

Stress Dependence of V_p and V_s up to 10MPa

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ABSTRACT

Measurements of shear (V_s) and compressional (V_p) wave velocities were conducted under confined conditions at a stress of 0.001MPa to 10MPa with both bender elements and ultrasonic piezoelectric transducers in a modified cubic triaxial cell setup. In resedimented Boston Blue Clay, we show that bender element technology is capable of measuring the shear waves up to stresses of 2MPa, while the ultrasonic P-wave transducers are unable to measure the stiffness of the soil skeleton at these low stress levels in saturated specimens. In order to identify the feasibility of concurrently measuring P-wave velocity and S-wave velocity, 300-micron quartz sand was tested. The results show that bender element shear velocities are less than those inferred from piezoelectric transducers due to the instrument effect (Fig.2), thus indicating the importance of identifying the measurement method.

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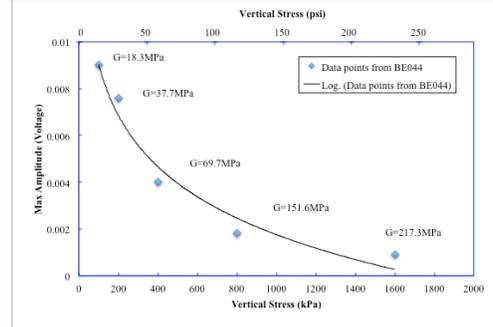


Fig. 1: The bender elements are optimally used for soft materials. The amplitude decay can be seen in the above figure, with the corresponding small strain shear modulus values next to the data points. An estimated terminal stress level can be approximated as $G_{max}=350\text{MPa}$ using BBC.

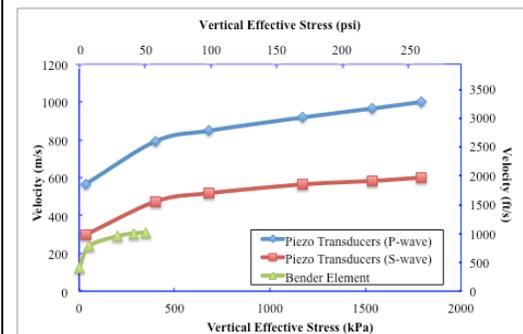


Fig. 2: An experiment on quartz sand was conducted using two different velocity measurement techniques: piezoelectric crystal transducers (1MHz) and bender elements (8kHz). As seen above, there is a misalignment between the S-wave velocity obtained from the ultrasonic transducer and the bender elements.

