AN INVESTIGATION ON THE ACCURACY OF LABORATORY MEASUREMENTS OF THE SMALL-STRAIN SOIL STIFFNESS

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Small-strain soil properties are required for a couple of static or mostly dynamic calculations. The frequent laboratory tests to measure soil properties at small strains include resonant-column and piezoelectric bender element test. Other element tests may also measure such properties being equipped with transducers capable of detecting fine quantities. To probe the accuracy of small-strain measurements at the laboratory, a detailed experimental study was conducted on a dummy polyurethane specimen. Polyurethane was selected to avoid effect of soil anisotropy or excess pore water pressure on the test results. The three different apparatus utilized at this study were the resonant-column, the bender element and the cyclic triaxial equipped with gap sensor. A number of strain gauges were also attached on the dummy specimen; the gauges' measurements was a benchmark in each test to check the reliability of the results. The resonant column rotation velocity was also checked by an encoder.

Though the outcomes of the experiments were in agreement totally, there were some differences in some details as is depicted in Figures 1 and 2.

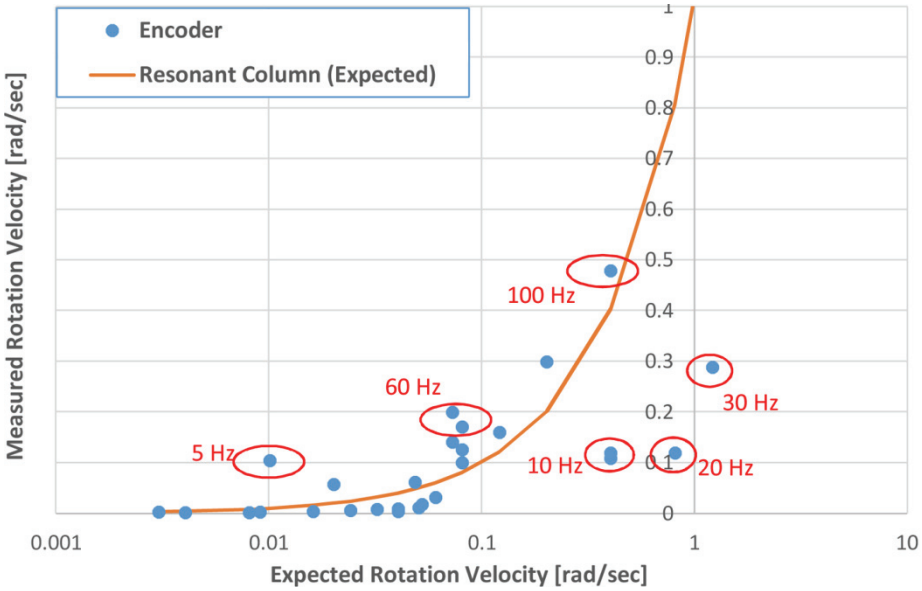

Figure 1. Measured rotation velocity of the encoder compared with the expected velocity measured by the resonant column apparatus (semi-logarithmic scale).

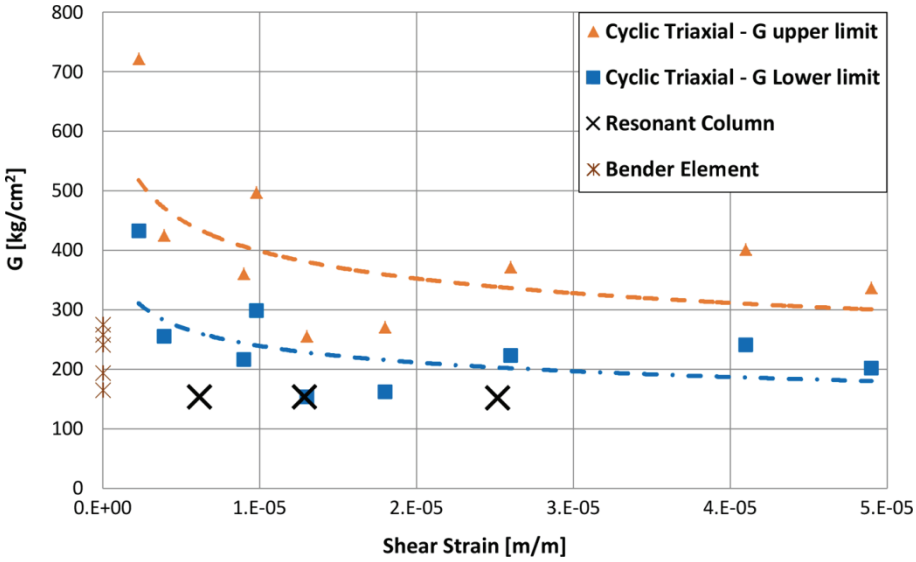

Figure 2. Shear modulus of the polyurethane specimen measured by the cyclic triaxial, resonant column and bender element experiments.

Based on the study results, to achieve more accurate small-strain properties, some justifications are required in the interpretation of some test results regarding the loading condition and the specimen properties, which are discussed through the paper.