

Effect of Liquefaction Degree During Cyclic Loading on Subsequent Undrained Cyclic Shear Behavior

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ABSTRACT

It was previously believed that once liquefied, ground would become less susceptible to liquefaction due to post-earthquake densification. However, liquefaction was often observed again in the same locations where liquefaction once occurred, calling for elucidation of the mechanism of re-liquefaction. To clarify the mechanism of liquefaction and re-liquefaction, some studies have been conducted that focused on strain history and changes in skeletal structure during cyclic loading ([1] etc). In this study, we focus on the effect of the degree of liquefaction during pre-cyclic loading on subsequent liquefaction as a fundamental study to elucidate the mechanism of re-liquefaction.

After applying different liquefaction histories through strain-controlled undrained cyclic loading, the drain cock was opened to consolidate the soil, and then a stress-controlled undrained cyclic shear test was conducted. As shown in Figure 1, it was found that the greater the degree of liquefaction during pre-cyclic loading, the greater the decrease in mean effective stress p' (plastic compression) due to stress-controlled undrained cyclic shear test. It is also important to note that the greater the degree of liquefaction, the greater the volume change during consolidation. From the above, it was found that re-liquefaction resistance is not only influenced by density, but also by the degree of liquefaction during pre-cyclic loading.

Based on the soil skeleton structure concept, the degradation of the structure acts as plastic compression (decrease in p'), so it can be understood that the greater the degree of liquefaction, the higher the degree of the structure. It has been thought that structures only become lower as plastic deformation proceeds, but since soil particles are in a suspended state during liquefaction when they lose their rigidity, it can be thought that the structure becomes higher during redeposition.

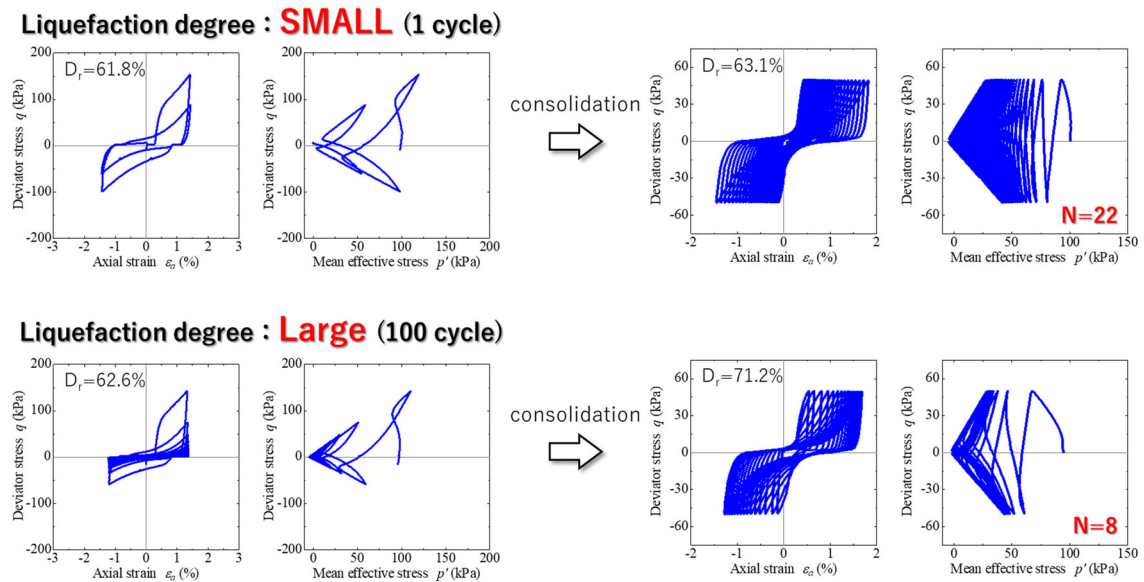


Fig. 1. Re-liquefaction behavior with different liquefaction degree

REFERENCES

- [1] Yamada, S., Takamori, T. and Sato, K. 2010. Effects of reliquefaction resistance produced by changes in anisotropy during liquefaction. Soils and Foundations, 50 (1), 9–25.