The Performance of Prefabricated Vertical Drains (PVDs) in The Acceleration of The Consolidation Process of Soft Clay

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Introduction

• Discharge capacity of PVDs, the key factor that dictates the performance of PVDs, reduces significantly due to extreme deformation during consolidation process of soft clay. However, the degree of reduction of the discharge capacity of deformed PVDs is still inclusive.
• A smear zone, a disturbed zone induced during installation of PVDs, retards the horizontal consolidation of soft clay because the hydraulic conductivity of the smear zone is much lower than that of undisturbed zone outside. The characteristics of the smear zone needs to be further investigated to have a better prediction of a smear zone.

Objectives

• Develop 2 model test devices: PVS-S apparatus and SZM device.
• Investigate the discharge capacity of deformed PVDs experimentally (PVD-S apparatus) and numerically.
• Experimental (SZM device), numerical, and theoretical study the characteristics of the smear zone.

Assumptions

• Soil specimen is fully saturated and homogeneous.
• Water and soil skeleton are incompressible.
• Darcy's law is valid.

Primary results

• Discharge capacity of deformed PVDs (Fig. 1).
• The extent of a smear zone (Fig. 2), Head distribution (Fig. 3), and the distribution of the hydraulic conductivity of the smear zone (Fig. 4).

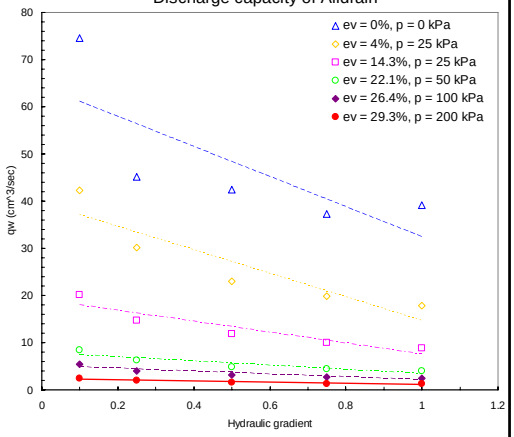
Findings

• Discharge capacity of a deformed PVD was lost by 96.5% at the vertical strain of 29.3% (Fig. 1).
• The extent of a smear zone was larger than 6.5 times as the equivalent diameter of the mandrel (Fig. 2).
• The hydraulic conductivity of the smear zone decreased as 7.5 times as that of outside soil (Fig. 4).

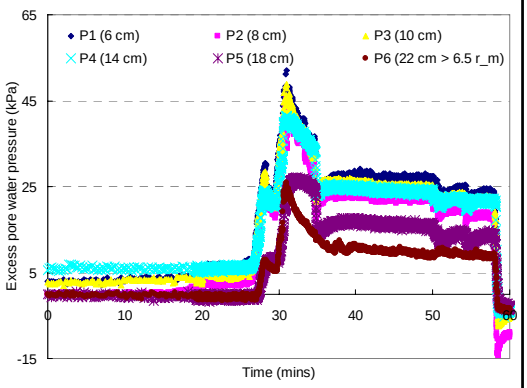
Future works

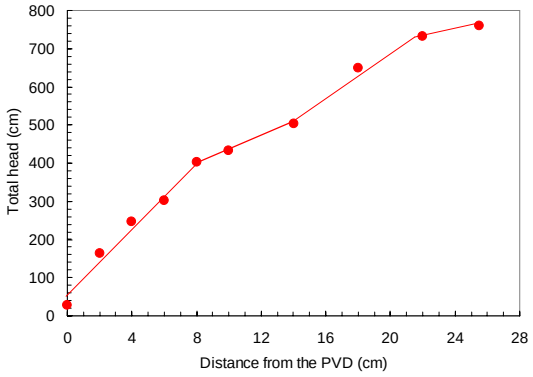
• Run more Discharge capacity of deformed PVDs and Smear zone tests.
• Perform numerical analyses using PLAXIS v. 8.2x.
• Analyze a smear zone theoretically.

Discharge capacity of Alidrain



The change in excess pore water pressure during the installation





Distribution of hydraulic conductivity in distance from the PVD