

A Solution to Analyze the Geosynthetic Reinforced Piled Embankments Considering Pile-Soil Interaction

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Abstract : A pile-supported embankment with geosynthetic-reinforced mat (PSGR embankment) has been considered as an effective solution to reduce the total and differential settlement of the embankment constructed over soft soil. In this paper, a new simplified method proposed firstly incorporates the load transfer between piles and surrounding soil and the settlement of pile, and also considers arching effect in embankment fill, membrane effect of geosynthetic reinforcement, and subsoil resistance, to evaluate the behavior of PSGR embankment. Subsoil settlement is assumed to consist of two parts:(1) the settlement of subsoil surface between piles equivalent to that of pile caps assuming the geosynthetic reinforcement without deformation yet; (2) the subsoil subsiding along with the geosynthetic deforming, and the deflected geosynthetic being considered as centenary. The force equilibrium, including loads acting on the upper surface of geosynthetic, subsoil resistance, as well as the stress-strain relationship of the geosynthetic reinforcement at the edge of pile cap, is established, thus the expression of subsoil resistance is deduced, and subsequently the tension of geosynthetic and stress concentration ratio between piles can be calculated. The proposed method is validated through observed data from three field tests and also compared with other eight analytical solutions available in the literature. In addition, a sensitive analysis is provided to demonstrate the influence of with/without considering pile-soil interaction for evaluating the performance of PSGR embankment.

Keywords : pile-supported embankment, geosynthetic, analytical solution, soil arching effect, the settlement of pile, sensitive analysis

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