



Comparative Analysis of Settlement and Pore Water Pressure of Road Embankment on Yan soft soil Treated with PVDs

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Abstract

The application of prefabricated vertical drains (PVDs) in the road embankment construction has been successfully performed in many projects throughout the country. The simulation of finite element method (FEM) can assist engineers in modelling very complex structures and foundations. This paper presents a plane-strain numerical analysis that was performed to verify the effectiveness of the model embankment stabilised with PVD using Plaxis 2D version 8. This study employed the smear effect of permeability ratio (k_r) of 3 in the PVD modelling. The data of settlement and pore water pressure in the left and right sides of road embankment were monitored for 177 days, then the data were collected and compared by a numerical simulation. The coefficient of determination (R^2) was used to assess the performance of the comparative analysis. The results of numerical simulation on settlement and pore water pressure obtained a coefficient of determination of greater than 0.9 which has reached a good agreement with those of the field measurement. On other the hand, there was no significant difference in the performance between both sides of the embankment. The smear effect parameter ($k_r = 3$) is recommended for PVD designs and can provide accurate FEM prediction.

Keywords: Soft Soil; Prefabricated Vertical Drains; Smear Effect; Finite Element Method; Field Measurement.

1. Introduction

Road construction on soft soil is often become the main issue faced by engineers today. This is because soft soil has high moisture content, high compressibility, and low shear strength [1]. This has led to the failure of bearing capacity and the occurrence of excessive settlement. The construction of the embankment will create external loading to the soft ground. The additional burden imposed on the soft ground causes consolidation settlement over a considerable period of time. Thus, a primary concern of embankment construction on soft ground is the post-construction settlement. Various techniques can be used to solve this geotechnical problem. Over the last decade, many researchers have carried out studies on soft soil properties such as soil-cement columns [2], prefabricated vertical drains (PVDs) [3], concrete piles [4], and others. However, ground soft soil improved with PVDs approach is often used in Malaysia because this technique is easier to install and it is economical.

Consolidation of soft soils by PVDs is the most popular techniques because it accelerates consolidation and reduces

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