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Design of Piled embankment and Settlement Control

Renpeng Chen

Summary

In China, high-speed transportation infrastructure, including high-speed railways and highways, develops rapidly in recent years. The standard for post-construction settlement of the high-speed transportation infrastructure is restrict with the considerations of safety and comfort. Piled embankments are widely used over the deep soft deposits. The piles that support the embankment are exposed not only to the heavy loading from the embankment self-weight, but also to the cyclic loading induced by high-speed vehicles through their service time.

In present work, the model tests on soil arching were performed and a method for anticipating the loads carried by the piles was developed. A series of large-scale model pile tests was performed to investigate the response of single pile subjected to axial cyclic loading. Cumulative settlement, axial force, stress at the soil-pile interface were measured. The test results indicated that the development of accumulated settlement depends on the cyclic load ratio and static load ratio.

Closed-form solution for piled embankment was obtained taking into consideration the soil arching in embankment fill, the negative friction along pile shaft, and the settlement of the foundation soil. Case study shows that the predictions of the load share ratio and the post construction settlement made by this solution match the in-situ monitoring data well. The design procedures and settlement control methods of pile-supported embankment have been proposed.

Finally, a full-scale dynamic testing system for high-speed railway embankment is introduced. In this testing system, different types of subgrade and soil improvement methods could be simulated. The loading system could simulate the trains' passing dynamic load with maximum speed of 400km/h. Using this testing system, many problems associated with high-speed railway embankment can be studied, such as cumulative settlement of the railway line and soil improvement technique for subgrade.