

## Research Opportunities in Geotechnical and Hydraulic Engineering

Two **doctoral students** are sought from April/May/June 2010 for a funded research project underway at the Institutes for Geotechnical Engineering (IGT) and for Environmental Engineering (IfU) at ETH Zurich on:

### **Instabilities in alpine Permafrost: Characterisation, Monitoring and Modelling of Active Rock Glaciers**



The research focuses on the geotechnical and hydrological/hydraulic processes leading to instabilities in rock glaciers with an exceptional opportunity to engage in multidisciplinary full scale field characterisation and monitoring followed by modelling of the behaviour.

**ABSTRACT:** The impact of global climate change on sensitive cryogenic regions is an important research area. Temperature changes are critical in cryogenic Alpine systems, and may be accompanied by expectation of increasing hazards to human life and infrastructure through climate change. Rock glaciers and degrading permafrost on steep Alpine slopes are particularly susceptible to melting of massive ground ice, which may lead to initiation of landslides and instabilities due to accelerated and differential motions. Despite recent progress, the links between thermohydrological processes and the evolution of natural hazards are not well understood. This study targets specific knowledge gaps that are essential for improved modelling and predictions related to mountain permafrost. The test site will be a rock glacier, located at Turtmantal (Valais, CH), which shows clear signs of thermal degradation. The research programme includes three main phases, namely (i) characterisation, (ii) monitoring and (iii) modelling. Initially, the internal structure at the test site will be investigated using state-of-the-art and novel geotechnical, geophysical and hydrological methods. Measurements will be conducted at the surface, in boreholes and trenches, as well as on samples in the laboratories. The most important physical parameters will be monitored subsequently using a suitable selection of repeated measurements and continuous monitoring with automated data acquisition systems. All spatio-temporal information gathered through characterisation and from monitoring will be integrated using thermo-hydromechanical modelling approaches. Understanding the response of mountain permafrost to thermal perturbations can only be achieved when the expertise of geotechnical, geophysical and hydromechanical research groups are strongly interlinked.

The project is funded by the ETH Research Fund within a Collaborative, Highly Interdisciplinary Research Project (CHIRP) funding stream for a period of 3 years, leading to submission of a doctoral thesis.

The successful candidates will have graduated at the top of their University with a Bachelor's degree in engineering sciences or civil engineering and specialisation at Master's level in geotechnical engineering, groundwater hydraulics or soil physics. He/she will be able to speak, understand and write English in a scientific manner to a high standard. Some competence in German and French will be extremely helpful, since the field work will take place in the Valais. He/she will have practical skill for field and laboratory work, and in particular, will have significant ability/potential in mechanics and analysis. Competence in unsaturated soil mechanics, soil physics, groundwater hydraulics or modelling will be advantageous.

IGT is equipped with state of the art laboratories for testing of saturated soil and frozen samples and has recently extended capacity for testing unsaturated soils. IfU is experienced in hydrological field measurements and will be equipped for experiments with freezing and thawing variably saturated soil columns.

The ETH Zurich is an equal opportunity employer.

Candidates for the **geotechnical position** should send their curriculum vitae (including a copy of their degree certificates) and either an abstract from their Masters thesis and/or an electronic link to the entire document to ETH Zurich, Professorship for Geotechnical Engineering, Mrs Sonja Zwahlen, Personnel Manager, 8093 Zurich, SWITZERLAND. (Email: [sonja.zwahlen@igt.baug.ethz.ch](mailto:sonja.zwahlen@igt.baug.ethz.ch)). [www.igt.ethz.ch](http://www.igt.ethz.ch).

Candidates for the **hydraulics position** should send their curriculum vitae (including a copy of their degree certificates) and either an abstract from their Masters thesis and/or an electronic link to the entire document to ETH Zurich, Professorship for Hydromechanics and Groundwater, Mrs Vera Löhle, Personnel Manager, 8093 Zurich, SWITZERLAND. (Email: [Loehle@ifu.baug.ethz.ch](mailto:Loehle@ifu.baug.ethz.ch)). [www.ifu.ethz.ch](http://www.ifu.ethz.ch).

**IGT**

Institut für Geotechnik

**ETH**

Eidgenössische Technische Hochschule

**IfU**

Institut für  
Umweltingenieur-  
wissenschaften