D05

Seismic response of different composited stabilizing structures to landsliding in shaking table test

○Ning MA, Honggang WU, Xiyong WU, Gonghui WANG, Toshitaka KAMAI

In this study a series of large-scale shaking table simulation tests were conducted to examine the behavior of stabilizing structures in soil slopes under earthquake condition. In all the tests, the size and materials of the model slopes were kept the same, but three types of stabilizing structures (constraining anti-slide piles, pre-stressed anchor slab-pile wall, and cluster stabilizing structure) were employed.

The soil slopes were prepared by putting a series of soil layers into a rigidity model box. It is noted that during preparing, each soil layer was kept the same thickness and tamped by the same method to ensure the slope to be in a homogenous state. After completion of the soil slope, the model stabilizing structure with various sensors was inserted into the slope. A instrumented model slope is exampled in Fig.1. A series of tests was performed under different loading conditions corresponding to differing seismic motion.

In terms of the Time-domain analysis, the responses were examined mainly by analyzing the dynamic soil pressures and displacement of the structures. In general, these values will be influenced by the input aseismic motion (as presented in Fig. 2). Our test results showed that the model would have stronger response when subjected to two dimensional seismic loadings (see XZ tests in Fig. 3). Dynamic soil pressures measured on the pile side facing to the upper part of the soil slope showed K-shaped distribution (Fig. 3). When the input acceleration reached high value (such as 1.2g), the position of peak dynamic soil pressure above the loading-bearing segment shifted upward, however, that below the loading-bearing segment did not show any shift. On the other hand, the dynamic soil pressure on the pile side facing to downslope part showed that the peak values appeared near sliding surface with its position shifting downward when the shaking became stronger. Compared to the ordinary anti-slide piles, these two combinational stabilizing structures suffered differing displacements in both the value and the distribution.

We also analyzed the test data on frequency domain with consideration of time effect. In time-frequency domain, we can identify the time zone in which the dynamic soil pressure and displacement showed different responses. In low frequency band, distribution of dynamic soil pressure was influenced significantly by acceleration. The influenced time band was on the former part of the whole vibration period. Furthermore, with increase of peak acceleration, the influenced time band became narrow gradually (Fig.4). Similar phenomena were observed on the displacement.

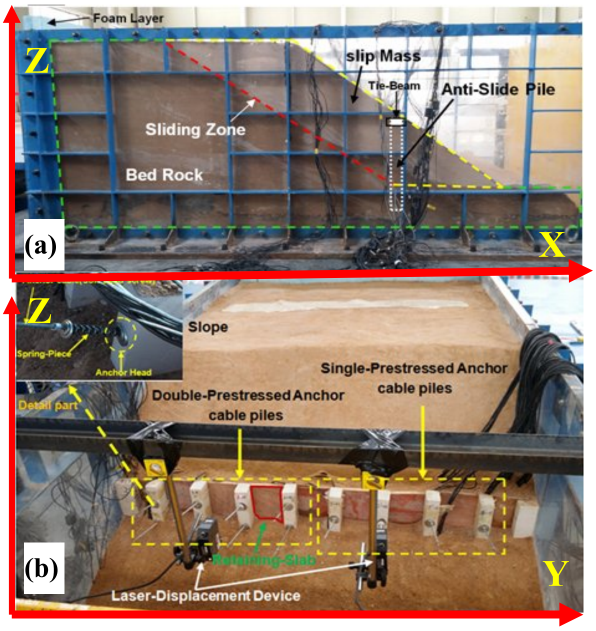

Fig.1 installation of slope with stabilizing structures model before shaking (a) cross-section scheme of constrained anti-slide piles model (b) planar scheme of prestressed anchor slab-pile wall

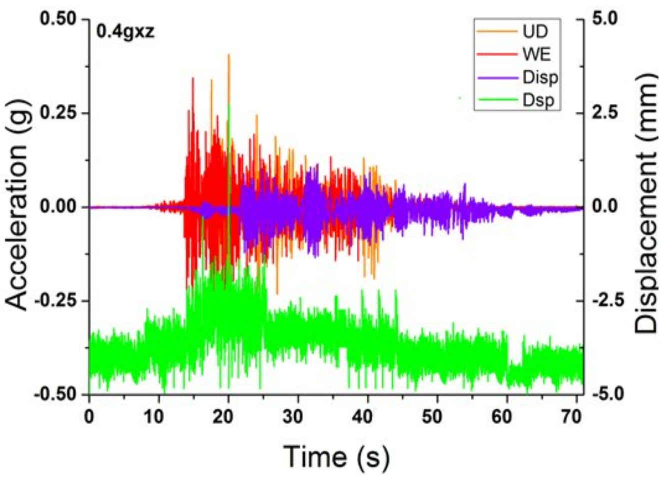

Fig.2 Relationship of dynamic soil pressure(01)(green) and displacement (purple) with input acceleration(red and orange) on time domain(Time-history curve)

