

2019 CGS-SOS Workshop

Fundamentals of Risk in Geotechnical Engineering



*Technical, Business,
Regulatory and Legal
Perspectives*

Organized by:
Canadian Geotechnical Society
Southern Ontario Section



Location: Pearson Convention Centre, 2638 Steeles
Avenue East, Brampton, Ontario, L6T 4L7

Ticket Prices:

	One Day	Both days
Early Bird – CGS/TAC Members and Government Employees	\$135	\$250
Early Bird – Non Members	\$160	\$275
Regular – CGS/TAC Members and Government Employees	\$150	\$275
Regular – Non Members	\$175	\$300
Students	\$60	\$120

Day One: Wednesday – Feb. 13, 2019

A Regulatory Perspective: The Role of Engineers in managing project risks

Ms. Annette Bergeron, P.Eng., FCAE
President of Engineers Canada, PEO past
President

The Evolution of Risk-informed Geotechnical Engineering

Professor John Christian
University of Massachusetts Lowell

Managing Legal Risks in Geotechnical Engineering

Ms. Sharon Vogel, FCI Arb
Lawyer at Singleton Urquhart Reynolds Vogel

Geotechnical Failures-Perspectives and Examples (1)

Mr. John Westland, M.A.Sc., P.Eng.
President and Principal Consultant, Ground
Truth Engineering

Day Two: Thursday – Feb. 14, 2019

The Role of Geotechnical Baseline Reports in Managing Project Risks

Mr. Randall J. Essex, P.E.
Executive Vice President, Mott MacDonald

The Role of Load and Resistance Factor Design (LRFD) in Managing Geotechnical Risks

Dr. Dennis Becker, P.Eng.
Principal at Golder Associates

Geotechnical Failures-Perspectives and Examples (2)

Mr. John Westland, M.A.Sc., P.Eng.
President and Principal Consultant, Ground
Truth Engineering

Workshop Objective:

This technical workshop is designed to provide insights into the concept of risk, risk management and mitigation from legal, business and engineering standpoints in geotechnical engineering and includes case histories in underground constructions. The workshop highlights the importance of adopting rationale, consistent and documentable design approaches that are informed of and accounting for the uncertainties in the geotechnical parameters, analysis and design approaches. It will provide the participants with a concise understanding of risk, its implications for projects with significant ground engineering components from owner, consultant and contractor perspectives, and aims to promote risk-informed decision making in the field of geotechnical engineering.

Distinguished speakers with diverse backgrounds in this field are invited for this workshop to cover technical, business, regulatory and legal aspects of this topic.

Each day of the workshop will qualify for up to eight (8) PEO PEAK hours. The workshop is suitable for Geotechnical and Geo-structural Consultants and Designers, Contractors, Government Agencies, University Students and other practitioners who desire continual improvement to their engineering skills. This workshop is an excellent source of information and professional development for professionals in the field of geotechnical engineering and other interrelated fields.



CGS-SOS: Preliminary Workshop Agenda
(Subject to Change)

Fundamentals of Risk in Geotechnical Engineering
Technical, Business, Regulatory and Legal Perspectives

