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DEFOMATION ANALYSIS OF CEMENT-TREATED SOIL BY FEM IMPLEMENTED WITH PARTICLE DISCRETIZATION

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ABSTRACT

In geotechnical engineering, a soft soil is often stabilized by mixing cement. The mechanical properties of the cement-treated soil depend on the amount of cement mixed with the soil. The cost or workability of the treated soil also depends on the amount of cement. Computer simulation plays an important rule for predicting the behaviour of treated soil or for design the cement treatment. The prediction model of mechanical behaviour soil is important.

Many researchers have investigated the compression strength or stiffness of cement-treated soil. Based on classical constitutive models, some useful models have been proposed. However, the tensile strength or stiffness of the treated soil has not been sufficiently investigated even though it is very important to investigate the stability of a stabilized foundation. The reason for the lack of such investigations is that it is very difficult to evaluate the brittle nature of cement-treated soil.

In this paper, the authors proposed a numerical analysis method to simulate the deformation of cement-treated soil subjected to tensile forces based on laboratory test results. The proposed method is based on the finite element method (FEM) implemented with particle discretization [Hori et al. 2005]. Authors incorporated new constitutive modelling of the treated soil to this FEM.

A key of our proposed method is to assume that cement-treated soil change from Mises-material change to Coulomb-material due to crack propagation. This is considered by modelling of the contact condition of discretized each element.

Simulation results for the laboratory test (see Figure 1) to investigate the effect of the amount of cement mixed are shown in Figure 2. In this figure, a_w means mixing ration of cement to soil. Simulation has good accuracy with laboratory test results. Figure 3 shows comparison between computed strain-distribution and observed failure-mode at the end of test. Totally, the proposed analysis method gives a good description of the mechanical behavior of the stabilized soil subjected to tensile forces.

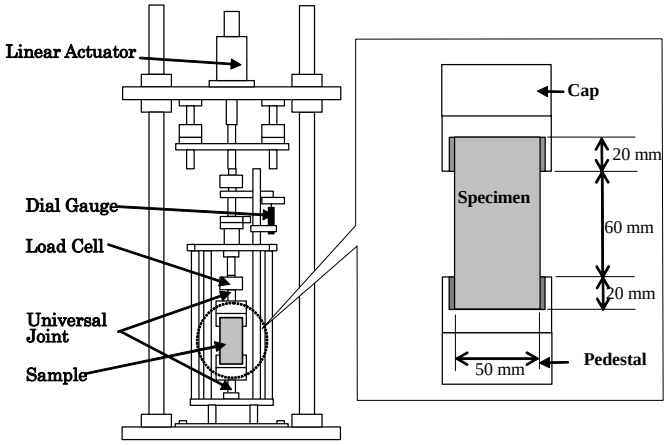

Figure 1 Laboratory test setup

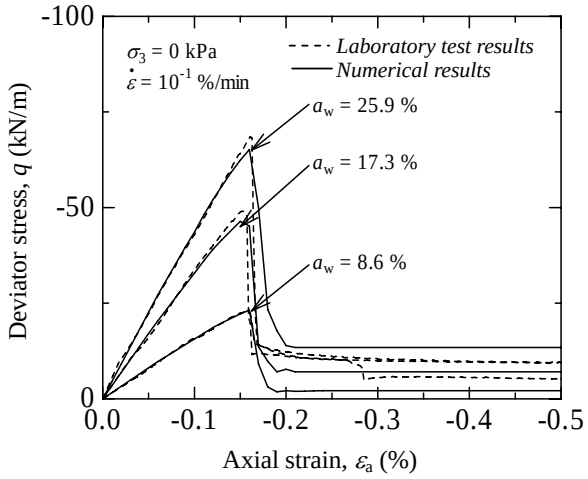

Figure 2 Simulation results for the laboratory tests

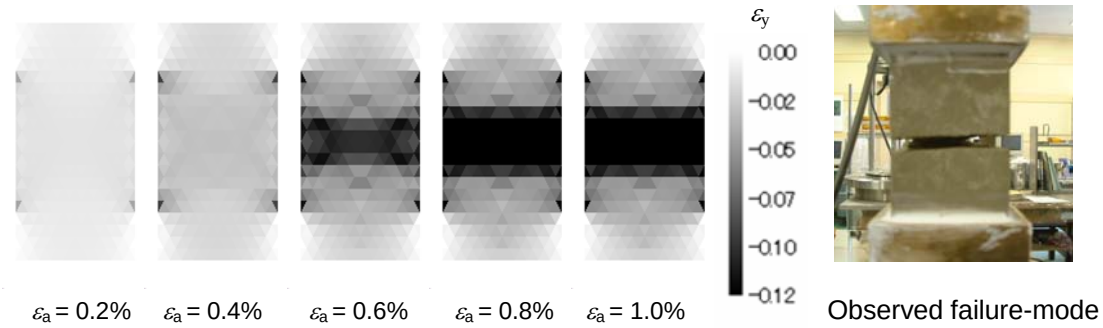

Figure 3

REFERENCES

[1] Hori,M., Oguni,K., Sakaguchi,H. 2005. Proposal of FEM implemented with particle discretization for analysis of failure phenomena, J. Mech. Phys. Solids, 53, 681–703.