Project A Design and performance monitoring of engineered earthen covers on slopes

Project Description:

Rainfall infiltration in an unsaturated earthen cover on slope induces loss of suction (and even positive pore-water pressures), which can eventually lead to failure; this is a typical triggering mechanism. Although sophisticated numerical tools are available to predict the behaviour of earthen slope covers, the uncertainties about hydraulic soil characterisation at the site scale and the hydraulic boundary conditions make these tools potentially unreliable. The presence of topographic irregularities, cracks on the soil surface, vegetation, and strong variation in hydraulic conductivity along the vertical soil profile make hydraulic slope behaviour uncertain. Full understanding of the soil-atmosphere interaction and the interplay between the soil cover and the bedrock (weathered coal) is indispensable in order to rationally define the boundary conditions. Hence full understanding of slope failure conditions as a response to rainfall infiltration is very complex and difficult to achieve without experimentation at both laboratory and local scale. Therefore a hydro- mechanical analysis of the partially saturated earthen cover and its components is needed for the Loy Yang rehabilitation project. This analysis will include:

1. Design of the cover system taking into account the compaction properties (most lightly compaction used in Loy Yang is not well covered in the past, but the recently developed M (Monash)PK framework can be used to explain the behaviour) along with the well-established approaches developed in the US. The lessons learnt from the ski slope will be incorporated in this study. Work will include measurement of design parameters.
2. Laboratory validation investigation focussing on the unsaturated behaviour of the different components of the earthen soil cover and instrumented model scale test mimicking typical slope inclination (s) and rainfall events
3. In-situ monitoring of suction and rainfall (*i.e.,* use of tensiometers, thermocouples,TDRs, piezometers, and weather station).

The above components will be used in the modelling part of the project and design of the slope trials..

Project Lead:

Professor Malek Bouazza: He is a world-leading expert in geosynthetics and environmental geotechnics. He is a civil engineer, internationally renowned for his research work in geosynthetics and environmental geotechnics. At Monash, Professor Bouazza's team has the facilities to run highly sophisticated laboratory tests and specialised modelling of thermo-hydro-chemical permeability of liners to refine the design of liner systems used in mining operations.

The Opportunity

This position is for 3 years fulltime research towards a PhD. A tax-free stipend ($26,682 per annum) is provided. There is potential for the applicant to earn additional money through assistance in undergraduate teaching. Attendance at both national and international conferences will be expected and funded during the course of the degree. The applicant will work with an internationally recognized research group specializing in geotechnical *in-situ* monitoring and numerical simulation.

Candidates must meet the eligibility criteria for PhD. candidature at Monash University:
https://www.monash.edu/graduate-research/future-students/apply

Selection Criteria

The successful candidate must meet ALL of the following criteria:

- Bachelor of Engineering or Science with Honours.
- An excellent academic record.

Furthermore, the candidate must have an interest in *in-situ* monitoring technologies applied to geotechnical engineering, proficiency in maths, mechanics, and numerical simulation. Excellent oral and written communication skills, and the ability to work efficiently alone as well as in a team. Experience with and interest in unsatuarated soils characterisation is essential to be considered for this project.

Enquiries

Professor A. (Malek) Bouazza
Department of Civil Engineering
23 College Walk, Monash University, Vic. 3800, Australia
Tel. +61 3 9905 4956, Fax. +61 3 9905 4944
malek.bouazza@monash.edu

Applications

Applications should include:

1) Cover letter, specifying interests, qualifications and experience as it relates to the project.
2) Curriculum vitae which should include employment history, details of journal publications, and the names of two academic referees.
3) A certified copy of you academic transcript.