CGS-SOS: Preliminary Workshop Agenda (Subject to Change)				
Fundamentals of Risk in Geotechnical Engineering Technical, Business, Regulatory and Legal Perspectives				
Day 1 (February 13, 2019)	Outline	Start/End time	Duration (hours:mins)	Speaker
	Registration and Breakfast	7:30 to 8:15	0:45	-
	CGS Introduction	8:15 to 8:30	0:15	CGS Workshop Leads (Lucie Kijak/Ali Nasserri-Moghaddam)
	A Regulatory Perspective: The role of Engineers in managing project risks	8:30 to 9:30	1:00	Annette Bergeron, P.Eng., FCAE, President of Engineers of Canada/PEO past president
	The evolution of risk-informed geotechnical engineering (1)	9:30 to 10:15	0:45	John Christian, P.E., Professor, University of Massachusetts Lowell
	Break	10:15 to 10:30	0:15	
	The evolution of risk-informed geotechnical engineering (2)	10:30 to 11:15	0:45	John Christian, P.E., Professor, University of Massachusetts Lowell
	Geotechnical Failures-Perspectives and Examples (1)	11:15 to 12:00	0:45	John Westland, M.A.Sc., P.Eng., President and Principal Consultant, Ground Truth Engineering
	Networking and Lunch	12:00 to 1:00	1:00	
	Managing Legal Risks in Geotechnical Engineering	1:00 to 2:30	1:30	Sharon Vogel, Partner, Singleton Urquhart Reynolds Vogel LLP Construction and Infrastructure Law Practice Group (Lawyer)
	Break	2:30 to 3:00	0:15	
	Panel Discussion	3:00 to 4:00	1:00	All Speakers for the day (AB/JC/SV/JW).
	CGS close	4:00 to 4:15	0:15	CGS Workshop Leads (Lucie Kijak/Ali Nasserri-Moghaddam)
	Total		8:30	
Day 2 (February 14, 2019)	Outline	Start/End time	Duration (hours:mins)	Speaker
	Registration and breakfast	7:30 to 8:15	0:45	
	CGS Introduction	8:15 to 8:30	0:15	CGS Workshop Leads (Lucie Kijak/Ali Nasserri-Moghaddam)
	The Role of Load and Resistance Factor Design (LRFD) in Managing Geotechnical Risks	8:30 to 10:15	1:45	Dennis Becker, Ph.D., FEIC, FCAE, P.Eng., Principal, Senior Geotechnical Specialist, Golder Associates
	Break	10:15 to 10:30	0:15	
	The Role of Geotechnical Baseline Reports in managing project risks (Tunneling/Excavations)	10:30 to 12:00	1:30	Randy Essex, P.E., Executive Vice President, Mott MacDonald
	Networking and Lunch	12:00 to 1:00	1:00	
	Geotechnical Failures-Perspectives and Examples (2)	1:00 to 2:15	1:15	John Westland, M.A.Sc., P.Eng., President and Principal Consultant, Ground Truth Engineering
	The Role of Geotechnical Baseline Reports in managing project risks (Case Studies)	2:15 to 3.15	1:00	Randy Essex, P.E., Executive Vice President, Mott MacDonald
	Break	3:15 to 3:30	0:15	
	Panel Discussion	3:30 to 4:30	1:00	All Speakers for the day (DB/JW/RE).
	CGS close	4:30 to 4:45 pm	0:15	CGS Workshop Leads (Lucie Kijak/Ali Nasserri-Moghaddam)
	Total		9:00	

SPEAKER BIOGRAPHIES:

Annette Bergeron, P.Eng., FCAE, President of Engineers of Canada

Annette Bergeron graduated from Queen's University with a BSCh E in Metallurgical Engineering and from York University's Schulich School of Business with an MBA in Strategic Management and Entrepreneurship.



She has over three decades of experience in industry, academic administration, engineering and business education, entrepreneurship, and governance. Ms. Bergeron specializes in executive leadership and governance of not-for-profit corporations and has experience in both the private and public sector.

Ms. Bergeron was elected as the sixth female resident of PEO (2013-2014). She is also Past-President and Chair of Ontario Society of Professional Engineers (2004-2005 and 2010-2011). She was recognized in 2013 and 2014 as among the Top 25 Women of Influence across Canada. She is in her fourth year of being appointed to the Board of the Electrical Safety Authority and was also appointed to the Board of the South East Local Health Integration Network.

Randy Essex, P.E., Executive Vice President, Mott MacDonald

Randy Essex is an Executive Vice President with Mott MacDonald's Tunnels Practice. Randy has 40 years of tunnel engineering experience across North America and overseas, and is a Registered Professional Engineer in multiple states. Randy earned a BS degree in Geomechanics from the University of Rochester,



and two Master degrees in Engineering from the University of California, Berkeley. His career has focused on the design engineering and management of construction risk associated with underground construction. Randy has provided planning, design, technical review, construction engineering, expert witness, or Dispute Review Board services for more than 175 tunnel projects. The author of 45 technical papers, book chapters, and magazine articles, Randy is principal author of ASCE's publication Geotechnical Baseline Reports for Construction (the "Gold Book"). He is a member of the Executive Council of the International Tunneling and Underground Space Association, is a member of the Moles, and was recently awarded the Golden Beaver Award for Engineering.

