Experimental study on the self-sealing capability of soil-bentonite mixture cutoff wall

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1. Background and Objectives

Soil-bentonite mixture (SBM) is a material with a permeability low enough to be used as containment barriers for contaminated ground. SBM has several advantages such as high deformability and self-sealing capacity attributed to swelling of bentonite even if cracks occur. When surrounding ground is deformed by external forces, such as earthquakes and close construction works, a residual deformation might be generated on the SBM cutoff walls; nevertheless, the effect of self-sealing capability on hydraulic barrier performance of SBM has not been sufficiently studied.

In this study, unconfined compression test was conducted to evaluate the followability of SBM. Hydraulic conductivity test using a flexible-wall permeameter was conducted to qualify the effect of cracks and holes in the SBM specimens on the hydraulic barrier performance. In order to evaluate effect of deformation on hydraulic barrier performance, modified hydraulic conductivity test using deformation-controlled permeameters was held with simulating the deformation.

2. Main Achievements

1) The results of unconfined compression test showed that the more amount of content of bentonite powder (C_{BP}), the more follow ability it had. Uniaxial compressive strength values of SBM specimens made with silica sand were higher than SBM specimens made from fine sand if C_{BP} is the same because silica sand is a more poorly-graded material (Fig.1).
2) The results of flexible-wall permeability tests showed that a very little leakage in the SBM occurred if specimens had clacks, but the hydraulic conductivity obtained from those specimens and that from normal specimens is in the same order of magnitude (Fig.2).
3) The results of flexible-wall permeability tests showed that no significant leakage in the SBM occurred even if specimens had holes by the self-healing capacity of SBM (Fig.3).
4) The result of the modified hydraulic conductivity test showed that no dramatic increase of hydraulic conductivity was observed even with an average shear strain of 15%. The maximum curvature was 0.092 1/m. However, as a dramatic increase of effluent was not observed, it can be assumed that clacks did not occurred because of the followability.

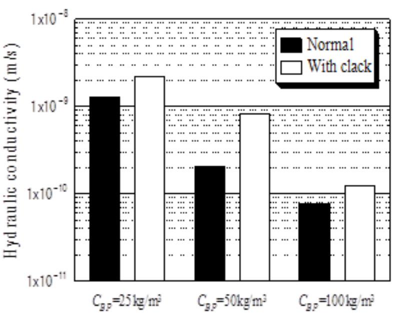

Fig.1 Results of hydraulic conductivity test on normal SBMs and SBMs with a clack

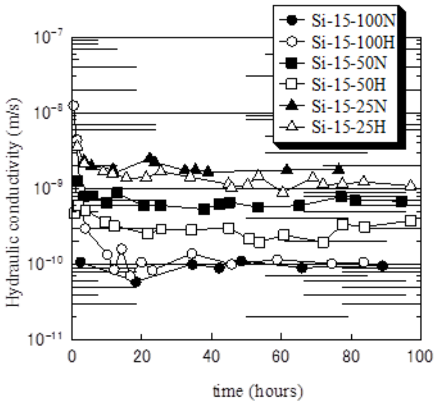

Fig.2 Results of hydraulic conductivity test on normal SBMs and SBMs with a hole

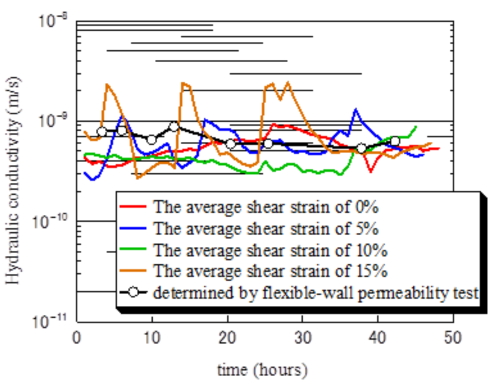

Fig.3 Results of the modified hydraulic conductivity test with deformation