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DYNAMIC RESPONSE OF 2×2 PILE GROUPS TO SOIL LIQUEFACTION IN INCLINED BASE LAYER: 1G SHAKE TABLE TESTS

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Behavior of piles subjected to soil liquefaction has not been fully understood because of many parameters affecting on soil-pile interaction. In this paper, dynamic soil-pile interaction of a 2×2 pile groups was studied. Physical modeling test was conducted employing similitude law (Iai, 1989 and Iai et al., 2005) and Sharif University of Technology shake table facilities. SUT shake table is a 4 × 4 m, 3DOFs facility, capable of taking models of up to 300 kN. A laminar shear box (Figure 1) with inner dimensions of 306 cm in length, 172 cm in width and 180 cm in height was designed and constructed at SUT. Two separate 2×2 pile groups (one with and another without lump mass) were installed in model (Figure 2) to investigate the effects of superstructure (mass) on pile group behavior. The model of soil layers consists of a level ground liquefiable layer over a non-liquefiable layer. The model was shaken with a sinusoidal base acceleration having a frequency of 3 Hz and amplitude of 0.3 g and parallel to the ground slope. The piles and the soil at near and far fields are fully instrumented to measure various parameters during and after shakings. The results including acceleration and pore water pressures in various elevations of the soil, free field soil displacement and bending moment of some piles are presented and discussed. Moreover, one physical model test was conducted without soil to investigate the effects of existence of unliquefiable and liquefiable layers on dynamic response of piles. The results show that existence of the liquefied soil did not have significant effect on the time history of the acceleration of the pile cap (Figure 3), but increased the amplitude of pile cap displacement by an order of 10 (Figure 4).

Figure 1. Laminar shear box used in this research.

Figure 2. Top view of the physical model.

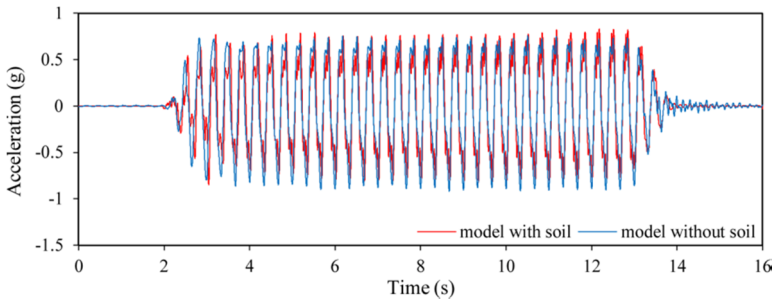

Figure 3. Time histories of pile cap acceleration for models with and without soil.

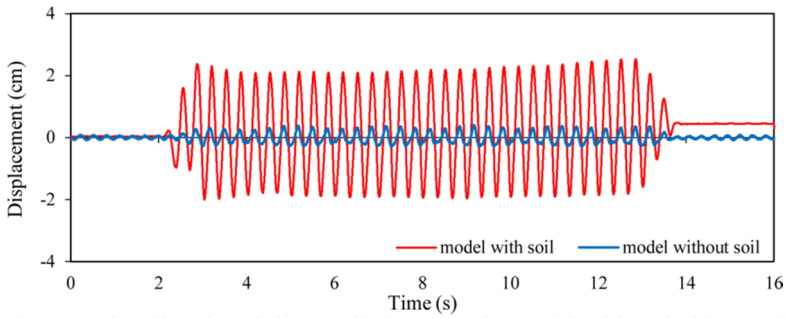

Figure 4. Time histories of pile cap displacement for models with and without soil.

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