John Westland, M.A.Sc., P.Eng., President and Principal Consultant, Ground Truth Engineering

John Westland is a geotechnical engineer with more than 30 years' experience practicing in the Greater Toronto Area. He is a graduate of the Geo-Engineering program at the University of Toronto and also obtained a Master's degree in civil engineering from UofT. John has managed and lead specialist geotechnical teams that have tackled challenging tunnelling, deep excavation, slope instability and forensic engineering projects. In the mid-1990's, when North American tunnelling practice began to embrace the use of Geotechnical Baseline Reports (GBRs), John was co-author of many of the first GBRs written for underground projects in Ontario. Through his career John has been retained to undertake forensic investigations of geotechnical failures and expert reviews of underground construction claims on more than 50 projects. John's analyses of



contract disputes and geotechnical failures have been tested through his role as an expert witness where he has been formally qualified as a geotechnical expert on several occasions and has participated in many alternative dispute resolution proceedings, including mediations and dispute review board hearings that have led to negotiated dispute resolutions.

After more than 30 years' experience working with geotechnical colleagues at Golder Associates, Thurber Engineering and GHD, John is now in private practice as the founder of Ground Truth Engineering Ltd.

Sharon Vogel, Partner, Singleton Urquhart Reynolds Vogel LLP Construction and Infrastructure Law Practice Group

Sharon Vogel is a Partner and Co-Chair of the Construction and Infrastructure Law practice group of Singleton Urquhart Reynolds Vogel LLP.



She specializes in the negotiation, mediation, arbitration and litigation of construction disputes and has appeared at all levels of court, including the Ontario Superior Court, Court of Appeal and the Supreme Court of Canada. She also has extensive experience drafting construction contracts on behalf of owners, developers, general contractors, subcontractors, and suppliers. She is ranked by Who's Who Legal as one of the top five construction lawyers in the country, and was named as one of the 25 most influential lawyers in Canada in 2017 by Canadian Lawyer.

Sharon is a Certified Specialist in Construction Law and a Fellow of the Chartered Institute of Arbitrators. Sharon is also a co-author of "A Guide to Canadian Construction Insurance Law".



John Christian, P.E., Professor, University of Massachusetts Lowell

John Christian has worked in dynamic analysis, soil liquefaction, amplification of seismic waves, stability of slopes, dynamic soil-structure interaction, and probabilistic seismic hazard assessments. His work has included earth dam analysis and design, evaluation of flow through porous media and earth dams, nuclear power plants, solid waste landfills, foundation engineering, offshore facilities, mooring facilities, and pipelines. He has performed geotechnical analyses for several on-site nuclear spent fuel storage facilities and for the stability of mining waste piles. A pioneer in the use of computer methods, he co-authored the first general, user-friendly computer program for analysis of slope stability with circular and non-circular failure surfaces. He is the co-author and co-editor of a seminal book on Numerical Methods in Geotechnical Engineering in 1977, co-author of a book on Productivity Tools for Geotechnical Engineers in 1996, and co-author of a book on Reliability and Statistics in Geotechnical Engineering in 2003.



His recent consulting assignments have included membership in peer review panels to review the geotechnical and seismological issues for proposed nuclear power plants, probabilistic studies of the stability of an existing major earth dam, probabilistic studies of the seismic behavior of mine waste slopes several hundred meters high, studies of the effects of blasting on glaciers located near a mine, evaluation of the feasibility of constructing a subway tunnel through gassy materials, and reviewing the adequacy of procedures for closing un-lined solid waste disposal sites. He was a member of the National Academy of Engineering Committee that

published in 2017 the report on the State of the Art and Practice in the Assessment of Earthquake-Induced Soil Liquefaction and Its Consequences.

As Vice President of a major engineering firm, he was involved in the design, evaluation, and construction of many nuclear power plants and other facilities for energy generation and distribution. He has been a member of the NAE Committee on New Orleans Regional Hurricane Projects and the committee to review the Louisiana Coastal Restoration Project. He has chaired the NRC committee to review the Bureau of Reclamation's procedures for security of dams and of the committee to review the federal government's procedure and guidelines (P&G) for project development. He has served as the Chair of the NAE Civil Engineering Section from 2011 to 2013.

