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Deformation analysis and prediction of bank protection structure with river level fluctuations

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Bank structure is an important barrier to maintain the safety of the embankment. The deformation of bank protection structure is not only affected by soil pressure caused by the excavation of the riverway, but also by the water pressure caused river water level fluctuations. Thus, it is necessary to establish a coupled soil-water model to analyze the deformation of bank structure. Based on Druck-Prager failure criteria and groundwater seepage theory, a numerical model of bank protection structure with consideration of the pore water pressure of soil mass is established. According to the measured river level data with seasonal fluctuating, numerical analysis of the deformation of bank protection structure is implemented. The simulation results show that the river water level fluctuation has clear influence on the maximum lateral displacement of the pile. Meanwhile, the distribution of plastic zone is related to the depth of groundwater level. Finally, according to the river water level data of the recent ten years, we analyze the deformation of the bank structure under extreme river level. The result shows that, compared with the scenario of extreme high river level, the horizontal displacement of bank protection structure is larger (up to 65mm) under extreme low river level, which is a potential risk to the embankment.

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