Numerical simulation of bank protection structure deformation effected by the river level fluctuations

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Introduction: In this Study, a bank protection structure at Yangtze River bank in Nanjing section is taken as an example and a 2D water-soil coupling model is established, in which the influence of water level fluctuation on groundwater seepage and soil shear strength is considered.

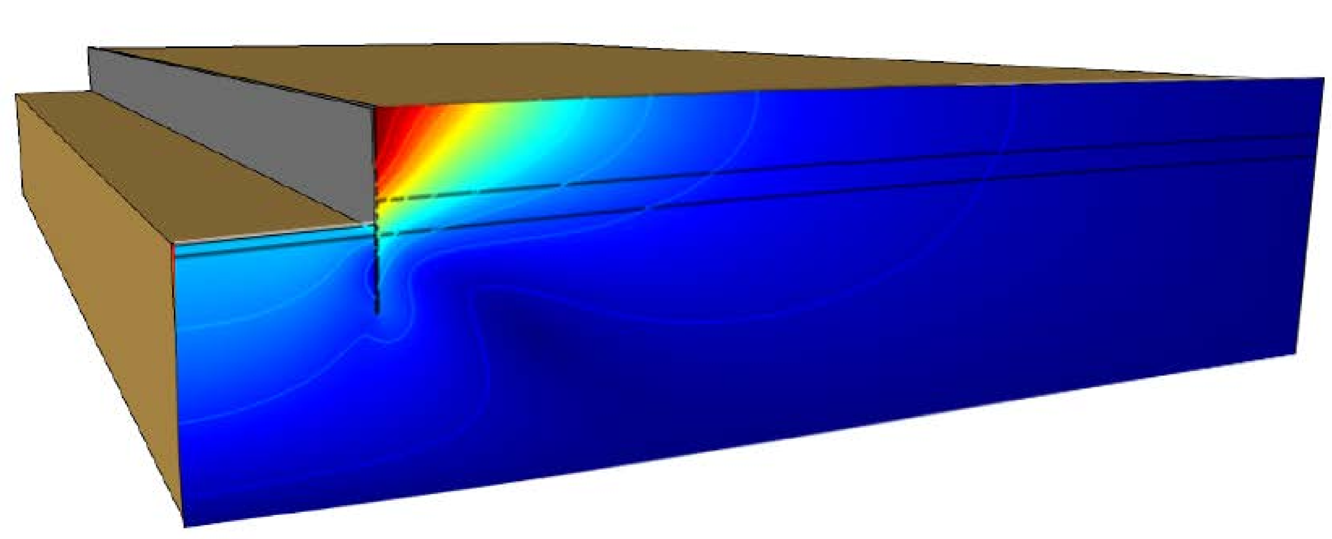


Figure 1. Schematic diagram of bank protection structure

Computational Methods: The deformation of bank protection structure is not only affected by the inner earth pressure, but also by the hydrostatic pressure caused by the fluctuation of river water level. This fluctuation leads to the changes of soil seepage field and groundwater level and therefore affects the soil mechanical properties. In this case, a section vertical to the pile wall is selected to establish the geometric model.

