ABSTRACT

The dynamic behavior of unreinforced and nailed soil slopes with and without facing wall was studied in the laboratory shaking table tests. The crest acceleration, deformation of the slope, failure pattern, and variation of forces in the nails during the cyclic loadings were monitored. Medium grained local sand (Kansai River sand) with 3% water content was used in the study. The 0.15 m, 0.18 m and 0.21 m high unreinforced slope models at 30^0, 35^0 and 40^0 slope angles were initially considered. In the second phase of the program, 30^0, 35^0 and 40^0 reinforced slopes with a constant slope height of 0.18 m were tested. Each slope was reinforced with six numbers of hollow aluminum nails arranged in two rows. The nails at three different inclinations were studied to quantify the effect of nail inclination. In the next phase, two 0.18 m high, steep reinforced slopes at 60^0 and 70^0 slope angles with and without nails along with facing walls were studied. The steep slopes were reinforced with nine nails arranged in three rows. The failure surfaces observed in the shaking table tests for all the cases were shallow and of rotational type. The cracks observed at the crest were more prominent and more in numbers for the nailed slopes. The cracks were less prominent and less in number with the increase in slope angle and slope height. The induced nail force varied nonlinearly with respect to loading cycles. The nails oriented in horizontal direction were found to be more efficient. The nail forces and amplification of motion increased with the increase in slope angle and slope height. The amplitude of acceleration toward the outward slope direction was found to be larger than that toward the inward direction for all the cases. Numerical simulation of all the soil slopes, tested in the laboratory, was performed by a large strain finite difference program called FLAC. The numerical analyses did not show any prominent failure surface. It also did not predict the slumping of the material at the toe of the slopes. However, the crest settlement and separation of the facing wall from the soil were modeled reasonably well.

Keywords: Dynamic behavior; shaking table test; reinforced soil slope; acceleration response; FLAC.