SEISMIC BEHAVIOR OF SOIL-BENTONITE VERTICAL CUT-OFF WALL

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1. BACKGROUNDS AND OBJECTIVES

In situ containment with soil-bentonite (SB) cut-off walls has been proved to be a valid method to prevent the contaminants in contaminated soil and illegally-dumped waste from migrating in the aquifer. SB is a less brittle material compared with typical barrier materials such as soil-cement and steel sheet pile, and has self-sealing property against the crack due to the swelling of bentonite. Thus, SB is expected to maintain its hydraulic barrier performance even against strong ground motions due to the earthquake. However, there are few experimental researches on the seismic behaviour of the SB cut-off wall. Vertical cut-off walls are generally constructed in the shallow aquifer with liquefaction potential. A previous study by authors evaluated the seismic behaviour of the SB cut-off wall in the liquefied sandy aquifer by conducting a series of dynamic centrifuge model tests. However, It was unable to simulate precisely the deformation of SB cut-off wall, which is an important factor affecting the hydraulic barrier performance, due to the interaction between SB cut-off wall and soil box, and the limitation of boundary conditions in the centrifuge model test.

In this study, several cases of centrifuge model tests were conducted to assess the seismic behaviour of SB cut-off wall in the sandy aquifer, particularly in terms of deformation of SB cut-off wall, by modifying some testing conditions to solve the technical problems observed in the previous study. In addition, conventional triaxial tests were conducted for SB specimens to evaluate the strength and deformation property of SB under static/dynamic loading conditions. Finally, by employing a dynamic effective stress analysis code, FLIP, seismic behaviour of SB cut-off wall was numerically analyzed to evaluate the validity of the seismic behaviour observed in centrifuge tests and the effects of boundary conditions on the deformation of SB cut-off wall.

2. MAIN ACHIEVEMENTS

1) Undrained triaxial tests under static loading conditions proved that SB was a strain-hardening material similar to typical sandy soil. However, under dynamic loading conditions, the observed shapes of stress-strain relation of SB were more likely consistent with those of typical cohesive soil.
2) In centrifuge model tests, SB cutoff wall was subjected to more than 10% in ultimate horizontal shear strain. Arching effect on the SB cut-off wall was considered to cause its significant deformation due to the settlement of sandy aquifer with the dissipation of excess pore water pressure after the ground motion. However, no significant local failure was observed in the SB cut-off wall due to its flexibility.
3) Analytical results indicated that the limitation of lateral movement of the sandy aquifer in the centrifuge test caused the underestimation of the deformation of SB cut-off wall. Further studies are required to assess the effect of deformation of SB cut-off wall on the hydraulic barrier performance quantitatively.

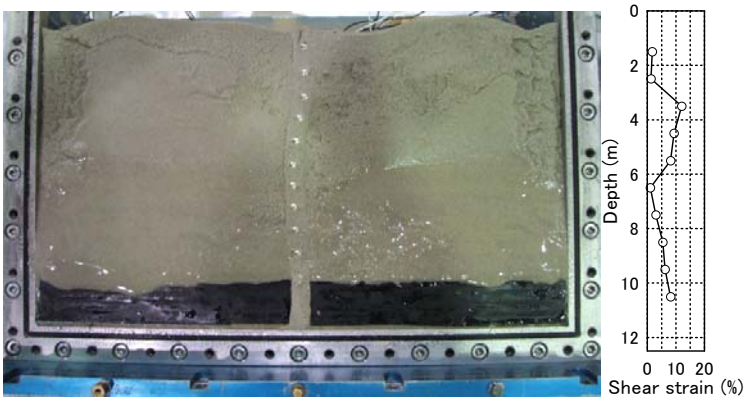

Figure 1 Ultimate deformation and shear strain of the soil bentonite cut-off wall observed in the centrifuge model test