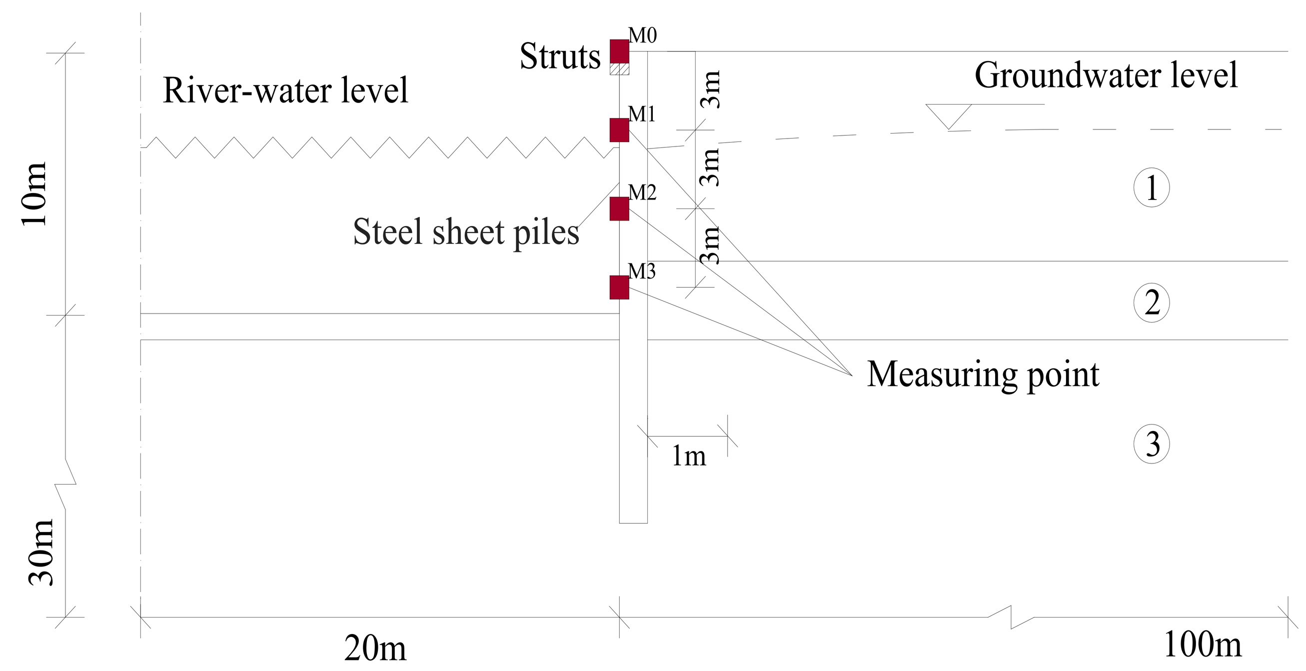
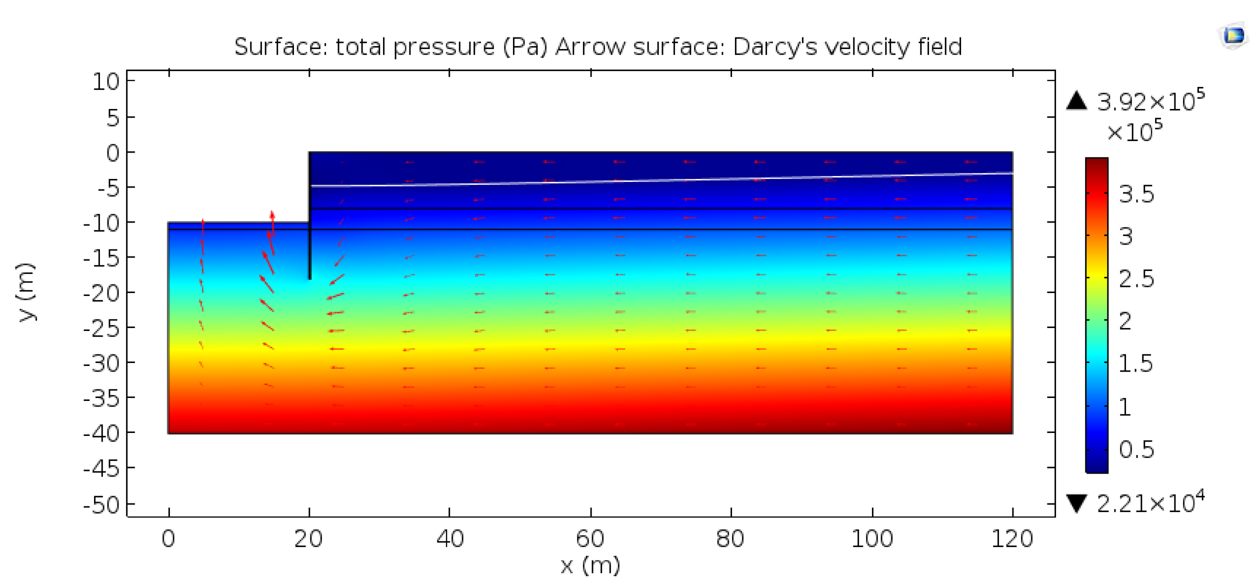


Figure 2. Model geometry and boundary condition

Results: The result of one scenario (river water level at -6m) shows the distribution of total pressure field, the displacement and plastic deformation of the structure. Based on this model, we pridicted the deformation of the structure under different water level, even in extreme cases.



