III-267 FE ANALYSES OF A TRIAL EMBANKMENT ON SOFT BANGKOK CLAY

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1. Introduction

The aim of this research is to examine prediction performances for several different ways of computations by comparing the results of the finite element analyses with the monitored deformation during and after construction. The simulation was carried out using the program DACSAR developed by Iizuka and Ohta(1987). The constitutive model used in the F.E. program is the elasto-viscoplastic model proposed by Sekiguchi and Ohta (1977).

2. Site Investigated

We simulated a trial embankment which was constructed on an open field in the AIT campus (Asian Institute of Technology), Bangkok, with 18m×30m on the base plane and 10.5m×22m on the top plane, as shown in Fig.1. For the first phase of the construction, the fillment of the embankment began on March 18, 1981 and completed on March 22, 1981. It was done in 5 stages up to 2.8 m high with a slope 3:4. In the second phase of the construction, 2 m deep trenches were excavated near the toes of the embankment. The soil excavated was placed on the slope side of the embankment as the new fillment.
In the finite element simulation, we assumed the plane strain condition along the longitudinal direction. The average

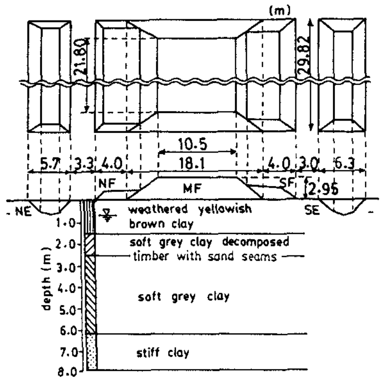

Fig.1 Profile of embankment

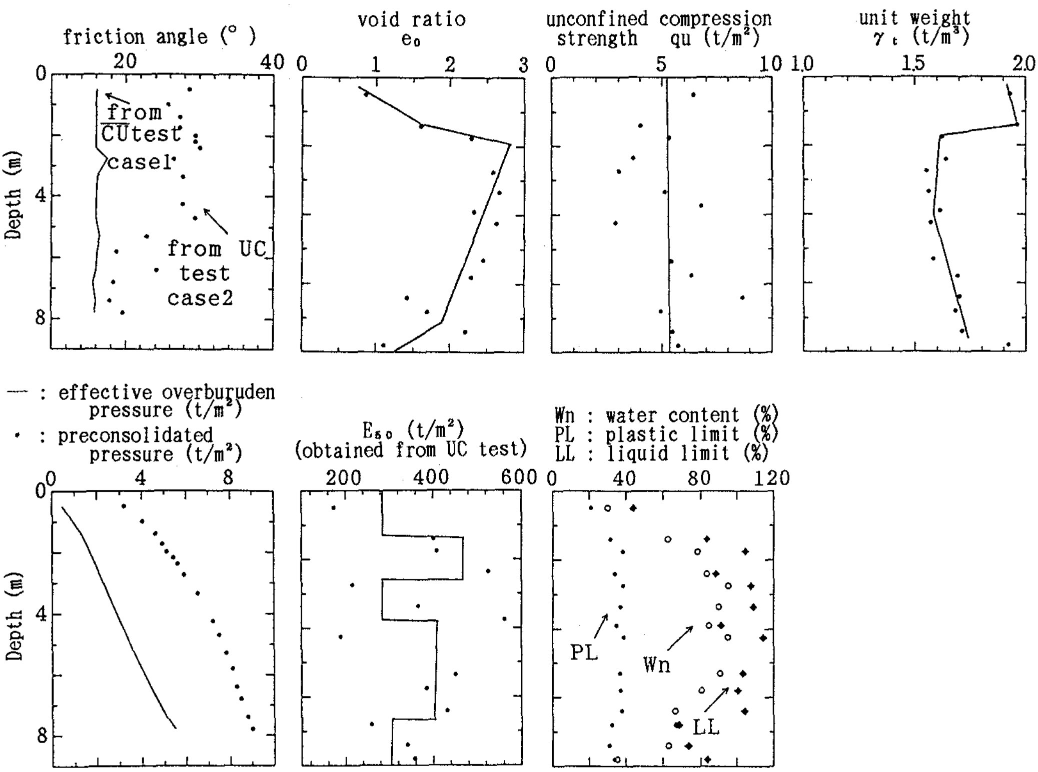

Fig.2 Soil properties

density of the fill material is measured as 1.4t/m^3. The soil properties obtained from the laboratory tests are summarized in Fig.2, where the subsoil of AIT is divided into four strata (see, Fig.1). It can be seen that the top portion of ground is covered with the fairly stiff weathered clay (crust layer) and the soft clay (so called Bangkok clay)is laid under the crust till 8.0 m deep. Details of field conditions and construction sequences are reported in Ohta and Chen (1982).

3. Specification of input parameters

In order to examine the computation performance under the several different ways is chosen in modelling the foundation ground of embankment, 5 cases are considered. Three of them are elasto-viscoplastic models and others are elastic. In the case of elasto-viscoplastic models, two ways in specifying input parameters are considered. One is that the critical state parameter M, which is a key parameter in the Cam-clay type elasto-viscoplastic model, is determined directly from ϕ' obtained from $\overline{CU}$ test, and another is that M is estimated from the half of the unconfined compression strength using the procedure originally proposed by Ohta et al (1989). The crust layer (depth 0～1.5m) which has been formed through the repetition of wet and dry weather is fairly stiff. It is likely that soil sample from the crust layer is easily disturbed and its strength/stiffness is readily underestimated. So we consider the case assuming E_{50} obtained from the unconfined compression test (UC test) 100 times higher than its raw value. Cases considered in the computation are summarized in Fig.3. Furthermore we also consider elastic models (case3 and case4). Case3 is the case taking into account (elastic) soil/water coupling effect and case4 is the usual elastic model in terms of the total stress.

	clay layer	crust	
case1	$\overline{CU}$test → ϕ' (elasto-viscoplastic)	UCtest → 100E_{50} = E, ν = 1/2 (elastic) → E', ν' = 1/3	effective stress analysis
case1'	$\overline{CU}$test → ϕ' (elasto-viscoplastic)	UCtest → E_{50} = E, ν = 1/2 (elastic) → E', ν' = 1/3	effective stress analysis
case2	UCtest → qu/2 → ϕ' (elasto-viscoplastic)	UCtest → 100E_{50} = E, ν = 1/2 (elastic) → E', ν' = 1/3	effective stress analysis
case3	UCtest → E_{50} = E, ν = 1/2 (elastic) → E', ν' = 1/3		effective stress analysis
case4	UCtest → qu/2 = Cu (elastic) → E = 210Cu, ν' = 1/2		total stress analysis

fill material : elastic E=210Cu (Cu=qu/2 from UCtest)

Fig.3 Determination procedure of input parameters

4. Comparison of FE results and field measurements

The surface settlement at the center under the embankment and the corresponding FEM results are shown in Fig.4. It can be seen that the computed results of case1 (elastic visco-plastic model) well agree with the measured behavior of in-situ soil, while the result of case1' is quite different from the measured value. It implies that 100×E_{50} gives reasonable estimate in modelling the crust layer. But the essential reason of "100 times" is still unknown although the estimate of surface crust layer is dominant in the whole behavior of foundation ground. Further investigations will be required.

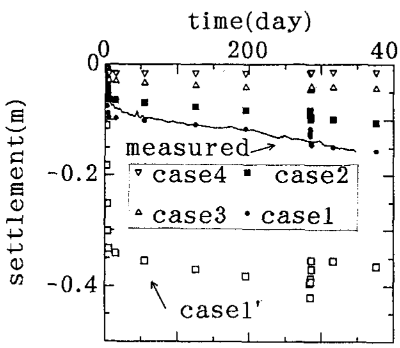

Fig.4 Computed and monitored settlement

5. References

Iizuka & Ohta (1987) Soils and Foundations, Vol.27, No.3, 71-87
Ohta and Chen (1982) Research Report No.RR146, AIT
Ohta et al (1989) Proc.12th ICSMFE, Vol.1, 71-74
Sekiguchi & Ohta (1977) Proc.9th ICSMFE, Specialty Session 9, 229-238