

USE OF PVDs TO MEASURE THE IN-SITU HORIZONTAL HYDRAULIC CONDUCTIVITY AND COEFFICIENT OF CONSOLIDATION

Dates: August 2003 - current
Faculty: Dr. Andrea Welker
Graduate Students: Brian Devine (through 2005) and Matthew Gore
Undergraduate Students: Joseph Goessling (2004) and Alison Bennett (2005)

Collaborative research with Nilex Corporation, supported by Villanova University.

Prefabricated vertical drains (PVDs) have been used extensively for soil improvement and more recently for remediation of contaminated soils. Both soil improvement and remediation projects take advantage of the close spacing of PVDs (typically 1 m center-to-center). If used for soil improvement, the horizontal coefficient of consolidation, which is considered the most important factor in improvement design, would need to be determined. If used for remediation, the hydraulic conductivity would be needed for design.

There are existing methods to obtain the in-situ horizontal hydraulic conductivity and coefficient of consolidation. However, these methods are not routinely used because of their high cost. Typically, laboratory tests are performed to determine the vertical hydraulic conductivity and coefficient of consolidation. The results of these tests are usually multiplied by some factor to convert the vertical values to horizontal values. The disadvantages associated with this procedure include the effects of disturbance and small sample size that impact any laboratory test as well as uncertainties in selecting the appropriate multiplication factor and accounting for smear.

A cost-effective device that utilizes PVDs to measure the in-situ horizontal hydraulic conductivity and/or the horizontal coefficient of consolidation, dubbed the "PVD Permeameter", is currently under development. This method promises to be a cost effective technique for obtaining in-situ values for the horizontal hydraulic conductivity and coefficient of consolidation that already include smear. To date, field tests at one site in Alameda, CA have been completed, laboratory experiments have been completed, and data from a second field trial in Wilmington, DE are being evaluated. Our work indicates that the PVD Permeameter is a promising technology.

The objectives of this research are to:

1. Improve the existing PVD Permeameter.
2. Develop testing procedures.
3. Develop appropriate methods to interpret data.

Ultimately, this work will lead to the last goal, which is to:

4. Validate the accuracy and applicability of data obtained from the PVD Permeameter.

Publications Resulting from this Work:

Welker, A.L., Devine, B., and Goughnour, R. (2005) "Development of the PVD Permeameter," *Proceedings of GRI-18, Geotechnical Special Publication 130-142 & GRI-18*, ASCE Austin, TX, January 2005.

Welker, A.L., Devine, B.J., Goughnour, R., and Foster, J. (2004) "Measurement of In-situ Hydraulic Conductivity and Coefficient of Consolidation using Prefabricated Vertical Drains," *Transportation Research Record (TRR)*, Journal of the Transportation Research Board, No. 1874, pp. 155-162.

