LABORATÓRIO NACIONAL DE ENGENHARIA CIVIL

TESTING and METROLOGY

UMEHIF

River and Hydraulic Structures Physical Model Laboratory

HYDRAULICS AND ENVIRONMENT DEPARTMENT

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Scope

The Hydraulic and River Structure Models Laboratory (UMEHIF) is a LNEC-EM laboratory integrated in the hydraulics and Environment Department/Water Resources and Hydraulic Structures Unit of LNEC. It develops research and technology based on experimentation and physical modelling. It also provides advanced technical expertise with a view to obtain sustainable solutions for specific flow problems in rivers, aquifers and hydraulic structures.

UMEHIF has two testing halls with an area of 5000 m2, which are supplied by hydraulic circuits with a capacity up to 1000 l/s. It is also equipped with high precision equipment for measuring physical magnitudes applied to hydraulics. UMEHIF consists of physical models of hydraulic structures (spillways, intakes, hydraulic circuits, etc.) and ten experimental facilities/flumes.

UMEHIF has led to the development of more than 200 studies on physical models of hydraulic structures, including those corresponding to almost all large Portuguese dams, as well as for infrastructures in Europe, Asia, Africa and America. These studies have led to the definition of alternatives for the design, which present a better hydraulic performance or result in greater economy in the construction of the project, by simultaneously promoting the safety of infrastructures and populations. The experimental channels have led to the development of applied research, by addressing specific flow problems in rivers, aquifers and hydraulic structures, which eventually resulted in countless PhD theses and Master's dissertations.

Field of expertise

UMEHIF carries out its activity on experimental channels and small scale physical models, by developing different types of laboratory tests, with the following purposes:

- Characterisation of flows in rivers, aquifers and hydraulic structures;
- Research and development of technology applied to the physical and experimental modelling of hydraulic structures such as spillways and orifice spillways, stilling basins, intakes and hydraulic circuits;
- Development of structural solutions for works associated to dams as alternatives to the design ones, promoting the safety and improvement of the hydraulic performance;
- Study of specific aspects of river dynamics (flow in composite and alluvial riverbeds, sedimentation in reservoirs, localised erosions close to bridge piers on alluvial riverbeds and downstream the dams);
- Design of solutions for protection works against erosion and flooding, as well as for the study of river requalification and rehabilitation solutions (fish passes and other measures);
- Characterisation of the flow resulting from embankment failure;
- Validation and calibration of numerical models

Highlights

Lisbon Drainage Master Plan (PGDL) – Hydraulic studies on a scale model (scale 1:30) of the entrance of the tunnel Monsanto-Sta. Apolónia and Chelas-Beato. It was performed with the help of digital construction (Cad3D, 3D printing and CNC machining) considering a modular design. The studies showed that the hydraulic operation of work is appropriate for all the range of flood flows predicted in the base design. It was possible to identify some aspects that could be improved in the construction of the work.

Studies about the failure mechanisms due to overtopping of dams and earth dykes, with the help of physical models for characterisation of hydrodynamic and geotechnical phenomena of the evolution of the breach. The studies are aimed to produce a tool for risk management of the failure of dams and earth dykes with a view to increase the present capacity to reliably predict the formation of breaches and hence contributing to the safety of people and goods.

LNEC support to promoters of hydraulic projects at national and international level (Eletricidade de Portugal, Hidroelectrica de Cahora Bassa, etc.):

- Physical models of spilways (*Picote, Sabor, Salamonde, Tua, Fridão, Caniçada*);
- Study about the navigability of the junctions of rivers Tua and Douro and analysis of the rockfill apron downstream the Crestuma dam.
- Physical and numerical model of the spillway of Cahora Bassa and Moamba Major dams, Mozambique;
- Studies on a physical and numerical model of the spillways of Fierza dam, Albania.