = 145 kN/m$^2$. This viaduct can be constructed in two different locations, having different soil characteristics, which have been determined using tests, as it is indicated below.

Soil 1. Poorly graded sand (SP) constituted by medium and fine sands.

Bulk unit weight: 17.5 kN/m$^3$.

Average number of blows in SPT: 13.

Elastic modulus: 12 MN/m$^2$.

Dimensions of the footings: B = 3.5 m, L = 4 m.

Supporting plane of the foundation: at a depth of 1.5 m.

Soil 2. Fat clay (CH).

Bulk unit weight: 20.2 kN/m$^3$.

Average number of blows SPT: 35.

Undrained elastic modulus: 50 MN/m$^2$.

Dimensions of the footings: B = 4 m, L = 6 m.

This foundation rests on the ground surface.

In soil 1, the fresh rock is at a depth of 4 m and coincides with the water table. In soil 2, the fresh rock is at 10 m depth and this soil is saturated.

1. Determine the most adequate soil to construct the viaduct, taking into consideration allowable settlements. In the clayey soil, it will be assumed that immediate settlement is 55 % of total settlement.
2. Determine the total vertical stress at a point in soil 2 located at a depth of 0.5 m below the centre of the footing, just at the end of the construction process. Also, at that time, calculate the effective vertical stress and the pore water pressure.