Development of National Institute of Technology, Kochi College type cyclic box shear apparatus capable of conducting liquefaction strength test

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ABSTRACT

In recent years, the liquefaction damage of the ground due to the earthquake disaster is increasing. In the liquefaction strength test, a cyclic triaxial compression test has been generally used, However, there are problems such as difficulty in testing and the need for a large amount of samples. On the other hand, the box shear test is relatively simple and requires only a small amount of sample. Therefore, at National Institute of Technology, Kochi College, we developed a low stress type cyclic Box shear test that can perform low stress and constant volume test. We performed the liquefaction strength test using the dynamic Box shear test apparatus. As a result, the developed cyclic box shear test apparatus was able to obtain the same results as the cyclic triaxial compression test apparatus.

KEY WORDS: Nankai Earthquake; liquefaction; Liquefaction strength test; Liquefaction strength curve; cyclic box shear test apparatus; low stress; constant volume

INTRODUCTION

In recent years, many earthquakes have occurred in Japan, including the 2011 of the Pacific coast of Tohoku Earthquake on March 11, 2011, the Kumamoto Earthquake on April 14 and 16, 2016, and the Eastern Hokkaido Ibari Earthquake on September 6, 2018. As a result, liquefaction damage occurred frequently. Liquefaction damage has been confirmed sediment flow, land subsidence, sand boil, and subsidence and inclination of houses (Wakamatsu and Senna, 2014). Liquefaction damage has caused huge damage to people. Therefore, if the prediction of liquefaction is performed with high accuracy, countermeasures can be taken in advance and liquefaction damage can be suppressed. In recent years, landslide disasters caused by heavy rain have occurred frequently in Japan. Most debris disasters are caused by surface failure that occurs on surface soil. In order to take countermeasures against this surface failure, it is necessary to obtain the strength parameters of the soil in a medium to low stress state. Conventionally, the strength constant of soil has been determined by a triaxial compression test. The triaxial compression test has advantages such as easy control of drainage conditions and accurate stress control. On the other hand, there are problems such as the difficulty of the experimental method and the necessity of a large amount of samples. Therefore, a box shear test is adopted, in which the test can be performed relatively easily and the amount of the sample is small.

Fig.1 Box shear test apparatus: National Institute of Technology, Kochi College type

Fig.2 a configuration diagram of the apparatus. This apparatus is composed of Vertical side load device, Reaction force side load device and Shear side load device.