

Determination of Permeability of Soils Using Acoustic Wave

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Permeability of soils is one of the major geotechnical parameters used for designing and analyzing geotechnical structures. However, the procedure for the determination of the permeability is not easy. It is time consuming and expensive even though considerable efforts have been made, both in the theoretical and the experimental arenas, for developing methods for accurate determination of the permeability in soils. The conventional tests used in most laboratories and in situ also may not avoid the tendency of breaking the textures of soils related to drilling or sampling.

This study tries to develop a new method of estimating the permeability of soils using the acoustic wave technique. Due to the non-destructive nature of the technique, the results of this study will provide the permeability of soils for intact condition. This method has many other advantages, such as short test time and capability of obtaining the continuous permeability profile for the full depth of soils.

The theoretical background of this study is that there are two compression wave velocities for saturated soils. One propagates through the pore water, and another propagates partly through the pore water and partly through the solid grains. The second wave velocity is called the slow P-wave velocity. Since the slow P-wave travels through the pores and grains, its velocity has the information about pore spaces. This information is shown through the characteristic frequency of the slow P-wave. The characteristic frequency is related to the permeability by Biot(1956) equation. Measuring the slow P-wave velocity therefore will determine the permeability of soils.

This paper presents the theoretical backgrounds of this method and some experimental results.