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Strength and stiffness characteristics of cement paste-slime mixtures for embedded pile

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ABSTRACT

Slime is induced by the excavation performed during the installation of embedded piles, and the slime tend to mix with the cement paste injected into pile shafts. The slime reduces skin friction and results in significant settlement of the embedded pile. Hence, the slime should be removed. However, the slime typically remains in the borehole because the slime is difficult to remove completely. Therefore, the properties of cement-based materials need to be determined based on the slime and water-cement ratios to better understand the actual bearing mechanisms of embedded piles (Kim et al., 2020; Zhou et al., 2020). The objective of this study is to investigate the strength and stiffness characteristics of cement paste-slime mixtures with different slime ratios cured for 1, 3, 7, 14, and 28 days. Uniaxial compression tests and elastic wave measurements are conducted to obtain the static and dynamic properties, respectively. The mixtures are prepared in a cell instrumented with piezo disk elements and bender elements to measure the elastic waves, as shown in Fig. 1. The uniaxial compressive strengths and static elastic moduli of the mixtures are evaluated based on uniaxial compression tests for all curing periods and slime ratios. In addition, the dynamic constrained, shear, and elastic moduli are estimated based on the compressional and shear wave velocities. Results show that, for all the slime ratios, the uniaxial compressive strength and static elastic modulus increase logarithmically with the curing period. The compressional and shear wave velocities increase with the curing period and decrease with the slime ratio, as shown in Fig. 2. The bearing mechanisms of embedded piles may be effectively estimated based on the strength and stiffness characteristics of cement paste-slime mixtures.

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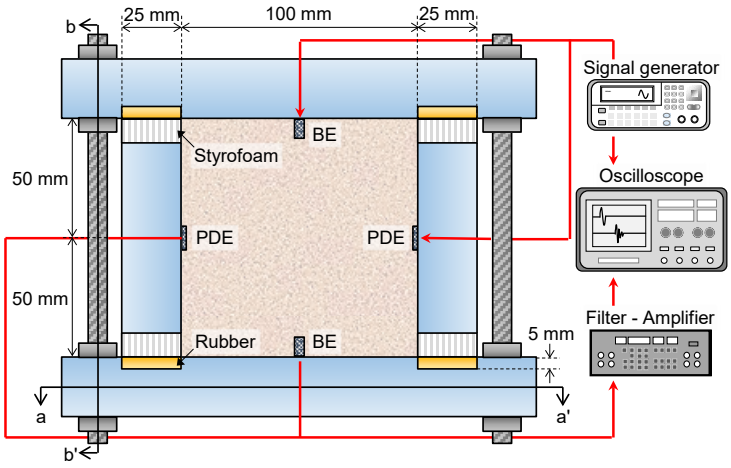
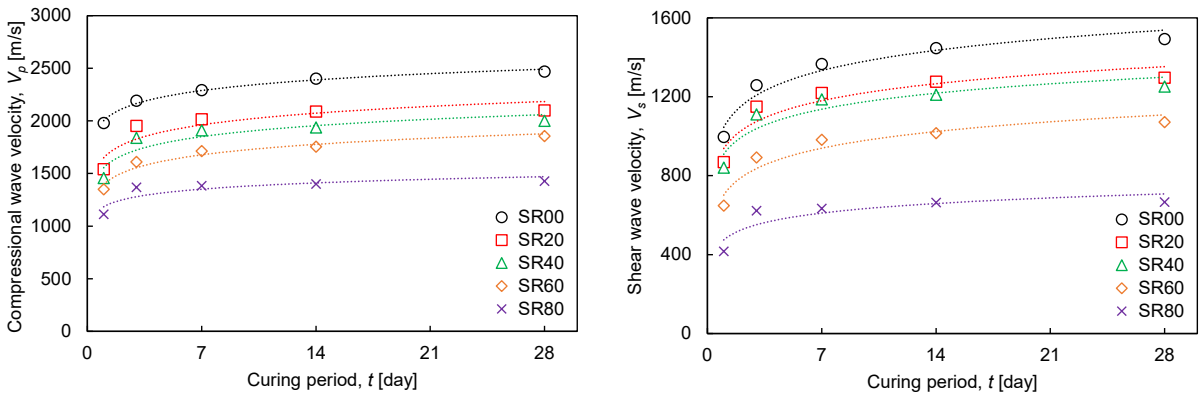


Fig. 1 Schematic drawing of measurement system for elastic waves



(a) Compressional wave velocity (b) Shear wave velocity

Fig. 2 Elastic wave velocities versus curing period

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