



**Vancouver
Geotechnical
Society**
A Local Section of the
Canadian Geotechnical
Society

www.v-g-s.ca

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A Two-Day Short Course by Dr. Gordon Fenton, Professor of Civil Engineering and Engineering Mathematics at Dalhousie University and Dr. Vaughan Griffiths, Professor of Civil Engineering at the Colorado School of Mines

Risk Assessment in Geotechnical Engineering

**Monday & Tuesday, May 9 and 10, 2016
Coast Coal Harbour Hotel, 1180 West Hastings Street, Vancouver**

The VGS will be hosting a two day short course in early May on Risk Assessment in Geotechnical Engineering presented by Dr.'s Gordon Fenton and Vaughan Griffiths. A detailed course program is available on the VGS website (<http://v-g-s.ca/schedule>).

Purpose and Background

Soils and rocks are among the most variable of all engineering materials and are, therefore, highly amenable to a probabilistic treatment. The application of statistical and probabilistic concepts to geotechnical analysis is a rapidly growing area of interest for engineers as indicated by recent new books, journals and dedicated sessions at practice-oriented conferences. The course content and delivery will assume no more than an introductory understanding of probability and statistics on the part of the participants; however, the goal is to present a "user friendly" training on modern probabilistic techniques applied to classical geotechnical engineering problems such as seepage, settlement, bearing capacity and slope stability.

The course will include:

- Discussion of potential benefits of probabilistic approaches as opposed to the classical "Factor of Safety" methods
- Review of probability theory and random variables
- Development of Load and Resistance Factor Design (LRFD) in geotechnical engineering
- Modeling spatially variable soil properties
- Basics of Monte Carlo simulation and the Random Finite Element Method (RFEM)
- Examples of established probabilistic methods of analysis in geotechnical engineering, such as the First Order Second Moment (FOSM) method and First Order Reliability Method (FORM)
- Estimation of soil property statistics and choosing a distribution
- Advanced estimation methods: Best Linear Unbiased Estimation and Kriging
- Risk-based decision making
- Reliability-based design concepts in and calibration of the 2014 Canadian Highway Bridge Design Code

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Seminar Benefits and Learning Outcomes

- Understand the rationale for probabilistic geotechnical analysis
- Gain exposure to some methodologies for probabilistic geotechnical analysis
- Obtain introduction to some software for probabilistic geotechnical analysis
- Gain a better understanding of LRFD methods in geotechnical design and their relationship to probabilistic methods
- Understand the relationship between the Factor of Safety and the Probability of Failure (or Reliability Index)

Who Should Attend?

- This course is aimed at practitioners of geotechnical engineering who wish to keep abreast of developments in reliability-based design methodologies.

Presenters

Dr. Fenton is a Professor cross-appointed to the Civil Engineering and Engineering Mathematics Departments at Dalhousie University. His research interests include probabilistic modeling of geotechnical systems and the development of geotechnical reliability-based design codes and has authored over 140 peer-reviewed papers. He is currently Chair of the Canadian Highway Bridge Design Code Geotechnical Systems Committee, chair of the newly formed National Building of Canada (NBCC) Task Group on Geotechnical Systems, a member of the NBCC Standing Committee on Structural Design, and a member of the NBCC Task Group on Climatic Loads. He is also the North American Managing Editor for the international journal "Georisk", past chair and current member of the ASCE Geo-Institute Risk Assessment and Management Committee, and vice-chair of the ISSMGE Engineering Practice of Risk Assessment and Management Committee. For his research efforts, Dr. Fenton was selected by the Canadian Geotechnical Society to deliver the Cross-Canada Lecture Tour in the fall of 2015, has received the C. Allin Cornell Award from the International Civil Engineering Risk and Reliability Association, the Thomas C. Keefer Award from the Canadian Society for Civil Engineering, the George Stephenson Medal from the Institution of Civil Engineers, UK, the Gzowski Medal from the Engineering Institute of Canada, and was elected a Fellow of the Canadian Academy of Engineering. His research work is summarized in his textbook "Risk Assessment in Geotechnical Engineering", Wiley (2008).

D. Vaughan Griffiths, Ph.D., D.Sc., P.E., D.GE., FICE, F.ASCE, completed his Masters degree at UC Berkeley and Doctoral degrees at the University of Manchester, UK. He is currently Professor of Civil Engineering at the Colorado School of Mines where his primary research interests lie in application of finite element and risk assessment methodologies in civil engineering. He has written over 300 research papers and is the co-author of three textbooks, "Programming the Finite Element Method", 5th edition, Wiley (2014), "Risk assessment in Geotechnical Engineering" Wiley (2008) and "Numerical Methods for Engineers", 2nd edition, Chapman & Hall/CRC (2006). He gives regular short-courses for ASCE continuing education on "Finite Elements in Geotechnical Engineering" and "Risk Assessment in Geotechnical Engineers". Dr. Griffiths is a former ASCE Director and is currently an editor of Computers and Geotechnics and on the Advisory Panel of Geotechnique.

