

Dam&DikeCare – Experimental Characterization and Numerical Modelling of Breach Processes in Earth Dams and Dikes

Summary

The project objectives include the development of an integrated conceptual model for the failure of dams and dykes, including hydrodynamic and geotechnical phenomena, and a new generation of 3D tools for numerical simulation of fluid-sediment mixtures. To achieve these objectives, the work plan articulates theoretical, laboratory and computational activities. The main innovations proposed include: i) the implementation of a realistic geotechnical behaviour conferred by a careful choice of materials for the body of the embankments, namely with both types of soil, granular and clayey, respectively, without and with cohesion; ii) the use of innovative instrumentation and advanced visualization and measurement techniques, namely, which allow the detailed and non-intrusive characterization of various quantities (e.g. velocity field in the approach of failure, temporal evolution of the breach and erosive processes of the slope downstream); iii) the development of a numerical tool to predict the temporal evolution of the breccia geometry, combining a 3D geotechnical module without mesh and a 2D

hydrodynamic module, thus creating a hybrid model for simulating the evolution of the breach and the failure hydrograph.

The project is based on five tasks: Task 1, which consists of developing a conceptual model for the calculation of discharge in landfills following overtopping, covering both geotechnical and hydrodynamic phenomena of failure; Tasks 2 and 3, which are based on a laboratory basis, in which data are collected for the empirical characterization of hydraulic and geotechnical phenomena (Figure 1), that is, of the velocity fields close to the breach and the effluent flows from the rupture, as well as the erosion/deposition processes soil, with the respective characterization of all geotechnical instability phenomena (detachment of soil masses from the dam body for the flow, due to slope instability); and Task 4, of a computational nature, in which the numerical model of fluid-sediment mixtures is developed (Figure 2). Task 5 aims to disseminate and transfer know-how acquired during the Project, having organized 2 workshops and 1 seminar.



Figure 1. Breaching of overtopped dams. Left: physical model; right: fixed bed model to investigate hydrodynamic processes.

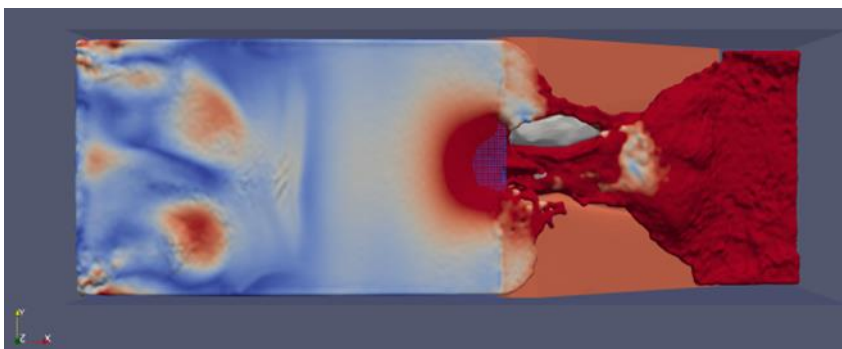


Figure 2. Numerical model in Smooth Particle Hydrodynamics (SPH) of a breaching model dam.

D2CARE

Project Reference

PTDC/ECI-EGC/31618/2017

Leading Institution

LNEC – National Laboratory for Civil Engineering (Portugal)

Partners

IST-ID – Associação do Instituto Superior Técnico para a Investigação e Desenvolvimento (Portugal)

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CERIS

153 642.34€

Project Website

http://groups.ist.utl.pt/hydroevent/s/?page_id=338