Fundamental studies on in situ quality evaluation method for soil-bentonite cut-off wall

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1. BACKGROUNDS AND OBJECTIVES

Soil-bentonite mixture (SBM) is a material with a permeability low enough to be used as the containment barrier for contaminated soil, and has some advantages such as high deformability and self-recovery in barrier performance attributed to swelling of bentonite if cracks occur. Since cut-off walls are required to contain contaminants properly, homogeneity of the wall after construction is a significant consideration. Therefore, quality evaluation of constructed walls is important technical issues. However, any in-situ quality evaluation method for SBM cut-off walls has not been established yet, since SBM maintains its high deformability even after the construction and it is technically difficult to collect core samples with qualities enough to evaluate their properties reliably. In this study, applicability of piezocone test (CPTU) as an in-situ qulity evaluation technology is examined by conducting unconsolidated-undrained triaxial compression tests and large-scale soil tank tests. Besides, hydraulic conductivity of SBM was estimated from the excess pore water pressure dissipation test and compared with the hydraulic conductivity from the flexible wall permeability tests.

2. MAIN ACHIEVEMENTS

1) The results of hydraulic conductivity tests show that less amount of bentonite powder leads higher hydraulic conductivity of SBM to exceed the performance criteria (k = 10^{-9} m/s) in some cases. Therefore, if heterogeneous parts exist in the wall, hydraulic barrier performance can be degraded.
2) The results of unconsolidated-undrained triaxial compression tests show that less amount of bentonite powder leads drastically higher undrained shear strength and lower pore pressure to become negative values.
3) The results of CPTUs indicate that profiles of cone resistance and pore water pressure with depth have some specific trends according to the content of bentonite powder. In particular, the trend of q_t and u values changed notably at the boundary of SBM layers with different bentonite contents. From these results, it can be said that the zones with lower bentonite contents in the SBM cut off wall can be detected by CPTU.
4) Hydraulic conductivity values estimated by the excess pore water pressure dissipation test are close tothose by the hydraulic conductivity tests under a similar confining pressure. Thus, CPTU has some possibilities to estimate the hydraulic conductivity of SBM cut off wall after construction. From these observations, CPTU has good potential to be an effective method for quality evaluation of the SBM cut-off wall.

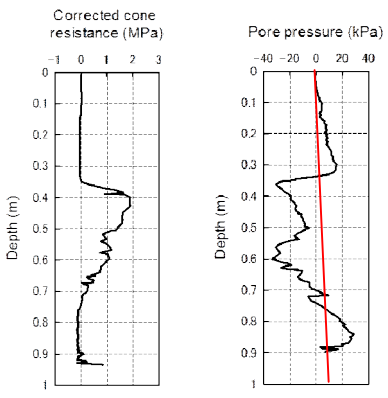

Fig.1 The results of CPTU

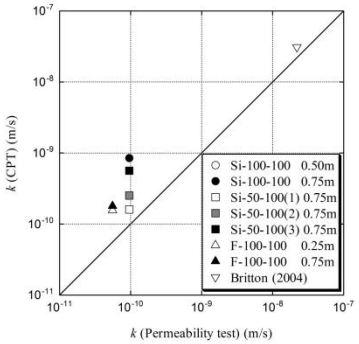

Fig.2 Comparison of k values obtained by two methodologies

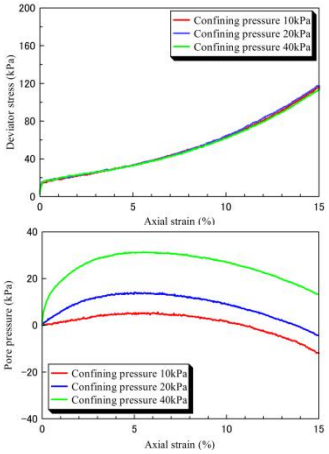

Fig.3 The results of UU test