

Mechanical behavior and hydraulic barrier performance of overlapped geosynthetic clay liners subjected to differential settlements

Shotaro Ogawa

Key Words : Geosynthetic clay liner, Differential settlement, Hydraulic barrier performance, Trapdoor test

1. BACKGROUND AND OBJECTIVES

On March 2011, a mega-thrust earthquake occurred in offshore North East Japan. The subsequent tsunami caused hydrogen explosions at Fukushima Daiichi Nuclear Power Plant, and a large quantity of radioactive polluted soil and waste was generated. Geosynthetic clay liners (GCLs) are expected to act as a hydraulic barrier in the final cover system of disposal facilities for these polluted soil and waste. GCL is one of the water shielding bentonite liners and it has a low hydraulic conductivity because its inner bentonite swells as it absorbs water. In this study, a trap door test was conducted to investigate the behavior of overlapped GCLs subjected to differential settlements, under a small overburden pressure. Tank test was also performed to evaluate the hydraulic barrier performance of GCL overlap section. Besides, direct shear tests were conducted to investigate the frictional force which works between GCL and GCL, or GCL and Toyoura sand.

2. MAIN ACHIEVEMENTS

- (1) GCLs kept the overlapped section, even at the largest induced differential settlement of 145 mm, which corresponds to distortion of 0.58. Distortion Δ/L is defined as the settlement Δ , over a horizontal distance L .
- (2) The results of direct shear tests showed that frictional force which works on boundary between GCL and GCL depends on the cohesion, on the other hand, which works on boundary between GCL and Toyoura sand depends on the internal frictional angle. In this experiment, geotextile encased GCL with a woven geotextile on one side, and a nonwoven geotextile on the other side was used.
- (3) The results of trap door tests and direct shear tests showed that behavior of GCLs overlapped section was affected by deformation following property of cover soil layer.
- (4) The results of soil tank tests showed that decreasing of overlap width had little effect on hydraulic barrier performance of the GCL overlap section. GCL overlap section maintained its hydraulic integrity even against the overlap slippage up to 100 mm and a reduced overburden pressure.

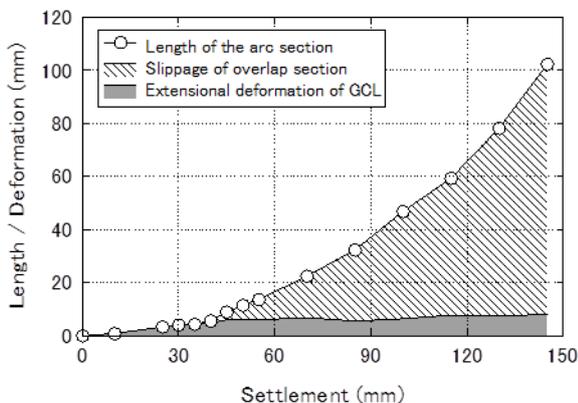


Fig. 1 Profiles of extensional deformations of GCLs and slippage of the overlap section

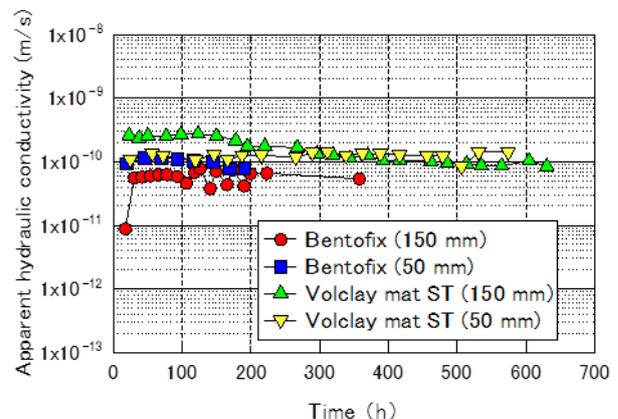


Fig. 2 Apparent hydraulic conductivity values of the overlapped GCLs with time