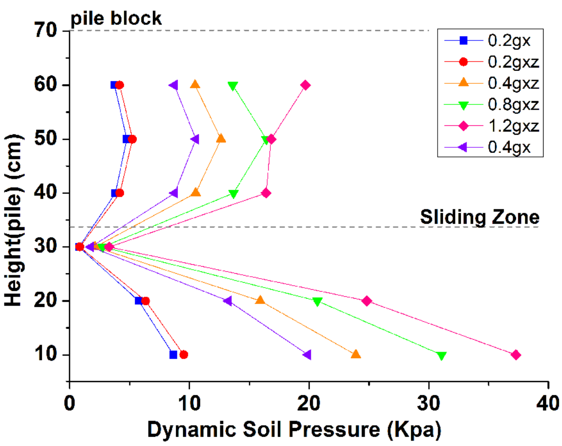

Fig.3 Distribution of dynamic soil pressure(01) of prestressed anchor slab-pile wall model along pile back in different vibration condition

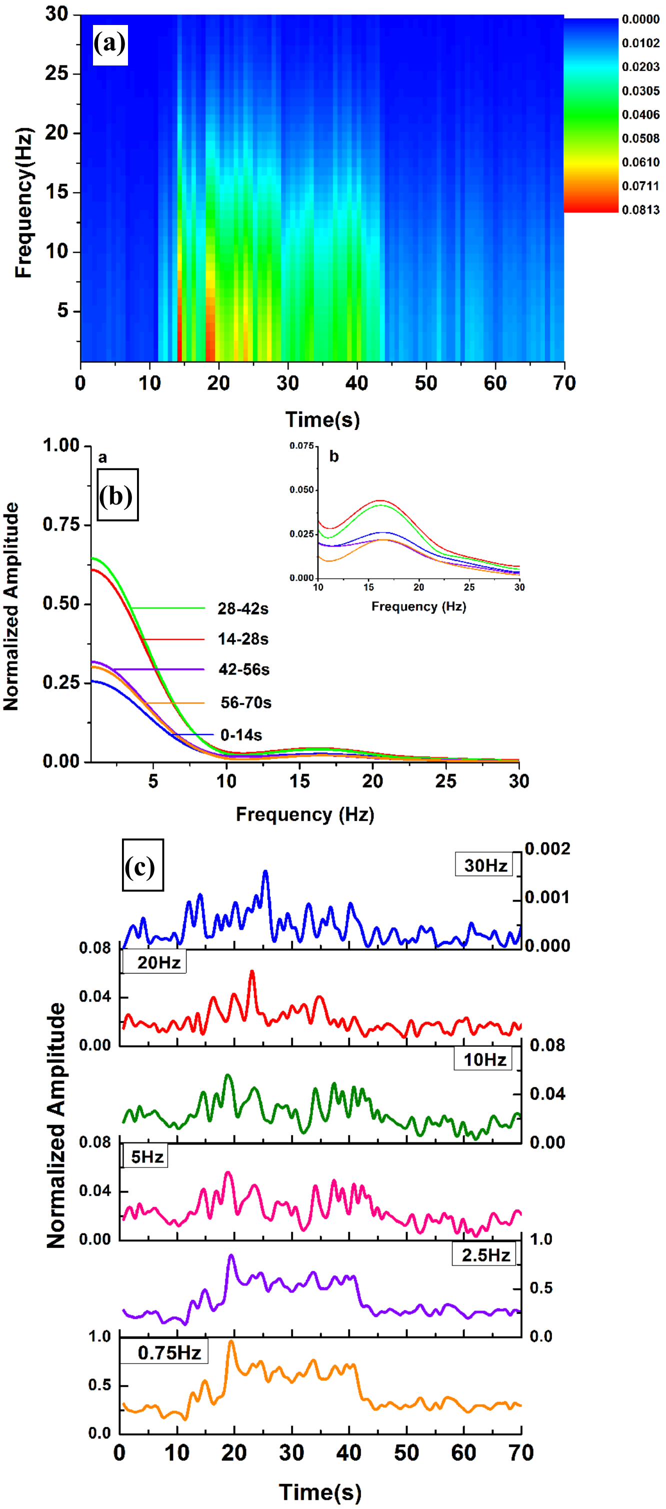

Fig.4 Distribution of dynamic soil pressure in Time -Frequency domain (a) amplitude of the frequency belong dynamic soil pressure(01) (b) distribution on average amplitude of Frequencies in time bands (c) variation of typical frequencies in time- duration.