Vancouver Geotechnical Society
A Local Section of the Canadian Geotechnical Society

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NOTICE OF UPCOMING DINNER PRESENTATION

2011 SPRING CANADIAN GEOTECHNICAL SOCIETY

CROSS CANADA LECTURE TOUR

WEDNESDAY, APRIL 13, 2011

SUBJECT: **Deep Tunnelling in Hard Brittle Rock**

SPEAKER: **Dr. Mark Diederichs, PEng.**
Professor, Queen's University, Kingston, Ontario, Dept. Geological Sciences and Geological Engineering

Mark Diederichs is a Professor in the Department of Geological Sciences and Geological Engineering at Queen's University. He received his BSc and MSc from the University of Toronto in Geological Engineering. He received a PhD in Civil Engineering from the University of Waterloo. He joined Queen's University in 2001 after working in consulting, as well as in research and development for the Canadian mining industry.

Mark's research involves the characterization of heterogeneous rockmasses and prediction of their behavior under engineering disturbances such as tunneling, mining, slope construction and cavern construction. In addition, Mark is an expert in the brittle damage and fracture of rock in a tunnelling environment and also consults and leads research in tunnel construction and support issues related to weak rock and squeezing ground. The critical and common element in all of this work is the integration of the geological model with the engineering analysis. Simplifications made in engineering design that fail to account for geological history, geological structure and the natural variability in geo-materials result in the most expensive failures, delays and cost overruns in engineering construction. Failure, on a large tunneling or slope construction project, to model the correct material behavior (squeezing, bursting or structural disintegration) of the individual rock units as well as the composite geosystem (fractures, faults, bedding, folds) can result in major engineering problems during construction.

Dr. Diederichs carries out his research in conjunction with major tunneling projects in Canada, Italy, France, Switzerland, Norway, Sweden and South America. He also acts as an independent reviewer on large complex tunnelling projects around the world. Currently, this expertise is being directed at the challenge of underground nuclear waste storage in Canada and Switzerland. He has authored over 160 published scientific articles and received a number of research awards including the Rocha Medal from the International Society of Rock Mechanics, the Geo-Colloquium Award from the Canadian Geotechnical Society, the John Franklin Award from the Canadian Rock Mechanics Association and recently the Queen's Chancellors Award.

CONTENT:

The deepest tunnel in the world, the Gotthard Base Tunnel, has broken through this past year. The shorter and somewhat shallower Loetchberg was completed several years ago. The largest rock tunnel in the world (Niagara Beck) is nearing completion. The Jing Ping Project in China is struggling through marbles at over 2 km depth. The Olmos tunnel in Peru is dealing with serious bursting under the Andes. Other tunnels are planned or under construction around the world that share key challenges with these world class projects. Namely, they must contend with brittle rock failure processes that lead to safety issues, support challenges and tunnelling delays both in drill-and-blast excavations and tunnels driven by boring machine or TBM.

This talk will take the audience through a number of major tunnelling projects and explore the mechanisms and resulting impacts of this behaviour on the tunnel performance. Key problems include spalling in the walls, spalling in the face, the interaction of spalling processes with joints and fabric within the tight, stressed rockmass, and issues of stress rotation.

The currently applied analyses and design tools will be discussed as will the potential of future tools currently under development. The key challenges for numerically simulating and modelling this brittle spalling process, as well as the interaction of this damage with existing structure, will be examined. The ever-present question of dilation (what, how and who cares) will be addressed.

The challenges of support and the solutions developed by the mining and tunnelling industry will be reviewed followed by a discussion of the inherent challenges of providing adequate burst-resistant support in a timely fashion within the constraints of a TBM environment.

Examples will be cited and discussed from Switzerland, Italy, South America, Canada and elsewhere.

DETAILS

Executive Inn, 4201 Lougheed Highway, Burnaby, BC V5C 3Y6 (Phone: 604-298-2010)
Social Hour: 5:30 to 6:30 pm (drinks available at the hotel bar)
Technical Presentation: 6:30 to 7:30 pm
Dinner: 7:45pm ($10 will be charged for dinner to cover a small portion of the cost.)
RSVP: Dinner reservation to ali.amini@shaw.ca by Sunday, April 10, 2011

The VGS would like to thank the following companies (in alphabetical order) for financially sponsoring this Cross Canada Lecture Tour:

- ***BGC Engineering Inc.***
- ***EBA Engineering Consultants Ltd.***
- ***GEO-SLOPE International Ltd.***
- ***Reinforced Earth Company Ltd.***

The Cross Canada Lecture Tour is organized by the Canadian Geotechnical Society and its various local sections, and travel funds are provided by the Canadian Foundation for Geotechnique.