Department of Civil Engineering

The Stability Analysis in Geotechnical Engineering by Rigid Plastic Finite Element Method

Kazunori MIZUNO

Professor, Dr. Eng.

Email : kazu@gifu-nct.ac.jp

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Research Outline

Bearing capacity Analysis

My research is applying the Rigid Plastic Finite Element Method (RPFEM) to two type of stability problems in geotechnical engineering. RPFEM is based on the upper boundary method in the limit theorem. Those stability problems which we take as an object of study are the bearing capacity problem and slope stability problem in soils.

First, we calculate the ultimate bearing capacity of the soft clay ground in which the rigid continuous footing foundation is installed with penetration by RPFEM (Fig. 1.).

The calculation results are shown in Fig. 2. Under this calculation, if embedded depth D_f is same although footing foundation width B is different, bearing capacity q_f is almost same value.

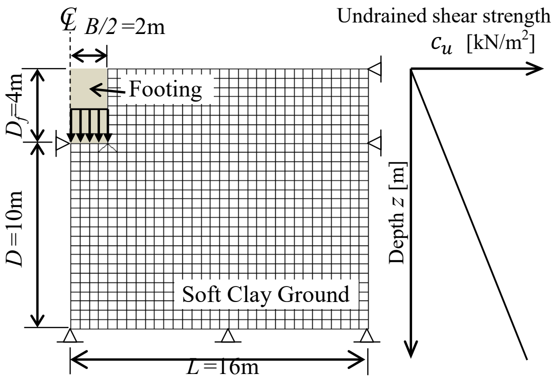

Fig. 1. Finite element mesh and boundary conditions

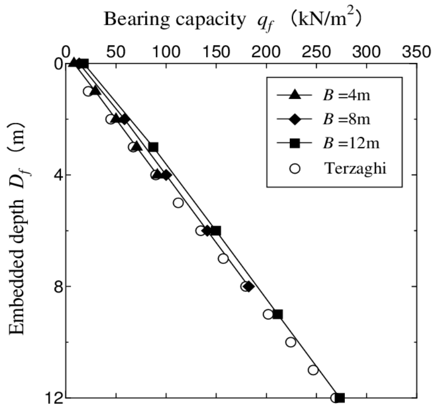

Fig. 2. Relationship between q_f and D_f

Slope stability Analysis

We try to calculate to slope stability problem by RPFEM. The purpose of this analysis is to know the influence of material constants (γ_t and c_u) and shape of embankment (height of embankment H and inclination of slope θ in Fig. 3.) to the safety factor F_s.

Fig. 4 shows relationship between γ' H/c_u and safety factor F_s. It found that both of relationship express only one curve like a hyperbola every each inclination of slope θ. Thus, the findings of this calculation is we can get safety factor F_s easily once inclination of slope θ and height H of embankment is decided after we experience the test for soil wet density and shear test under undrained condition in laboratory. Moreover, we shall pay attention to the line which safety factor F_s = 1.0. Once we get the value of γ_t, c_u, and θ, we can estimate critical height of embankment H_c.

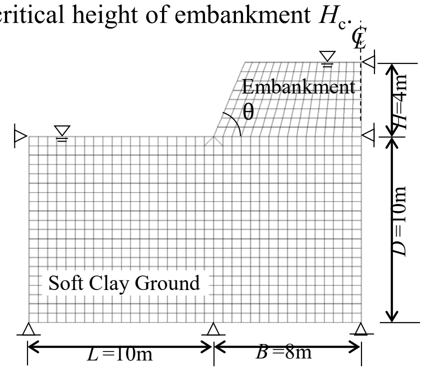

Fig. 3. Finite element mesh and boundary conditions

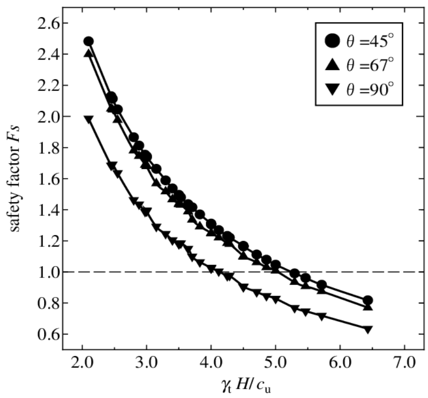

Fig.4. Influence of material constant and shape of embankment