In addition to serving on the editorial boards of several professional journals, he has been the Editor-in-Chief of the ASCE Journal of Geotechnical and Geoenvironmental Engineering and now serves as its Ombudsman. He is the former Chairman of the Geotechnical Engineering Division of the American Society of Civil Engineers and of the U. S. National Society of the International Society of Soil Mechanics and Foundation Engineering and a former member of the board of the International Society of Soil Mechanics and Geotechnical Engineering. He is a Distinguished Member of ASCE and an elected member of the U. S. National Academy of Engineering. He delivered the Terzaghi Lecture of the ASCE in 2003 and the 2012-2013 Geo-Institute Cross USA Lectures. He has the B. S., M. S., and Ph. D. degrees in Civil Engineering from the Massachusetts Institute of Technology.

Dennis E. Becker, Ph.D., FEIC, FCAE, P.Eng., Principal, Senior Geotechnical Specialist, Golder Associates

Dennis E. Becker is a Principal and Senior Geotechnical Engineer in Golder Associates with 40 years of national and international experience on numerous large scale civil engineering and resource development projects. Dennis has substantial experience with all aspects of geotechnical engineering, and has developed extensive and varied areas of expertise. He is frequently responsible for overall technical and administrative control for projects that involve difficult ground conditions and/or require the development of innovative solutions using both standard and new technologies. He is a past Leader of the Global Ground Engineering Group in Golder Associates.



Dennis is active in engineering and professional societies, and maintains close liaison with universities. He serves on technical committees of the Canadian Standards Association (CSA), National Building Code of Canada, Canadian Highway Bridge Design Code and CSA Offshore Code (Foundations), extensively involved with the development and implementation of limit states design (LRFD) for foundations, and was Co-Editor of the 4th Edition of the Canadian Foundation Engineering Manual. He is also involved in the ASCE Geo-Institute's initiative to produce a Guidance Document on Risk Informed Decisions in Geotechnical Engineering. Dennis has received senior awards from the Canadian Geotechnical Society, Engineering Institute of Canada and Canadian Society of Civil Engineers, and is a Fellow of the Canadian Academy of Engineering and Engineering Institute of Canada. Dennis was President of the Canadian Geotechnical Society, Vice-President (North America) of the International Society for Soil Mechanics and Geotechnical Engineering (ISSMGE) and Editor of the Canadian Geotechnical Journal.



ABSTRACTS (Day 1-February 13, 2019):

A Regulatory Perspective: The Role of Engineers in Managing Project Risks

Annette Bergeron, P.Eng. FCAE

This opening keynote is designed to cover regulatory aspects of this topic and the presenter will share their perspectives of risk and its role in engineering works. To set the stage for the workshop, insights into the concept of risk and risk mitigation from a regulatory perspective will be provided, including case histories of public inquiries. This past, present, and future will be presented with some examples of how engineering regulators are ensuring that engineers mitigate their individual and project risks, including professional development for professionals.

Geotechnical Failures-Perspectives and Examples (1)

John Westland, M.A.Sc., P.Eng.

Examples of ultimate limit state and serviceability limit state geotechnical failures will be presented and discussed, with due consideration given to both the technical causes and the human factors that are root causes in the case studies. The examples will also be discussed in the context of the 1965 paper titled Failures in Foundations by Jacob Feld to invite discussion among participants on our current state of geotechnical practice and the extent to which we have learned from the failures of the past.

The evolution of Risk-Informed Geotechnical Engineering (1)(2)

John Christian, Ph.D., P.E.

Geotechnical engineers have always recognized that they operate in a field where almost everything is uncertain and risk is pervasive. At the same time there has been a reluctance to adopt the formal methods of reliability analysis. The staging of this workshop is strong evidence that the geotechnical engineering community has gone a long way toward bridging that gap and is adopting methodologies for evaluating risk and reliability. Thanks to the efforts of many pioneers over recent decades, concepts such as the reliability index and Bayesian updating are now part of the working tool box of a growing number of geotechnical engineers. The workshop identifies some of the landmarks and summarizes the current state of understanding for incorporating probabilistic concepts of reliability and risk in geotechnical engineering. Some technical issues remain unresolved, such as the most efficient ways to carry out calculations and how best to describe correlation (the copula problem). More important for present purposes are issues of how to communicate about risk with other engineers, other professions, and the public. Some tools, such as the F-N diagram, have been used successfully for this purpose, and there are several instances in which geotechnical reliability has been incorporated into projects. It is hoped that the present workshop will inspire more of them.

