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Centrifugal modeling of an embankment on soft soil with soil-cement columns and prefabricated vertical drains

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Thick soft soil deposits are widely distributed in the eastern coastal area in China. The unfavourable geologic condition poses a number of geotechnical problems, such as low bearing capacity, excessive settlement and slope instability. To enhance such soft soil, Xu et al. [1] proposed a new ground improvement method combining soil-cement (S-C) columns and prefabricated vertical drains (PVDs). Generally, S-C columns can increase the bearing capacity of the soft soil, while PVDs can accelerate the consolidation rate of the soft soil.

To investigate the performances of the soft soil improved by the combined method with S-C columns and PVDs, a series of centrifugal modelling tests were performed to investigate the effects of column spacing and column length on the behaviours of the composite foundation. Scaled-down model columns and a kind of wool strings were manufactured to simulate the S-C columns and PVDs in field. The ground settlement, lateral displacement of soil, and excess pore water pressure were monitored during modelling tests. The test results showed that the ground settlement and the lateral displacement decrease with an increase in column length and a decrease in column spacing.

After that, a comparison analysis was conducted between the test results and the predictions using the analytical solutions proposed by Ye et al. [2] for calculating the degree of consolidation of the composite foundation. A good agreement was reached between the test results and analytical calculations which demonstrates the applicability of the proposed method.

References:

[1] Xu C and Ye GB (2006) Chin J Geotech Eng 28(7):918-921

[2] Ye GB et al. (2012) Bull Eng Geol Environ (71):87-98

