



Experimental technique for visualization of aquitard compaction over aquifer caused by excess pumping

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Transparent soils are developed as a physical modelling of macroscopic soil behaviors in geotechnical engineering aspect. Transparent surrogates with its index-matching fluid, called as transparent porous media or transparent soils, have been used for simulating geotechnical properties of natural soils. Visualization technique itself have been applied to microscopic level of soil deformation and soil flow problems such as X-ray, Computerized Tomography (CT), and Magnetic Resonance Imaging (MRI) cameras by very expensive apparatuses with highly operating skills. Geotechnical researches need rather understanding of macroscopic scale of larger test models with inexpensive experimental industrial substances. Transparent soils have been developed to achieve these needs with easy handling performance.

The authors demonstrated a pumping test in a glass tank of 30mm width by 80mm length by 70mm height filled with transparent hydrated superabsorbent polymer to represent aquitard (clay layer) over aquifer (saturated silica sand). The subsidence within the synthetic clay layer due to pumping of pore water from silica sand was constantly monitored by target racking method using four 8mm-diameter particles immersed in the synthetic clay layer. The test successfully visualized deformation due to vertical propagation of pore water pressure during subsidence event within the transparent synthetic clay layer. It was also found that this experiment result and the results from three-dimensional numerical simulation of poroelastic deformation were consistent with each other.

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