Seepage model test on restored embankment using geocell reinforcement technique

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Road networks are an important social infrastructure that must be highly resilient. They should be stable against external actions and restore function after disaster damage. Further development is required for the management of the embankment. In this study, the authors are investigating the effectiveness of geocell reinforcement techniques to restore the damaged embankment due to hydraulic action.

The authors conducted a seepage model test to investigate the progressive failure phenomenon of an unreinforced embankment under hydraulic action. Then, they conducted a similar test for a restored embankment with geocell reinforcements and horizontal drainage pipes.

Fig 1 presents the seepage model test system, which comprises a soil box, water tank, groundwater observation wells, and a slope-geometry scanning system (Miyata and Miyamoto, 2021). In a series of tests, water heights at the back of the embankment and seepage times were controlled to simulate different hydraulic actions on the embankment. The maximum seepage height was the height of the embankment.

Fig 2 shows the scanned surface geometry of the unreinforced embankment at the initial condition and after the final stage of the seepage action. As the applied seepage action increased, local failure occurred, expanding from the toe of the slope to the top of the embankment.

Fig 3 shows the result of the seepage model test for the restored embankment by the proposed method. The reinforcement condition was determined by considering the test result of the unreinforced embankment. Slope-shaped geocells were installed at the top, and high-permeable box-shaped geocells were installed at the toe. Horizontal drainage pipes were inserted into the above of a box-shaped geocell to prevent rigging a water level in the embankment. Severe hydraulic actions, the water height being the same as the height of the embankment, did not change the slope geometry of the reinforced embankment. The usefulness of the proposed method was validated.

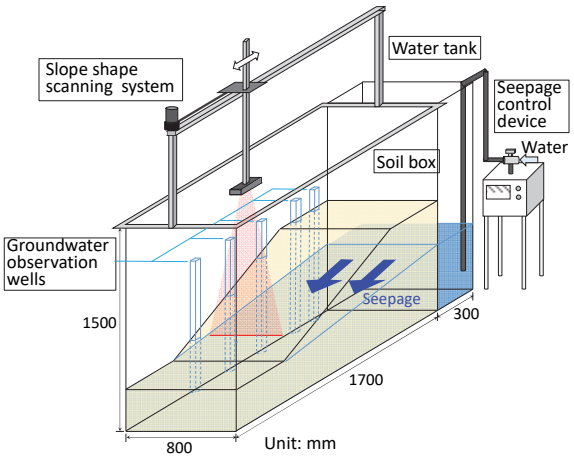

Fig. 1. Outline of seepage model test apparatus.

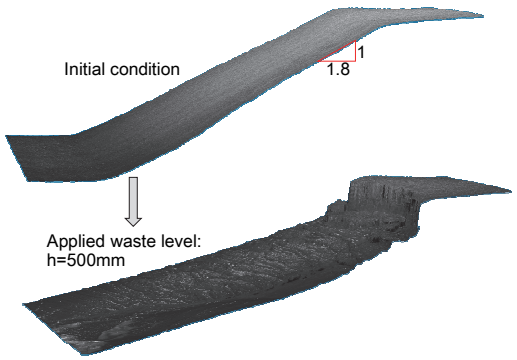

Fig. 2. Observed surface geometries in the test of unreinforced embankment.

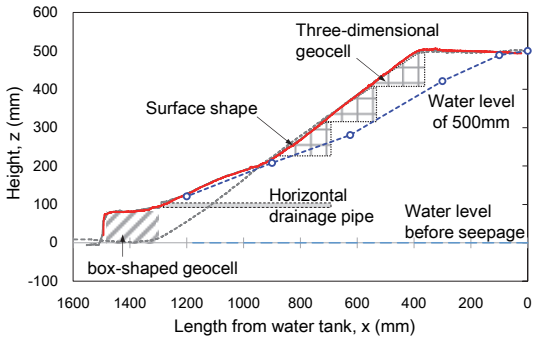

Fig. 3. Observed surface geometry and water level in the test of restored embankment using the proposed method.

REFERENCES

Miyata, Y. and Miyamoto, S. (2021). Physical modeling of embankments reinforced with geotextile bags and horizontal drainage pipes: Proc. of 7th Asian Regional Conference on Geosynthetics (GeoAsia7), REUR-1A.