USING WAVE VELOCITIES TO PREDICT COMPRESSION BEHAVIOR OF NORMALLY-CONSOLIDATED SEDIMENTS

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Compression behavior of sediments is crucial to geological engineering applications for ascertaining the deformation characteristics of the particular geologic formation. The compression behavoir of sediments in this context refers to the change in void ratio with a change in the mean effective stress. Compression behavior in sediments reflects the influence of the sample depth and depositional conditions on pore structure of the sediment mass.

Unfortunately, obtaining the geotechnical parameters required to assess the compression behavior of sediments can be a costly and time-consuming undertaking. Geophysical methods such as field seismic wave surveys have the potential to provide reliable estimates of these geotechnical parameters in a rapid and cost-effective manner.

This paper aims to use compressional and shear wave velocities to predict the compression behavior of normally consolidated-sediments. The study developed a general prediction equation that simulates the compression behavior of sediments. This developed equation is an exponential decline model that relates an increase of the shear wave velocity to an increase of the mean effective stress. Consequently, the decrease of void ratio is presented as a function of the shear wave velocity.

For this research, isotropic consolidation triaxial compression tests were performed on laboratory-derived sediment samples created to mimic actual sediments. The samples were prepared by mixing different percentages of fines and controlling the ratio of clay to silt fractions. Shear and compressional wave velocity tests were performed during this triaxial compression testing using bender elements.

The results showed that while there was no clear connection between consolidation data and compressional wave velocity, there was a strong correlation between the change in mean effective stress and shear wave velocity. Also, the experimental constants needed for the prediction equation were well correlated to various grain size parameters.