Influence of clay content on wave-induced liquefaction

This paper presents the results of an experimental study of the influence of clay content (CC) on liquefaction of seabed beneath progressive waves. Experiments were, for the most part, conducted with silt and silt-clay mixtures; in supplementary tests, sand-clay mixtures were used. Two types of measurements were carried out: (1) pore-water pressure measurements across the soil depth and (2) water-surface elevation measurements. These measurements were synchronized with video recordings of the liquefaction process from the side. The ranges of the various quantities in the experiments were wave height $H = 57.62$ to $18.3$ cm, wave period $T = 51.6$ s, and water depth $h = 555$ cm. The experiments showed that the influence of CC on wave-induced liquefaction is very significant. Susceptibility of silt to liquefaction was increased with increasing CC up to CC $30\%$ (which is clay-specific), beyond which the mixture of silt and clay was not liquefied. Sand may become prone to liquefaction with the introduction of clay, contrary to the general perception that this type of sediment is normally liquefaction-resistant under waves. For instance, sand with $d_{50} = 50.4$ mm was liquefied with CC $50\%$, whereas sand with $d_{50} = 50.17$ mm was partially liquefied with CC as small as $2.9\%$. Remarks are made as to how to check for liquefaction of clayey soils exposed to waves in real-life situations.

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