ARMA 2013 Short Course – Reliability in Geotechnical Design

Short Course
Title: Reliability Engineering for Tunnel Construction
Instructors: Mark Diederichs, Connor Langford, Queen's University, Kingston, Ontario, Canada

Venue: The Westin San Francisco Market Street
Date: Saturday, 22 June 2013; 8:30 a.m. – 4:30 p.m.
Cost: $190

Description: Understanding uncertainty in geomaterials is a key issue in geotechnical projects. In addition to the inherent uncertainty stemming from the natural variability of geomaterials, knowledge based uncertainty involving testing, transformation and modeling errors also plays a critical role in design. In tunneling, this uncertainty poses a significant challenge for obtaining reliable support design or hazard prediction calculations, resulting in a residual risk during construction. Despite this, present design methods have yet to adopt a logical basis for describing this uncertainty and assessing its impact on performance. While several tools are available to incorporate uncertainty into the design process, most only deal with it subjectively and qualitatively. Reliability methods, on the other hand, incorporate the uncertainty in material properties directly into the design process, allowing for an assessment of system performance and risk.

This workshop will provide a critical review of sources of uncertainty in geotechnical projects as well as a series of simple reliability based tools to help deal with uncertainty in design. A case study will be presented to show the usefulness of these tools. Finally a panel discussion will be held to discuss how risk sharing can better be incorporated into design contracts.

Program

Concepts

- Understanding the sources of uncertainty in geological systems and geomechanics investigation
- Qualitative consideration of uncertainty in design decision making
- Quantifying uncertainty for input into geomechanics analyses
- Reliability based design methods

Case Studies

- Assessing data uncertainty, correlations, sensitivities
- Incorporating quantified uncertainty into engineering analysis and design
- Examples of empirical, analytical and numerical approaches
- Incorporating reliability output into design

Discussion

- Where do we go from here?
    - How to encourage reliability based design in engineering
    - Issues with fundamental uncertainties (in situ stress, dilation,)
    - Failure mode switching and model selection uncertainty
    - Discuss contract implications