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Registration Form

Name			
Company			
Address			
City, Province			Postal Code
Telephone			Fax
Email			

Registration	Two-Day Registration		One-Day Registration	
	Before April 1 st	After	Before April 1 st	After
VGS/CGS Members	\$600	\$700	\$350	\$400
Non-Members	\$700	\$800	\$400	\$450
Full-Time Students	\$300	\$350	\$200	\$225

Lunch will be provided as well as snacks and drinks during the morning and afternoon breaks.

Please enclose with your registration form a cheque for the appropriate registration fee payable in Canadian dollars to "The Vancouver Geotechnical Society". For company registration, please provide the primary contact information above and attach a list of registrants. We are not set-up to process credit cards at this time.

The registration deadline is Friday, April 29, 2016. Registration will be considered valid only when this form and the cheque for the correct amount has been received and cleared. The cancellation deadline for registration is 1200 on May 2, 2016, after this time a refund will not be provided.

All cheques and completed registration forms to be mailed to:

Marc Bossé
c/o Thurber Engineering Ltd.
900 – 1281 West Georgia Street
Vancouver, B.C. V6E 3J7

For additional information or assistance with registration, please contact:
Marc Bossé (mbosse@thurber.ca) Phone: 778-899-8055

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Risk Assessment in Geotechnical Engineering

Monday & Tuesday, May 9 and 10, 2016
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Day 1:

- 8:30 - 9:15 Introduction to Risk in Geotechnics (DVG)
- motivation for this course
- applications of probabilistic methods in current practice
- examples of slope stability
- introduction to event trees
- 9:15 - 10:00 Basic Probability Theory (DVG)
- basic set theory
- conditional probability
- total probability theorem
- Bayes' theorem
- 10:00 - 10:15 Break
- 10:15 - 11:00 Introduction to Random Variables (DVG)
- discrete and continuous random variables
- common probability density functions
- 11:00 - 11:45 Use of Random Variables (DVG)
- expected values and variance
- covariance and correlation
- examples of bearing capacity and slope stability
- 11:45 - 1:00 Lunch
- 1:00 - 1:45 Reliability-Based Design (GAF)
- history of geotechnical design
- development of LRFD
- LRFD examples
- 1:45 - 2:30 Reliability Assessment and LRFD Theory (GAF)
- resistance vs load reliability analysis
- reliability index
- going beyond calibration with WSD
- implementation problems in geotechnical engineering
- 2:30 - 2:45 Break
- 2:45 - 3:15 Modeling Spatially Variable Soil Properties (GAF)
- types of random fields
- mean, variance, and correlation structure
- 3:15 - 4:15 Basics of Simulation and RFEM (GAF)
- Monte Carlo simulation
- pseudo-random number generators
- simulation of random variables
- simulation of random fields
- the Random Finite Element Method (RFEM)

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Day 2:

- 8:30 - 10:15 Simple Tools for Probabilistic Analysis (DVG)
- the First Order Second Moment (FOSM) method
- the First Order Reliability Method (FORM)
- 10:00 - 10:15 Break
- 10:15 - 11:00 Simple Tools for Probabilistic Analysis (DVG)
- the First Order Reliability Method (FORM) method (continued)
- simple Monte-Carlo (M-C) analysis assuming Single Random Variables
- 11:00 - 11:45 Geotechnical example problems and software demonstrations (DVG)
- 11:45 - 1:00 Lunch
- 1:00 - 1:45 Estimation of Soil Statistics (GAF)
- sample mean, sample variance, sample correlation length
- interpolation vs extrapolation
- choosing a distribution
- effect of correlation
- classical estimators
- the three averages
- 1:45 - 2:30 Advanced Estimation Methods (GAF)
- Best Linear Unbiased Estimation (BLUE)
- Geostatistics: Kriging
- 2:30 - 2:45 Break
- 2:45 - 3:30 Risk-Based Decision Making (GAF)
- decision making framework
- decision trees
- maximum expected value criterion
- 3:30 - 4:00 Calibration of the 2014 Canadian Highway Bridge Design Code (GAF)
- major philosophical changes
- floating resistance factor and level of understanding