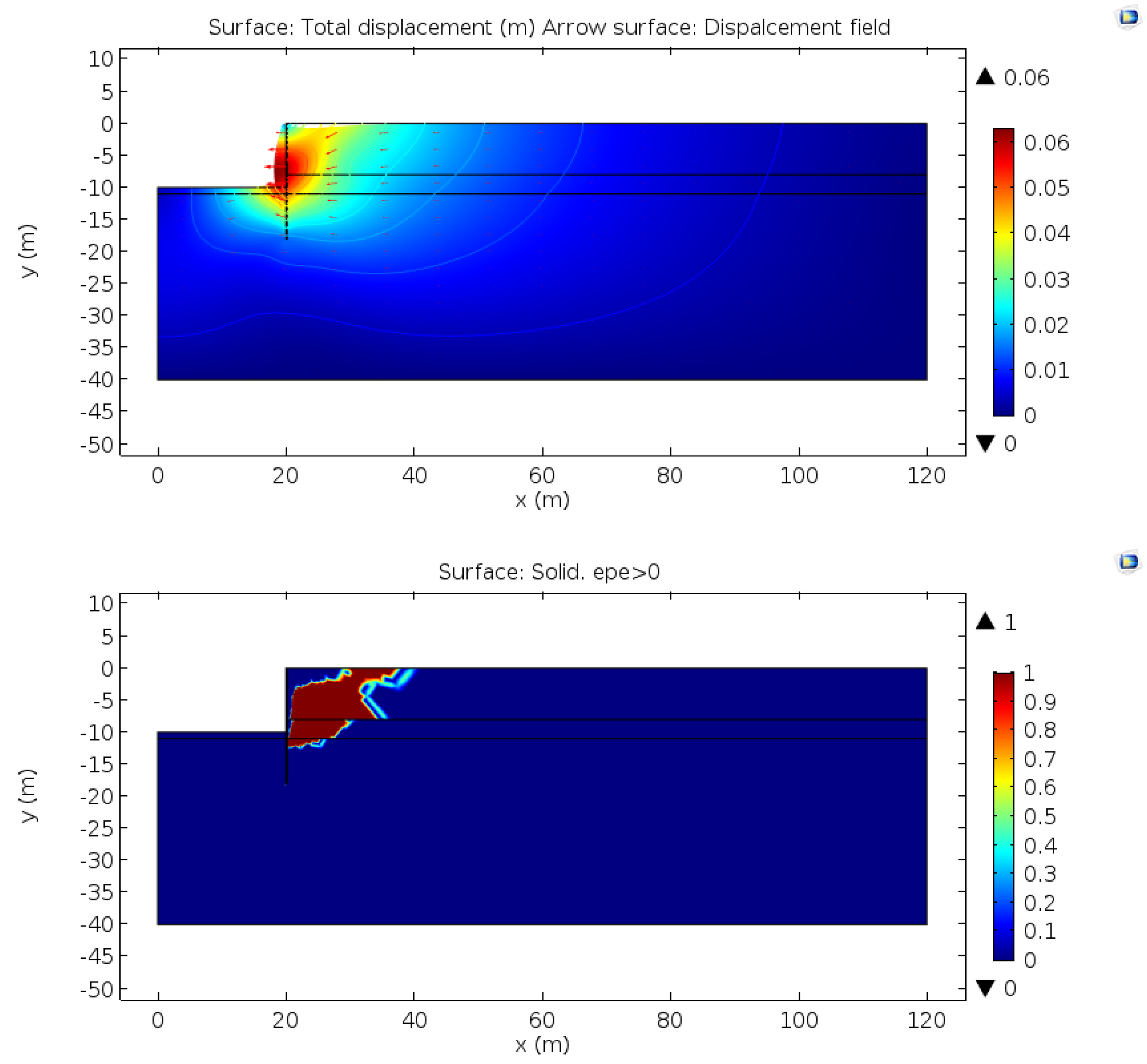


Figure 3. The total pressure and deformation of the structure at the river level of -6m

