Failure Mode in Embankments Supported by Piles with Geosynthetics

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ABSTRACT
A series of model tests were performed to investigate the failure mode in embankments supported by piles with geosynthetics. In the model tests, model piles with isolated cap were inserted through the holes in a steel plate, which could be operated up and down. Then geosynthetics was laid on the pile caps below sand fills. The settlement of soft ground was simulated by lowering the plate. As the plate was lowered, the soil arching was mobilized in the embankments. The deformation of both the sand fills and geosynthetics were captured by digital camera. Also the loads acting on pile cap and the tensile strain of geosynthetics were monitored by data logging system. Model tests showed that the embankment loads transferred on pile caps by soil arching increased with settlement of the soft ground rapidly. In case of without geosynthetics, the loads acting on pile caps dropped to a residual value after peak value, whereas loads on pile caps gradually increased until constant value in case of geosynthetic-reinforced. This illustrated that reinforcing with the geosynthetics have a good effect to restraint the settlement of embankments. Also, the deformation shape of geosynthetics between pile caps formed the circular arc according to the settlement of soft ground. The embankment loads transferred on pile caps could be estimated by considering both soil arching and tensile strain of geosynthetics in embankments supported by piles with geosynthetics.

KEY WORDS: Failure mode; embankment; pile; soft ground; soil arching; geosynthetics; model test

INTRODUCTION
When backfilling are performed behind abutments on soft grounds or embankments are built on soft grounds, unsymmetrical surcharges due to backfills or embankments may generate the lateral soil movement or the lateral flow, even the sliding failure in soft grounds (Peck et al., 1974; Hong, 2005). In order to prevent these damages, overburdens due to embankments or backfills should be minimized or supported so as not to be loaded directly on soft grounds.

Embankment pile systems are used to decrease such overburdens on soft grounds according to mobilizing soil arching in pile-supported embankments. Fig. 1 shows the typical section of embankment piles installed in soft ground.