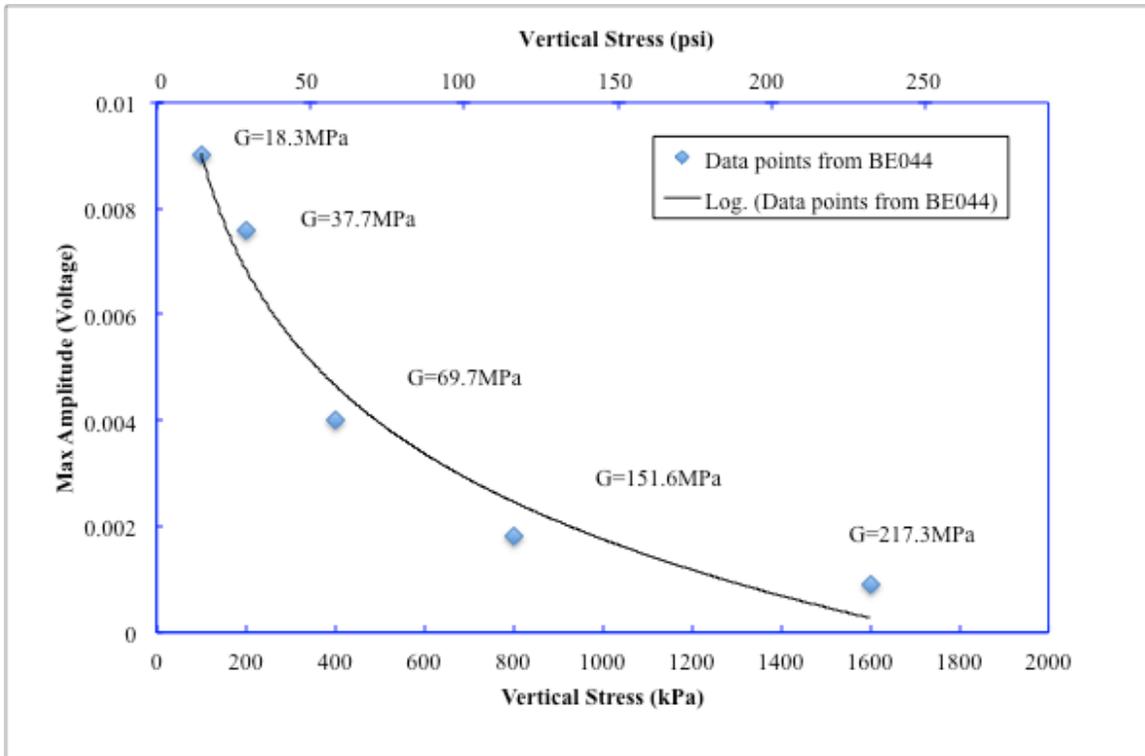


Fig. 1: The bender elements are optimally used for soft materials. The amplitude decay can be seen in the above figure, with the corresponding small strain shear modulus values (G) of RBBC obtained via bender elements next to the data points. A terminal stress level can be approximated at $G_{\max}=350\text{MPa}$ if one were to extrapolate the line further and allow for some variability in test results.

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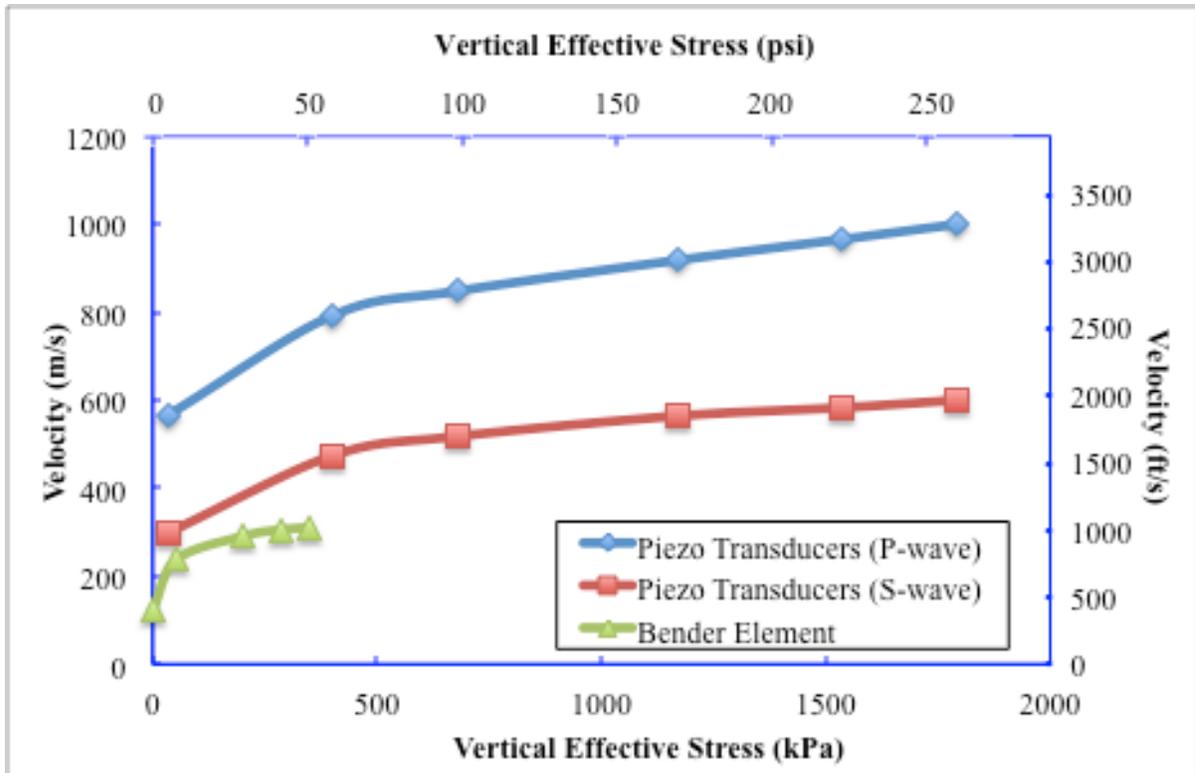


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