C08

Rainfall-induced sliding in 2-layered soil slope models

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1. INTROUDCUTION

Rainfall-induced landslides pose significant hazards in many parts of the world especially in the mountainous areas in a rainy environment, due to their highly frequent occurrences. By now, great effort has been devoted to the study of initiation, motion and deposition of rainfall-induced landslides with emphases on the pore pressure generation and dissipation, basing on the field studies and experimental works. Nevertheless, the understanding on rainfall-induced landslide is as yet limited. Especially, those failure phenomena of loose slopes with different soil strata have been less studied. Therefore, using a flume, a series of tests has been carried out to trigger rainfall-induced-landslides within different soil layers (contrast). Basing on the monitoring of pore pressure and soil displacement as well as the observed failure modes, the effects of soil contrast was examined.

2. FLUME TESTS

The flume used for the tests is 3m long, 25cm wide and 45cm deep. The soil slope has length 100cm, the depth of the double layered sample is 11.5 cm, the 1 layered slope is 12 cm. There were conducted tests where for upper layer was always used silica sand Si8 (γ = 1000kg/m3), and Si6 (γ = 1090 kg/m3), Si7 (γ = 1090 kg/m3) and Si8 used for the upper layer. The flume was raised to slope 25 degrees. Artificial rain of 200 mm/h was applied. 4 pore-water pressure and 2 displacement transducers were used for measuring the pore-water pressure (PWP) and the movement of the upper and lower layers. Markers, positioned next to the transparent wall of the flume, allowed determining the position and shape of the sliding surface. A digital camera and a video camera were used for taking records of the sliding.

3. RESULTS

Changing the lower layer affected dramatically the PWP generation, the sliding mode, the sliding-block formation and morphology, also the speed of the motion. In all the tests the initiation of the sliding started almost the same time since the start of the tests (at about 12th minute). The pore water pressure measured at the bottom reached highest value when lower layer was Si7, and it dropped in the test of one-layer slope. In the tests with Si6 the pore water pressure rose gradually and didn't reach high value. In each test retrogressive collapsing of the slope was observed. In the case of the one-layered slope the sliding surface was always touching the bottom and the displacement transducers were involved in movement simultaneously. The formation of cracks on the surface was 10 to 15 cm from the rim long before the blocks were tearing off from the main body of the slope. There was not observed liquefaction during block formation. In the case of Si7 the inclination of the markers in their tops the graphs of the displacement evidenced the sliding of the upper layer over the basal one. When Si6 was the bottom layer, its collapsing was leading to formation of blocks comprising both layers which were gradually deforming and flowing down in a liquefied appearance. The cracks formed close to the rim, and were not very well distinctive due to intensive liquefaction of the upper layer and quick movement. Because of the domination of vertical settling of small blocks the horizontal displacement transducer in the middle showed small and the bottom one no change.

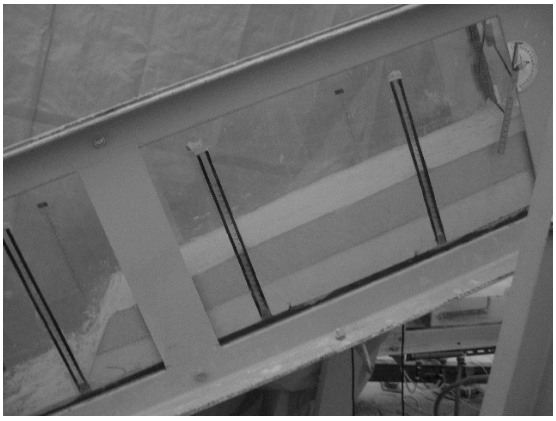

Fig. 1. Flume test – a slope put in motion under intensive rain

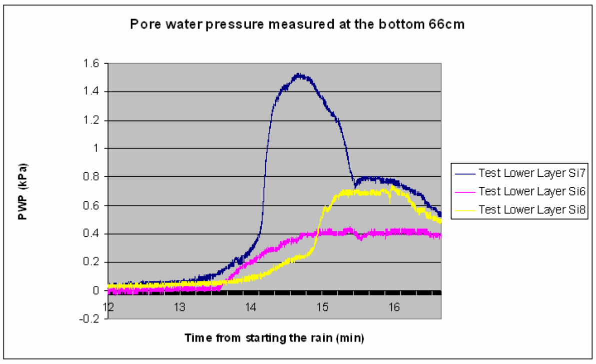

Fig. 2. Pore water pressure at bottom position 66cm