POLITECNICO DI MILANO

PhD in ARCHITETTURA, INGEGNERIA DELLE COSTRUZIONI E AMBIENTE COSTRUITO / ARCHITECTURE, BUILT ENVIRONMENT AND CONSTRUCTION ENGINEERING - 38th cycle

THEMATIC Research Field: MODELLING OF GLOBAL WARMING EFFECTS ON HIGH MOUNTAIN ROCK MASSES

Monthly net income of PhDscholarship (max 36 months)
€ 1275.0 In case of a change of the welfare rates during the three-year period, the amount could be modified.

Context of the research activity	
Motivation and objectives of the research in this field	Global warming is affecting alpine areas in a particularly aggressive way, both in terms of temperature rise and effects. Temperature rise involves a progressive increase in the altitude at which permafrost is present; therefore, a range of rock masses is becoming progressively unstable as a consequence of permafrost upwards receding. The object of this research is to model and foresee the effects of permafrost warming at the scale of the material (rock joints) and of the rock mass as a whole, by developing appropriate constitutive relationships and numerical models. With reference to the specific application site (Capanna Margherita on Monte Rosa), the outcomes of the research will help guide fundamental choices about safety, sustainability and renovation of the hut. Research results will also provide guidelines for the assessment of stability and the set-up of early warning systems in other relevant sites in high Alps.
Methods and techniques that will be developed and used to carry out the research	The activities will be developed in agreement with the research demands of Club Alpino Italiano, and will use the high altitude site on top of Monte Rosa at Capanna Margherita (4554 m a.s.l.) as reference application. Distinct Element models of the fractured rock mass below Capanna Margherita will be built and used for analyzing

	the stability conditions including the effects of temperature increase. The numerical analyses will be based on the in-situ geomechanical investigation and measurement of relevant data (temperature, water pressure, displacements) that define the conditions of the rock mass. In-situ data and numerical models will be developed in parallel. For several scenarios of climate evolution, the effects on stability conditions (without and with reinforcement works) will be systematically analysed.
Educational objectives	The candidate will be provided with in depth knowledge of advanced rock mechanics principles. He/she will learn to design and set-up an insitu testing campaign at high altitudes, to develop appropriate numerical models and to refine them on the basis of in-situ data.
Job opportunities	Rock mechanics and permafrost specialist in engineering companies.Technical specialist at monitoring devices and engineering manufacturers. Research fellow at Universities and public/private research institutions.
Composition of the research group	1 Full Professors 2 Associated Professors 0 Assistant Professors 0 PhD Students
Name of the research directors	Prof. Francesco Calvetti

Contacts
Prof. Francesco Calvetti *email: francesco.calvetti@polimi.it*

Additional support - Financial aid per PhD student per year (gross amount)	
Housing - Foreign Students	--
Housing - Out-of-town residents (more than 80Km out of Milano)	--

Scholarship Increase for a period abroad	
Amount monthly	637.5 €
By number of months	6

Additional information: educational activity, teaching assistantship, computer availability, desk availability, any other information

Scholarship co-funded by Politecnico di Milano, ABC Department, and CAI - Club Alpino Italiano

Additional information can be found in the Regulations for the 38th Cycle of ABC-PhD:
download is available at link:
https://www.dottorato.polimi.it/en/phd-programmes/architecture/architecture-built-environment-and-construction-engineering

Additional information about ABC department and ABC-PhD programme:
available at link:
https://www.dabc.polimi.it/

Additional support for the research activity:
a total amount of 5.197,62 Euros per student, available since the first year, to be spent according to the department rules.

Desk availability:
the ABC department provides non-permanent desks to be temporarily booked in common PhD rooms. In particular, the activity related to this scholarship will include some activities to be developed in the field, as described in the previous sections.