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Embedded type new in-situ soil stiffness assessment and monitoring technique

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ABSTRACT

We aimed to assess the evolution of small-strain stiffness and relative density in non-compacted embankment layers. We developed embedded type in-situ soil stiffness measurement devices for monitoring small-strain stiffness occurring after filling at a test site and conducted comprehensive laboratory compaction tests using an oedometer cell with a bender element. However, direct comparison is extremely difficult because the shear wave velocity measured in the field and laboratory depend on depth and effective stress, respectively. Therefore, we propose a method for establishing a relationship between effective stress and depth using a compressibility model. In this study, the shear wave velocity measured in the field was compared to the estimated shear wave velocity-depth profiles for completely dry and saturated conditions with different relative densities. The relative density under saturated soil conditions may vary between 50% and 90% and tends to be closer to 95%. Under dry soil conditions, the relative density of the embankment can vary from 30% to 70% and tends to approach 76%. For model validation, the relative density estimated from shear wave velocity-depth profiles was compared to that estimated from DCPI data. In other words, the results analyzed in the context of an effective stress–depth model enable the prediction of engineering properties such as the small-strain stiffness and relative density of embankment layers. This study demonstrates that physics-based data analyses successfully capture the relative density of non-compacted embankment layers.

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