Strip Footing on Surface of Purely Cohesive Material

Keywords

2D, Plane Strain, Modified Mohr-Coulomb model, arclength.

Problem Description

This example deals with an evenly distributed load on a cohesive elastoplastic material to determine the bearing capacity.

Discretisation

The problem is modelled using quadrilateral strain elements, QPN8. The model is totally restrained from moving in the x and y direction. The finite element mesh can be found in Figure 1.

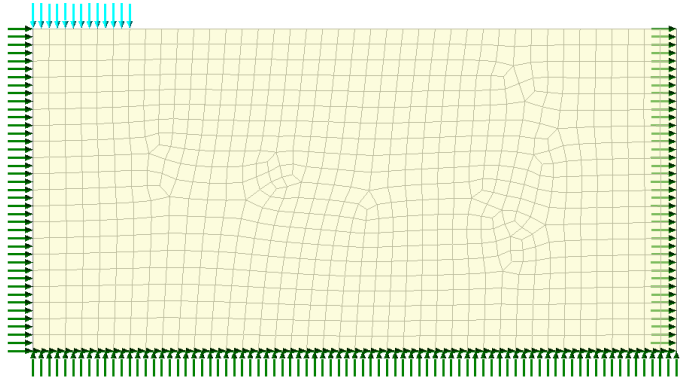

Figure 1: Finite element mesh showing supports.

Material Properties

The soil is modelled by means of Modified Mohr-Coulomb model. Table 1 gives the material properties for this example.

Table 1: material properties

Mass Density	Young's modulus, E	Poisson's ratio, ν	Angle of friction, φ	Cohesion, c
2.7 t/m^3	250.0E3 kPa	0.2	0°	100 kPa

Loading Conditions

The applied load is gradually increased using arclength until failure occurs.

Theory

The collapse load is given by the following equation, after Terzaghi & Peck [1].

$$q = (2 + \pi)c \qquad (1)$$

Comparison

The analytical collapse load is 514.16 kPa calculated using equation 1, which is identical to the 515.5 kPa obtained by LUSAS. Figure 2 depicts a plot of applied load versus displacement. We can see how the curve transforms into a plateau at the critical value. Some more findings can be seen on figures 3 and 4.

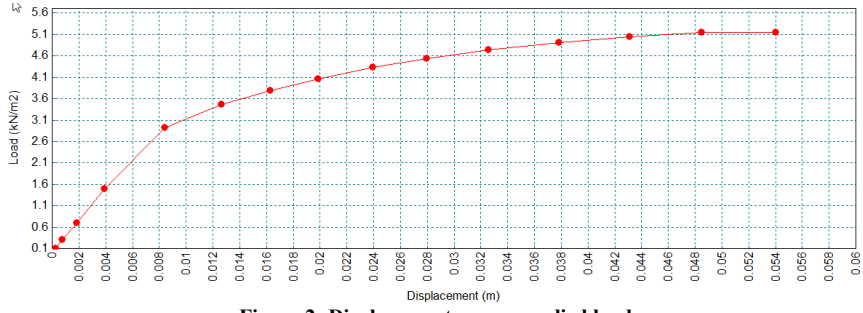

Figure 2: Displacement versus applied load

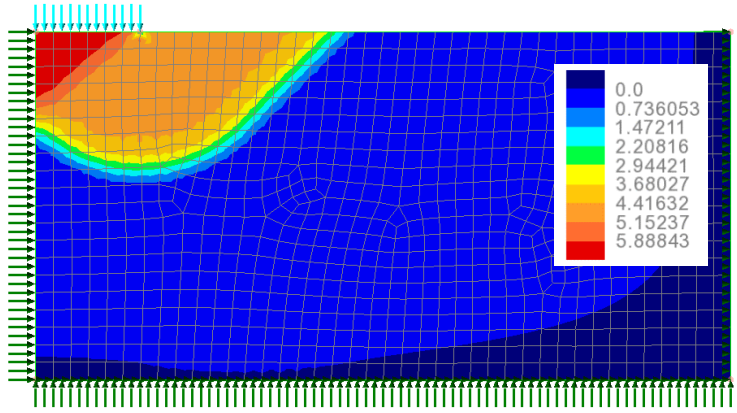

Figure 3: Displacement contours at failure (m)

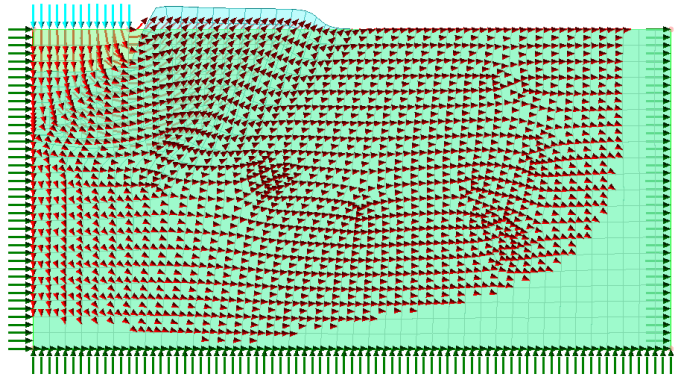

Figure 4: Vector displacement

References

[1] K. Terzaghi and R. B. Peck, Soil Mechanics in Engineering Practice, 2nd Ed. New York, John Wiley & Sons, 1967.

Input Data

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