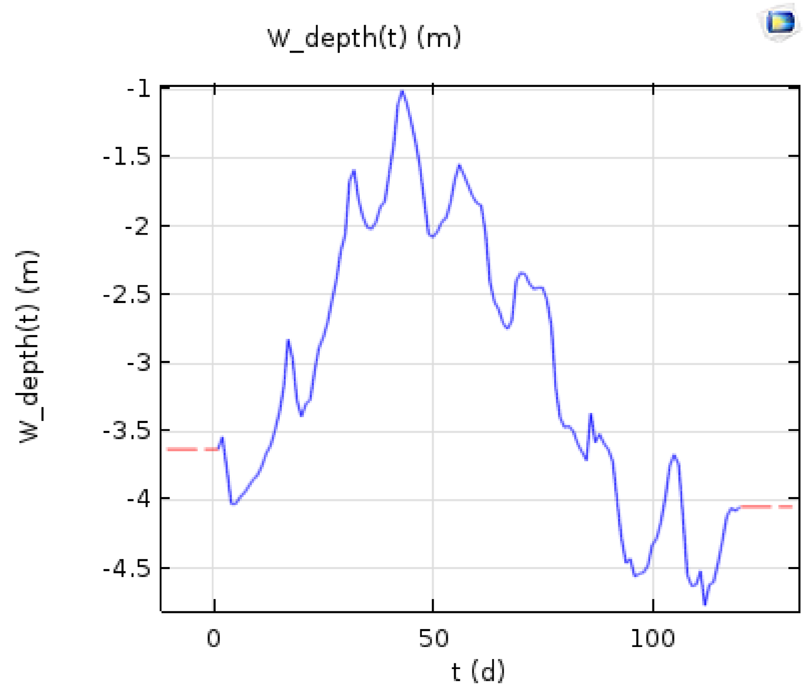


Figure 4. Monitoring data of water level

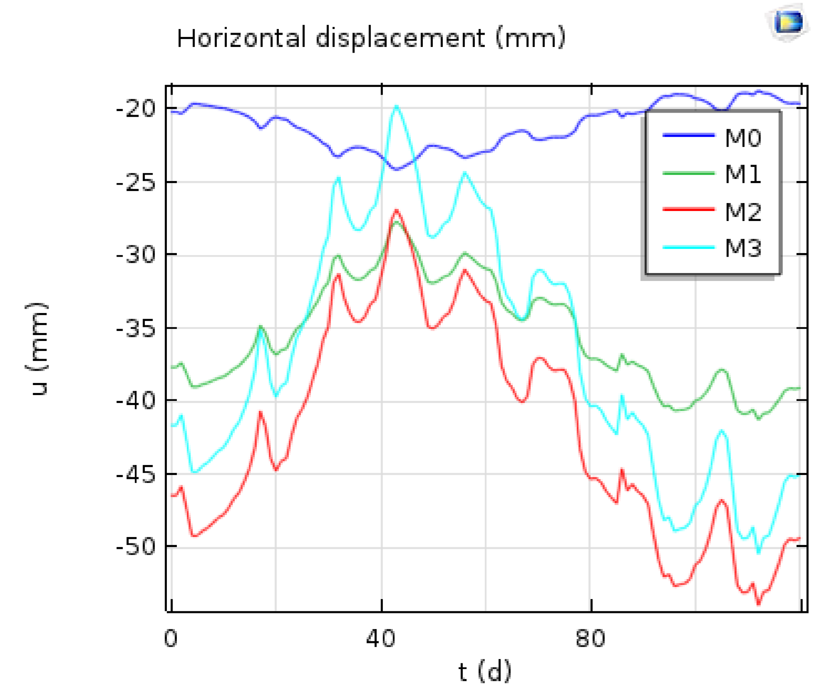


Figure 5. The u(t) curve

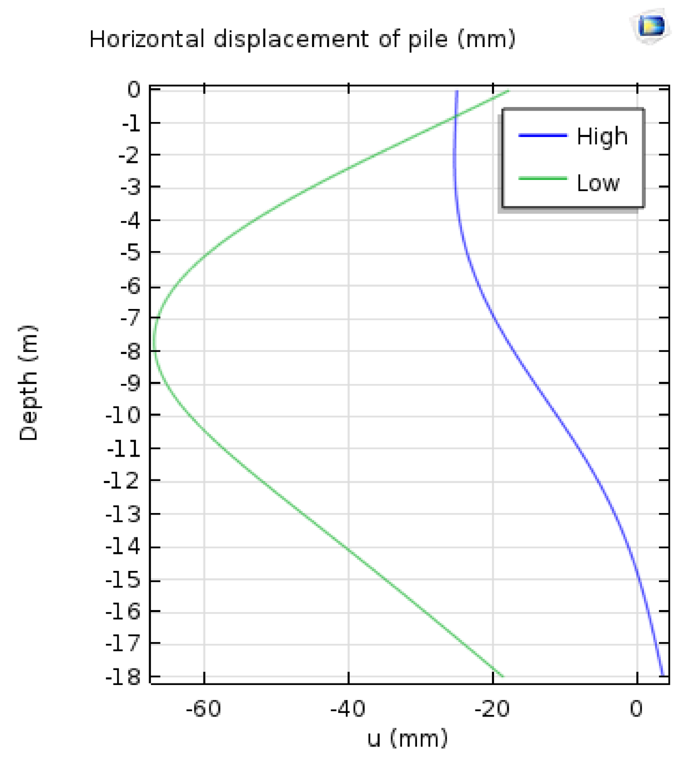


Figure 6. The u(h) of pile in extreme case

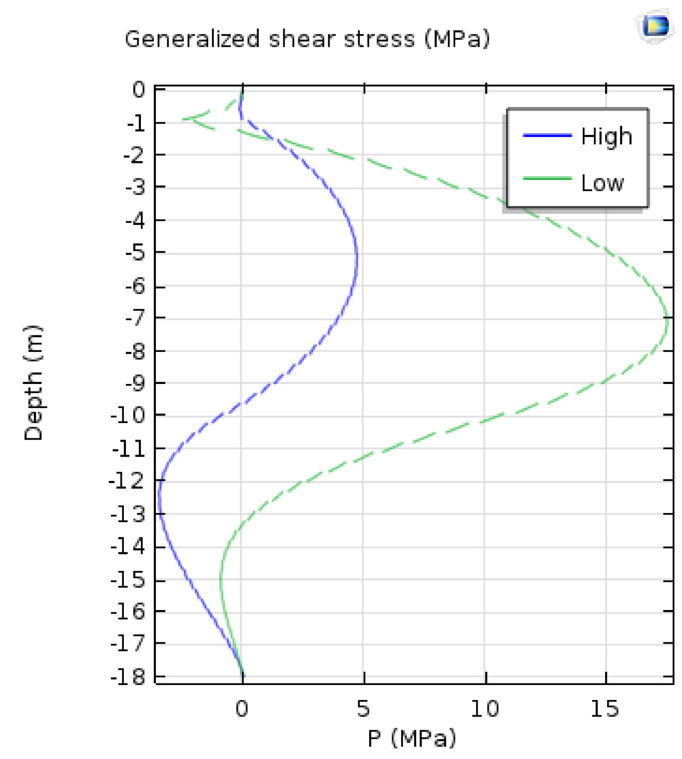


Figure 7. The P(h) of pile in extreme case

Conclusions: The results show that the river water level fluctuation has clear influence on the deformation of the this structure. For further study, we will validate and develop this model by comparing the results with long-term in-situ measured value in order to provide useful suggestions for engineering design.

References:

1. A. Spetz, Assessment of finite element softwares for geotechnical calculations, Master thesis, (2012)
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