Small-Strain and Large-Strain Modulus Measurements with a Consolidation Device

Reference

Zhao, Y., Mahmood, N. S., and Coffman, R. A., "Small-Strain and Large-Strain Modulus

ABSTRACT

By using a back-pressure saturated, constant rate-of-strain consolidation device with bender elements (BP-CRS-BE), values of large-strain constrained modulus (M) and small-strain shear modulus (G_{max}) were obtained from tests performed on kaolinite soil specimens. The methodology and procedures that were utilized to obtain values of M, G_{max}, large-strain shear modulus (G), drained Poisson's ratio (ν), horizontal effective stress (σ_h'), vertical effective stress (σ_v'), specific volume (v), coefficient of lateral earth pressure during unloading ($K_{0,UL}$), and drained friction angle (ϕ') are discussed herein. The following five observations were made. (1) The G_{max} values increased with increasing values of σ_v' and decreased with increasing values of the overconsolidation ratio (OCR). (2) The G_{max} values that were obtained by utilizing correlations and the large-strain BP-CRS-BE testing data (identified as $G_{max,CRS,p'}$), which were back-calculated by considering the modulus reduction, matched the G_{max} values that were obtained from the bender element measurements within the BP-CRS-BE device ($G_{max,BE}$). (3) The ν values increased with increasing σ_v' values but decreased with the increasing void ratio (e) values. (4) The $K_{0,UL}$ values increased with increasing OCR values. (5) The ϕ' values that were calculated for the soil that was tested within the BP-CRS-BE device by using the $K_{0,UL}$-OCR data that were obtained from the BP-CRS-BE device (21.2°, 16.0°, and 24.7°) were similar to the ϕ' values that were obtained from modified Mohr-Coulomb diagram from triaxial tests on the same soil (20.7°).