THE INCREASING ROLE OF SEISMIC MEASUREMENTS IN GEOTECHNICAL ENGINEERING

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ABSTRACT

The geotechnical engineer has always been faced with the problem of characterizing near-surface materials. The near-surface region is often within 10 to 100 m of the ground surface. Traditionally, field exploration programs have involved boring, sampling, and penetration testing. In the 1960s, in-situ geophysical measurements began to be employed in geotechnical engineering. This work primarily involved seismic (stress wave) measurements which were adapted from exploration geophysics. Seismic measurements were used to characterize geotechnical sites (e.g. layering, top of bedrock, depth to water table) and geotechnical materials (e.g. stiffnesses in shear and compression). The real demand for seismic measurements grew out of the need to evaluate the dynamic properties of near-surface soils for use in soil dynamics and geotechnical earthquake engineering. Today, however, in-situ seismic measurements are used in many more applications, because: (1) the measurements have a strong theoretical basis, (2) they can be performed in the field and laboratory, thus forming an important link between field and laboratory measurements, and (3) in recent developments in field testing involving surface waves, they are noninvasive which makes them cost effective in comparison to other investigative methods. Applications of these techniques are discussed, and recent studies are presented to highlight some of their strengths and limitations. Some of the recent studies include: (1) siting large tunnel shafts to avoid potential liquefaction problems, (2) evaluating the density of alluvium beneath an earthen dam, (3) monitoring the construction of a 27-m thick fill at a nuclear power plant, and (4) predicting the settlements of shallow foundations on granular soil.