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Abstract

CONSOLIDATION OF CLAYEY SOILS BY PREFABRICATED VERTICAL DRAINS

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The use of prefabricated vertical drains and surcharge to accelerate the consolidation of clayey soils is well established in soil improvement technology. For this method of soil treatment, it is important to monitor the progress of consolidation where the average degree of consolidation is usually defined as the ratio of current settlement to the ultimate settlement due to primary consolidation. An accurate estimate of the ultimate primary settlement is therefore, required in order determine the state of consolidation, and the appropriate time for surcharge removal when the desired degree of consolidation has been achieved.

This investigation presents a simple rigorous solution for the calculation of consolidation of clayey soils by displacement-type prefabricated vertical drains with finite permeability taking into account disturbance in a clay cylinder surrounding the drain pile caused by drain installation. The accuracy of Hansbo's and Onoue's approximate solutions regarding well resistance and smear as well as the ideal well of Barron's solution were examined in detail by comparing with this simple rigorous solution. A comparison of four different observational methods for monitoring the progress of consolidation to determine their similarity and differences, and their accuracy of predictions compared to actual observations had been proposed. Firstly, analysis of soil parameters and proposed mathematical expression, secondly comparative analysis of soil permeability of drain materials, and the depth of the clayey layer and finally comparison between observations of field in the runway of

Macau International Airport which was elaborately geotechnically monitored and theoretical results. The main results were summarized as follows:

1. The results of Hansbo, Onoue and Author were almost same irrespective of smear effect considering diameter ratio and permeability ratio, while the degree of consolidation by Author and Onoue were larger than that used by Hansbo in the case of considering smear effect as well as resistance. The lower the permeability was, the greater the difference was.
2. The comparisons of ultimate primary settlements between the theoretical predictions and actual field measurements was found that Hansbo's, Onoue and Author's solution gave good agreement with predictions, making them complementary tools for use in monitoring consolidation in field applications. The ultimate settlement predictions by Hansbo's, Onoue's and Author's formula show closer prediction toward the field measurement, and the settlement prediction by Barron's formula tend to be over estimated.