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Observation of the seismic slope behaviors in large-scale shaking table test

Meei-Ling LIN (1) and **Kuo-Lung WANG** (2)

(1) Department of Civil Engineering, National Taiwan University, Taipei, Taiwan (linml@ntu.edu.tw / Fax: +886-2-23626281 / Phone: +886-2-23626281); (2) Department of Civil Engineering, National Taiwan University, Taipei, Taiwan (d90521009@ntu.edu.tw / Fax: +886-2-23656444)

The seismic slope model test is usually performed using centrifuge modeling and shaking table test. Centrifuge model uses centrifuge acceleration as principal simulation law for prototype slope. The shaking table test requires different law of similarity because the test is based on same gravity force. The shaking table test had been conducted in this research and the dynamic law of similitude was applied.

Four slope specimens were prepared and shaking table test was conducted. The boundary effects were checked and verified before test. The height of slope is 50cm and the prototype slope to be simulated is 10m height. Two specimen preparation methods – compaction and pluviation are used to prepare specimen for different conditions and density. The total weight of specimens ranges from 5.8 ton to 6.8 ton. Results of shaking table test show that the slope maintained stable when input acceleration is less than critical acceleration. The amplification effect increases with depth of soil layer. The failure of slope was initiated when acceleration reached critical acceleration, which varied from 0.3g to 0.6g in the four specimens. The observed initiation of critical acceleration was consistent with the critical acceleration determined using the pseudo-static analysis. However, the magnitude of vertical acceleration observed in shaking table test is larger than pseudo-static analysis for the condition of progressive failure. The vertical acceleration has been applied in specimen 4 to discuss its effect. The result indicates that the failure in the specimen with vertical acceleration initiates at lower horizontal acceleration than specimens without vertical acceleration. Moreover, the failure depth of specimen 4 is deeper than other specimens.

The test results indicate that the movements of slopes are different for different specimens, and are typically close to the face of slope. Although the location of failure surface are difficult to determine, the final profile of specimen coincidences well with the shear surface determined based on the maximum shear strain in the numerical simulation. Dynamic soil parameters obtained using Hardin&Drnevich(1972) can properly simulate seismic slope behavior within linear elastic range. But the effect of degradation and non-linear dynamic behavior should be considered when strain increases in the slope specimen.