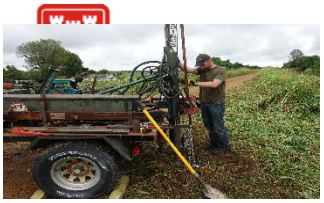
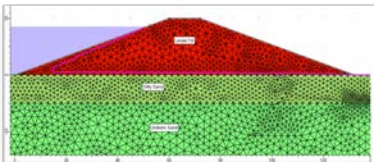


DEVELOPMENT OF BEST PRACTICES FOR TRANSIENT SEEPAGE ANALYSIS

Need



Generic levee for sensitivity analysis

The mechanics of transient seepage have been well understood for nearly three decades. Numerical models (both two-dimensional and three-dimensional) have been developed that can model transient seepage, including both water and air phase dynamics, hysteresis due to interface dynamics, and compressibility of the porous matrix. However, due to the lack of full-scale validation of the results of transient seepage on embankment dams and levees, practicing engineers do not explicitly trust the results provided by numerical transient solutions. Furthermore, geotechnical practice typically decouples seepage modeling from stability modeling. However, seepage and soil mechanics are coupled processes; changing pore pressures influences strength and deformation, which in turn influence the pore pressures due to volumetric changes in the soil structure.

Approach

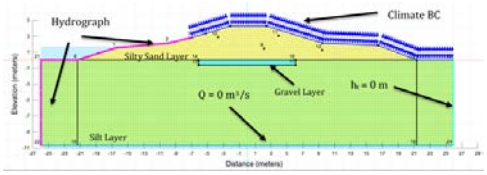
The objectives of this research project will be accomplished through field instrumentation, laboratory work, and numerical studies. Levee sections in Buck Chute, MS, Qwuloolt, WA, Cairo, IL, and Vicksburg, MS, were instrumented and a detailed site characterization will be conducted through additional borings, cone penetrometer tests, near-surface geophysics, and laboratory soils testing. Matric suctions and water content will be measured using state-of-the-practice instrumentation, as well as weather data. This will allow a better determination of the initial conditions of the levees prior to and during a flood event. Numerical assessment of the instrumented sites will provide validation of current modeling practice. Fully-coupled seepage and stability solutions will be developed and implemented on the instrumented levee sections to evaluate the associated error with performing a decoupled seepage stability analysis. This information will provide guidance on when and where transient seepage affects the solution enough for the additional effort to be warranted.

Outcomes

This research will provide software tools to assess the importance of unsaturated hydraulic properties and the variability associated with them. This will provide the practitioner with the tools necessary to bracket a range of realistic solutions for assessments of the dams and levees. Analyses and calibration of the instrumented levees will provide a resource for numerical model validation. The final product will be a best practices report defined through a series of both laboratory tests and field instrumentation output.

Weather station at Qwuloolt levee, WA

Installed field instrumentation on levee in Cairo, IL



2D Seepage Model on Qwuloolt Levee, Marysville, WA

Point of Contact

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For more information on FRM R&D, see the ERDC FRM wiki:
https://wiki.erdc.dren.mil/Transinet_Seepage