Managing Legal Risks in Geotechnical Engineering

Sharon Vogel, Lawyer

When managing the legal risks associated with geotechnical engineering, it is imperative to consider the project risks associated with unforeseen site conditions. Geotechnical reports are commonly relied on by various players in the construction industry to assist in alleviating the risks associated with the unknown, however reliance on a geotechnical report, carries with it risks for all involved. Through the lens of three key players in the construction industry; the owner, consultant and contractor, this workshop will explore the highly litigated area of unforeseen site conditions, with an emphasis on unforeseen soil conditions which are frequently contested. The first portion of the workshop will provide a greater understanding of the standard duties and responsibilities of owners, consultants and contractors in relation to concealed or unknown conditions. This portion will entail a contractual analysis of both consulting agreements and construction contracts, including an examination of the CCDC standard contract form utilized in construction projects, and a review of the CCDC's general conditions (including GC 6.4 "Concealed or Unknown Conditions") and its implications for project participants. The latter portion of this workshop will focus on the ways in which risk can be shifted which will include an analysis of the importance of contract drafting and the importance of fulfilling one's duties both under the contract and in accordance with industry standards. This workshop will provide participants with an understanding and appreciation of the legal risks at play in relation to geotechnical engineering.



ABSTRACTS (Day 2-February 14, 2019):

The Role of Load and Resistance Factor Design (LRFD) in Managing Geotechnical risks

Dennis E. Becker, Ph.D., FEIC, FCAE, P.Eng.

Effective management of risk is a requirement for successful geotechnical engineering design. This presentation presents an overview of the development and current application and implementation of Reliability Based Design (RBD) based codes in Canada, such as Load and Resistance Factor Design (LRFD). The connection with performance based design is also examined. The presentation identifies and discusses the primary differences of RBD and LRFD with traditional allowable (working) stress design, the advantages of using LRFD and RBD, and why these methods improve effective management of geotechnical risk in design.

Implementation challenges being faced by geotechnical practitioners, including appropriate selection of geotechnical characteristic values and geotechnical resistance factors specifically for uplift resistance due to frost action and for limit equilibrium slope stability analysis, and appropriate assessment of QA/QC pile installation monitoring within a LRFD framework are interrogated. The need and approach for developing project and site specific reliability indices and geotechnical resistance factors are also examined.

Lessons learned from projects are identified and discussed. Lack of sufficient understanding of fundamental concepts, and lack of training and education are factors that have contributed to the implementation issues identified. LRFD/RBD methods are not meant to be a substitute for good understanding of geology, geological processes, fundamental ground behaviour, failure mechanisms, and engineering judgement and experience.

The Role of Geotechnical Baseline Reports in managing project risks (Tunneling/Excavations) and Case Studies

Randy Essex, P.E., Executive Vice President, Mott MacDonald

Managing the risks associated with subsurface conditions may be the single greatest financial challenge the contracting parties face on an underground project. The preparation and use of a Geotechnical Baseline Report (GBR) in the contract is a key element of the risk management effort. Randall Essex served as the committee chairman and principal author of the 1997 and 2007 ASCE publications on the subject of GBRs. In his first session, Mr. Essex will overview the historical development of GBRs in underground construction, the philosophy behind risk identification and allocation through physical and behavioral baselines, lessons learned from the application of GBRs over the past 30 years, and how GBR preparation can be adapted to different forms of contract delivery. Mr. Essex will also discuss expansion of the use of GBR internationally, including the new FIDIC "Emerald Book", which will endorse the use of GBRs in international works. In his second session, Mr. Essex will discuss a number of project case histories where Differing Site Condition disputes were resolved on the basis of what was and was not written in the Contract GBRs, and what the bidders relied upon in preparing their bids.

Geotechnical Failures-Perspectives and Examples (2)

John Westland, M.A.Sc., P.Eng.

Examples of ultimate limit state and serviceability limit state geotechnical failures will be presented and discussed, with due consideration given to both the technical causes and the human factors that are root causes in the case studies. The examples will also be discussed in the context of the 1965 paper titled Failures in Foundations by Jacob Feld to invite discussion among participants on our current state of geotechnical practice and the extent to which we have learned from the failures of the past.