THE EFFECT OF SOIL PERMEABILITY ON THE LIQUEFACTION BEHAVIOR OF SAND SUBJECTED TO CYCLIC LOADING

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In this paper numerical procedures have been implemented to investigate the influence of soil permeability on the liquefaction potential of sandy soils using the Finite Element software OpenSees (Mazzoni et al., 2006). The numerical 2D-model has consisted of 10 m column of sand which can be capable of moving horizontally and vertically and restrained at the base in every direction that is subjected to cyclic load. Besides, to consider the effect of the amplitude and number of cycles of sinusoidal cyclic loads various cases of them have been applied in diffrent models . The pore fluid-stress coupled analysis has been performed in three steps as follows:

Step 1: An elastic analysis was done to consider the soil weight

Step 2: This step contains a plastic analysis while the applied load is what was considered step 1

Step 3: The plastic analysis is done in this step, however, another load in the form of sinusoidial cyclic is applied

The main effect of high permeability in soils is dessipating of excess pore pressure in a shorter time when compared to that of the low permeability cases. Figure 1 shows that in the soil with k=5e-3 the excess pore pressure is less than soils with k=5e-4, k=5e-6, also, it will be dissipated in a shorter time.

This issue cause the soil with higher permeability coefficent to be less susceptible to liquefaction.

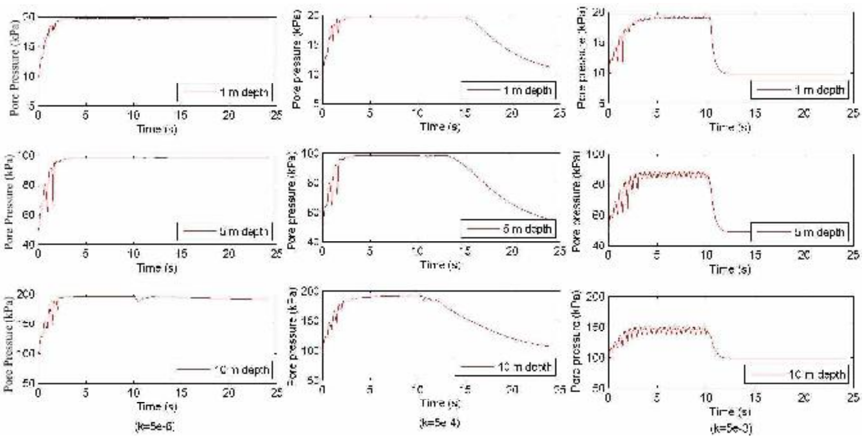

Figure 1. Excess pore pressure dissipation for different soil permeability at different depth

Shear stress and strain changes through cyclic loading process were examined for various soil depths in different permeability features. As shown in Figure 2, in this soil subjected to an identical cyclic sinusoidal load liquefaction occurs just at 2m depth. Although, the soil's permeability is more than other soils (k=5e-3) and as represented in Figure 1, excess pore pressure dissipates in the shoter time, liquefaction could take place (Kramer and Elgamal, 2001).

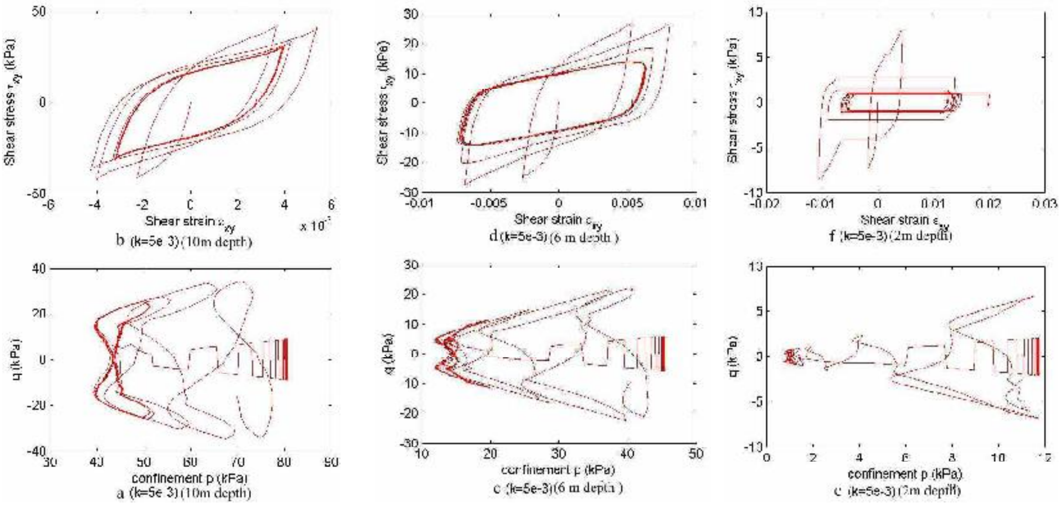

Figure 2. Confinement p VS. deviatoric stress q at (a) 10m depth (c) 6m depth (e) 2m depth shear stress $\tau_{x\,y}$ VS. shear strain $\varepsilon_{x\,y}$ at (b) 10m depth (d) 6m depth (f) 2m depth

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