

# Elastic characteristics of soils by acoustic sounding

The aim of this research is the continuous measurement of elastic properties in a borehole in soil deposits as a function of depth. This data is then used for the design of structural foundations (Figure 1).

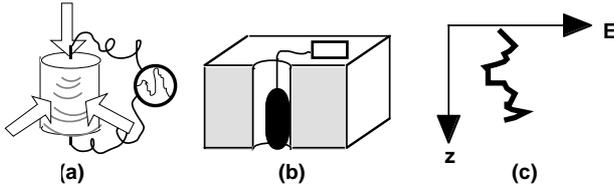


Fig. 1: The elastic characteristics of a soil (c) can be determined by borehole logging (b). The theoretical development is achieved through laboratory tests (a).

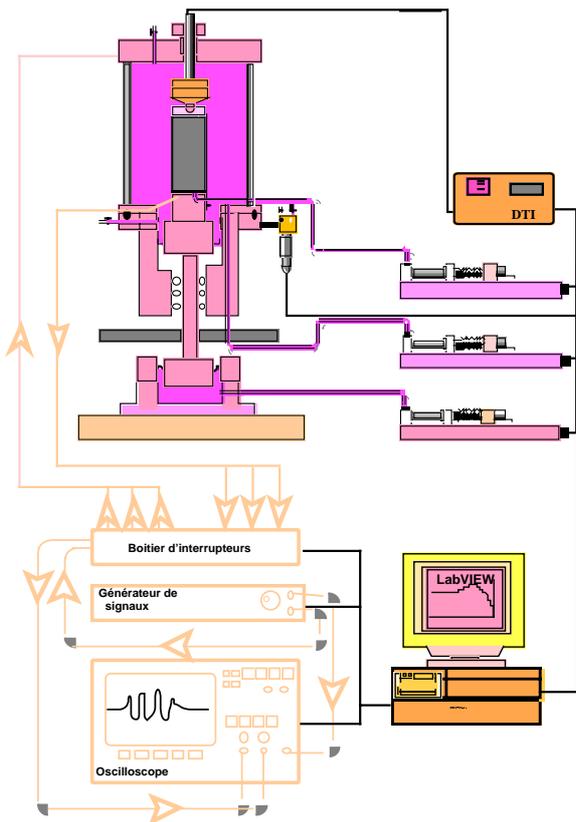


Fig. 2: Schematic representation of the ultrasonic triaxial cell

The first phase of the project was the adjustment of the triaxial cell for the simultaneous measurement on the same specimen of static characteristics (at very small deformations,  $\epsilon=10^{-5}$  to  $10^{-7}$ ) and dynamic characteristics, as well as

permeability. The entire set-up is controlled by computer (Figure 2).

Dynamic properties are measured with transducers of ultrasonic P and S waves (50 kHz - 500 kHz) which are in contact at each end of the soil specimen.

Using this cell, several coefficients, including the coupling factor, are determined. These coefficients permit to estimate the effects of water during the propagation of the acoustic wave, and to calculate the dynamic characteristics of the soil skeleton (alone), based on measurements made for a saturated soil. For less permeable deposits, two elastic moduli are proposed to practising engineers: an undrained modulus, which represents the soil response at the moment of loading and a drained modulus, which characterises the soil after dissipation of the excess pore pressures (long term).

By correlations, the dynamic moduli are converted, if necessary, into static moduli.

When the conversion of these moduli is possible, measurements a) in situ of dynamic moduli at medium frequency (20 kHz) and b) in the laboratory with the ultrasonic triaxial cell for known sites should validate the tests and the theories.

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## Publications

Huot, F. G. & L. Vulliet 1998. Small strain elastic moduli of saturated and dry sands. *Biot Conference on poromechanics*, Louvain, Belgium, Balkhema Ed.

Huot F. & L. Baron, 1997. Soils elastic parameters : a parallel between in situ and laboratory . *Third meeting of EEGS, Aarhus, Denmark, 8-11 sept 1997*, pp 311-314.

Huot F. & Van Duoc L. Détermination des caractéristiques élastiques des sols par diagraphies, *Rapport d'activités Période 3/96-> 7/96 et résultats numériques (documents internes)*