

Undrained Cyclic Behavior of Mixtures of High-Plasticity Clay and Sand

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Synopsis

The cyclic behavior of mixtures of high-plasticity clay (commercial bentonite) and sand and factors affecting it were studied by means of a ring-shear apparatus. It was found that bentonite content had a significant influence on the liquefaction process of the studied soils. A small amount of bentonite in the mixtures (<7%) would cause the formation of "loose" microstructures, resulting in the occurrence of rapid liquefaction under cyclic loading, while a high bentonite content (>11%) would cause the formation of clay matrixes, thus raising the soil's resistance to liquefaction. In addition, the effect of pore water chemistry on the cyclic behavior of a high plasticity bentonite-sand mixture was carefully examined. It was found that the presence of ions in pore water changed the soil's microstructure, making it more vulnerable to liquefaction. The results from a series of undrained cyclic shear displacement-controlled tests revealed the strong influence of loading frequency on the cyclic behavior.

Keywords: liquefaction, bentonite, pore water chemistry, loading frequency

高塑性粘土と砂の混合材料の非排水繰り返し載荷挙動

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要 旨

高塑性粘土(市販のベントナイト)と珪砂の混合材料の繰り返し載荷時の挙動をリングせん断試験機を用いて調べた結果、粘土含有量が液状化特性に大きく影響することがわかった。7%以下の比較的低い粘土含有量では粗な微細構造のため繰り返し載荷時に速く液状化に到達した。一方11%以上の場合液状化抵抗が増大した。間隙水の化学組成の影響については間隙水中のイオンが微細構造に影響し液状化しやすくなる傾向が得られた。せん断変位制御の非排水繰り返し載荷試験では液状化挙動の周波数依存性があることがわかった。

キーワード: 液状化, ベントナイト粘土, 間隙水の化学的特性, 載荷周波数