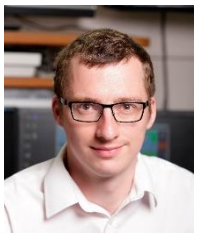
Centrifuge modelling techniques for investigating river embankments behaviour under steady-state and transient seepage conditions

River floods rank among the most significant natural hazards in Europe, causing substantial economic and human losses and are frequently due to severe damages endured by water retaining earthworks under extreme weather events. In this framework, a reliable assessment of the existing river embankments stability conditions for serviceability and limit states of operations, represents a key aspect to enhance the resilience of these critical infrastructures. Addressing this challenge requires the estimation of the actual pore water pressure distribution within the earthfill and acknowledging the role of river stage fluctuations on the groundwater seepage process and stability of the earthworks. Nevertheless, current engineering practice frequently disregards these aspects, leading to erroneous conclusions on the safety margins against potential slope instability and overall collapses. This webinar concerns a series of centrifuge tests carried out on a river embankment model, reconstructed with natural silty sand, subjected to simulated flood events. The experiments have been conducted at the Schofield Centre of the University of Cambridge, UK, as part of the '*RES FLUCTIS*' project, funded by the European Union's Horizon 2020 - GEOLAB programme, and aim at investigating the hydro-mechanical behaviour and the potential failure mechanisms induced by both stationary and time-dependent hydraulic boundary conditions. The presentation will specifically focus on technical aspects related to the model preparation technique, experimental setup, and preliminary findings from the centrifuge tests.

The Speakers



Dr. Sam. Stanier, NRFIS, University of Cambridge

Sam Stanier is currently a University Associate Professor in Civil Engineering at the University of Cambridge. He was awarded a Ph.D. in Geotechnical Engineering in 2011 by the University of Sheffield, UK, and subsequently spent 7 years at the University of Western Australia before returning to the UK in 2018. He has research interests that span experimental, analytical and numerical modelling of offshore geotechnical problems. Dr Stanier's current focus is on developing experimental methods to assess the validity of – and calibrate – strain-softening-hardening constitutive models for soils using image-based deformation measurement techniques.

Mr. Kristian Pether, Schofield Centre, University of Cambridge

Kristian Pether has been a technician at the Schofield Centre since 2003 and a technician within the Department of Engineering since 1996. Bringing a wealth of experience to centrifuge modelling operation in Cambridge, Kristian has been involved in all wide spectrum of physical modelling developments over the years and brings this experience to the fore during the development of new experimental techniques. His role encompasses experimental planning, equipment development, model creation, centrifuge test operation and post-test sample appraisal.

Dr. Elena Dodaro, DICAM, University of Bologna

Elena Dodaro is a Post-Doc at the University of Bologna, where she earned a Ph.D. in Geotechnical Engineering in 2023, under the supervision of Prof. Guido Gottardi. Her research activity focuses on the experimental and numerical modelling of the stability of river embankments under transient seepage conditions, taking into account partial saturation conditions. She is currently investigating natural-based strategies for the mitigation of backward erosion piping, within the EU project *LIFE 'SandBoil'*. In 2022, she was the PI of GEOLAB transnational *RES FLUCTIS* project.

Mr. Mario Marcolongo, DICAM, University of Bologna

Mario Marcolongo is a technician in the laboratory of DICAM, University of Bologna, supporting teaching and research activities related to Geotechnical and Structural Engineering. He obtained a Master in Geological Sciences in 1999 and subsequently worked as a Marine Geologist at *GAS* on the acquisition and processing of geophysical data, geotechnical analyses and mapping and offshore surveying for the laying of fibre optic cables. He also collaborated with *Spea Autostrade* on the geotechnical monitoring of underground constructions and contributed to the drafting of cartographic work related to the Bologna-Firenze high-speed rail.