Bearing Capacity of Foundation on Slope

Keywords

2D, Plane Strain, Arclength.

Problem Description

This example solves the case of a foundation resting on a slope face; the bearing capacity of this case was developed by Meyerhof (1957). The footing is assumed to be flexible and has a width of 1 m. The effect of soil self-weight is ignored. The collapse load is calculated for the case where the footing depth is zero.

Discretisation

The analysis is performed with triangle plane strain elements, TPN6. A fine mesh is used in the central area of the model to get more reliable results. The model is illustrated in figure 1.

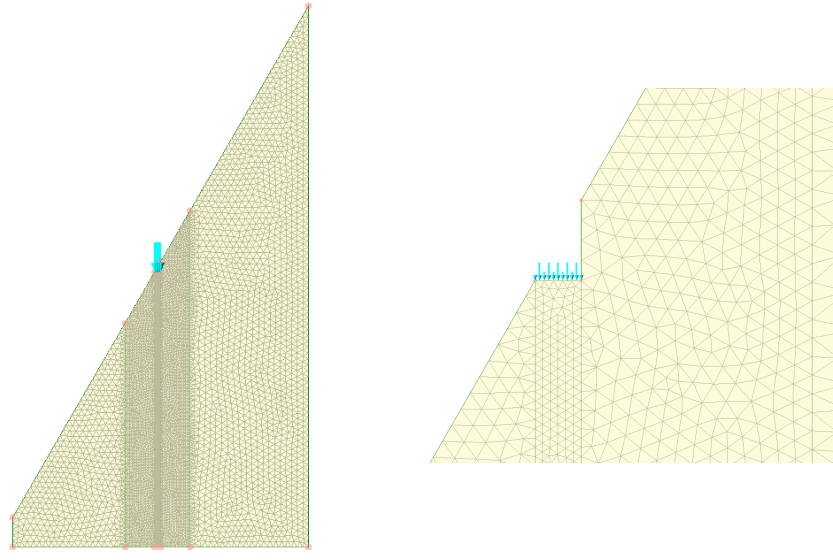

Figure 1: Mesh adopted for the model

Material Properties

Table 1 gives the material properties adopted in the studied model.

Table 1: Modified Mohr-Coulomb material properties

Young's modulus, E	Poisson's ratio, ν	Angle of friction, φ	Cohesion, c	Dilation
20E3 kPa	0.3	0°	50 kPa	0°

Loading Conditions

A load of 154 kPa is applied in stages using automatic loading up to failure. The load factor at failure is 1.0.

Theory

Meyerhof (1957) developed a theoretical solution for the ultimate bearing capacity of a shallow foundation located on the face of a slope [1]. Figure 2 shows the nature of the plastic zone developed under a rough continuous foundation of width B. Based on this solution, the ultimate bearing capacity can be expressed as (for the case $\varphi = 0$)

$$q_u = c_u N_c \qquad (1)$$

The value of N_c can be found from the chart in figure 3

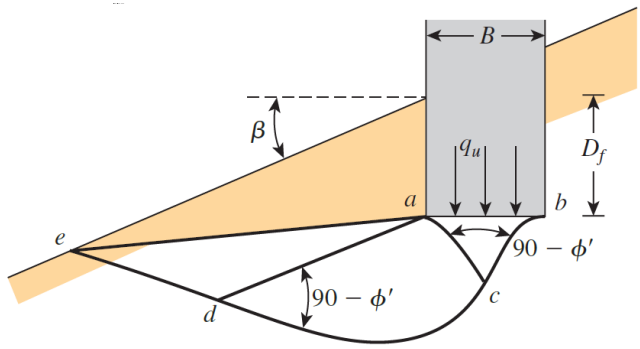

Figure 2: Plastic zone under a rough continuous foundation on the face of a slope [1]

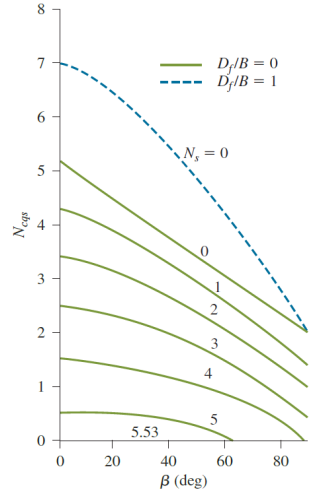

Figure 3: Variation of Nc with β [1]

Modelling Hints

The arclength method is used to find the failure load.

Comparison

According to the equation 1, the ultimate bearing capacity is 154 kPa, which in perfect match with value obtained from LUSAS.

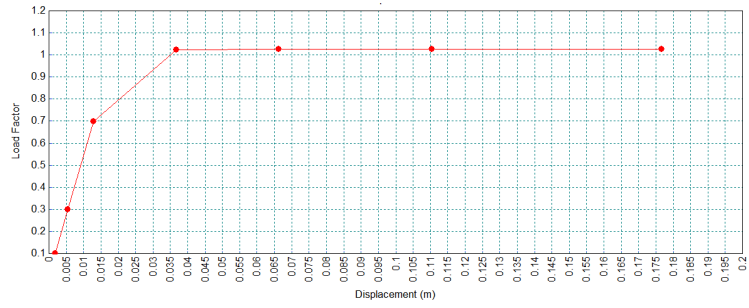

Figure 4: Total load factor

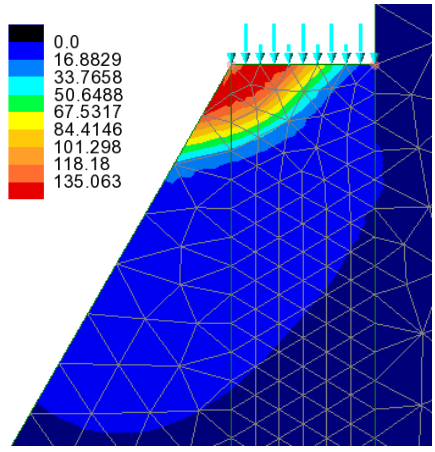

Figure 5: Displacement vectors

References

[1] Braja M. Das and Nagaratnam Sivakugan, Principles of foundation engineering, Nelson Education Ltd, 2019.

Input Data

foundation_on_slope.lvb