

Numerical Evaluation of Deep Ground Settlement Induced by Groundwater Changes During Pumping and Recovery Test in Shanghai

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Abstract : The hydrogeological parameters of the engineering site and the hydraulic connection between the aquifers can be obtained by the pumping test. Through the recovery test, the characteristics of water level recovery and the law of surface subsidence recovery can be understood. The above two tests can provide the basis for subsequent engineering design. At present, the deformation of deep soil caused by pumping tests is often neglected. However, some studies have shown that the maximum settlement subject to groundwater drawdown is not necessarily on the surface but in the deep soil. In addition, the law of settlement recovery of each soil layer subject to water level recovery is not clear. If the deformation-sensitive structure is deep in the test site, safety accidents may occur. In this study, the pumping test and recovery test of a confined aquifer in Shanghai are introduced. The law of measured groundwater changes and surface subsidence are analyzed. In addition, the fluid-solid coupling model was established by ABAQUS based on the Biot consolidation theory. The models are verified by comparing the computed and measured results. Further, the variation law of water level and the deformation law of deep soil during pumping and recovery tests under different site conditions and different times and spaces are discussed through the above model. It is found that the maximum soil settlement caused by pumping in a confined aquifer is related to the permeability of the overlying aquitard and pumping time. There is a lag between soil deformation and groundwater changes, and the recovery rate of settlement deformation of each soil layer caused by the rise of water level is different. Finally, some possible research directions are proposed to provide new ideas for academic research in this field.

Keywords : coupled hydro-mechanical analysis, deep ground settlement, numerical simulation, pumping test, recovery test

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