



The UofA
Geotechnical Centre



International Short Course on Permafrost Engineering

**Effective Design and Construction in
Permafrost Regions**

November 29th – December 4, 2018

Edmonton, Alberta

Department of Civil and Environmental Engineering
University of Alberta
and
Cold Regions Geotechnology Division
Canadian Geotechnical Society



Permafrost Engineering

November 29 – December 4, 2018 in Edmonton, Alberta

Why should you attend this Course

Upon completion of the course you will:

- Have a working knowledge of logistic challenges of building in Northern Regions.
- Understand the origin and different types of ground ice.
- Know how to determine the existing thermal regime and impact of changing environmental conditions on this regime.
- Understand the unique behavior of freezing, frozen and thawing soils and understand how to design for these conditions.
- Know how to evaluate and design foundations and slopes in permafrost.
- Be exposed to case histories related to hydrocarbon pipelines in permafrost, mine design, tailings impoundments under Arctic conditions and pile foundation support systems in regions of saline permafrost.

Who should attend this Course?

If you are an engineer who has never attended a permafrost engineering course or want to learn about the latest information in permafrost engineering.

- Public works engineer
- Environmental engineer
- Geotechnical engineer
- Mining engineer
- Construction engineer
- Pipeline engineer
- Regulatory engineer
- Engineers-in-training



COURSE CONTENT

Introduction

Definition of the North
Environmental considerations
Geology and physiography of northern regions
Definition of permafrost and its distribution
Engineering challenges working in permafrost

Surface Features (Landforms) in Permafrost Areas

Features associated with freezing, thawing or cyclic freezing and thaw

Ground Ice and Ground Ice Landforms

Surface and atmospheric water
Subsurface water
Ground ice and geology
Engineering classification of permafrost soils

Ground Thermal Regime in Permafrost Areas

Earth's energy balance

Thermal Properties of Frozen and Unfrozen Soils

Thermal conductivity, specific heat, latent heat and apparent specific heat

Heat Flow Equations

No phase change, phase change and heat flow around pipes

Site Investigation in Permafrost Areas

General considerations
Logistics
Drilling and sampling
Geophysical techniques
Temperature measuring systems

Frozen Soils Mechanical Properties

Elastic Parameters
Strength properties
Effect of temperature, ice content, confining pressure and time
Special aspects of failure of frozen ground
Creep behavior

Mechanics of Thawing Ground

Amount of thaw settlement and time rates of settlement
Linear theory of thaw consolidation

Freezing of Soils and Frost Heave Theory

Frost heave mechanics

Foundations in Permafrost

Geothermal aspects
Shallow foundations
Piles

Slope Stability in Permafrost

Falls, flows and slides
Creep
Cuts in permafrost

Case Histories



Course Conduct and Instructors

You will have numerous opportunities during the course to interact with and learn from the exceptional experienced instructors. Each is a professional engineer with extensive permafrost engineering experience in leading edge research and consulting, and is dedicated to your learning.

Lukas Arenson, Dr.Sc.Techn.ETH, Dipl.Ing.ETH

Dr. Arenson's main area of expertise is geotechnical, mountain permafrost engineering with specialization on frozen soil mechanics. He studied the dynamics of ice-rich frozen slopes, in particular rock glaciers, from a geotechnical viewpoint and has expert knowledge in in-situ testing and monitoring of mountain permafrost. In addition, he developed analytical solutions to analyze rock glacier stability. Later, Dr. Arenson concentrated on the thermo-mechanical processes of frozen and freezing soils on a microstructural level to better understand the strength and deformation properties of frozen soils with changing stress, temperature and salinity. Dr. Arenson has further been studying the effects of natural air convection in cold climates to prevent permafrost degradation, to re-establish pre-construction thermal regimes after pipeline or road constructions and to accelerate the consolidation of mine waste tailings.

Nicholas Beier, PEng, PhD

Dr. Beier is an Assistant Professor of Geoenvironmental Engineering at the University of Alberta. His research interests and expertise include freeze-thaw dynamics of mining wastes and frozen ground and waste management in

cold regions. He has directed or completed research in the following areas related to cold regions engineering: fundamentals of freeze-thaw dewatering for the management of mine waste, including oil sands fine tailing and fine coal tailings, application of soil freezing characteristic curve to various mining wastes slurries, freeze-separation of contaminants from mine waste waters, and waste rock characterization of an Arctic mine site.

Kevin Biggar, PEng, PhD

Dr. Biggar has worked in Arctic and cold temperature environments since 1981. He has considerable experience in foundations, frost heave, and fate and transport of contaminants in these conditions. He has done research in the following areas related to cold regions engineering: assessment of the fate of petroleum spills in permafrost, remediation of petroleum contaminated sites in Canadian climates, improvement of foundations in permafrost, improvement of electrical grounding in permafrost, ground freezing for soil stabilization and sampling of loose cohesion less sediments, and use of freeze-separation to clean up contaminated waters.



David C. Sego, PEng, PhD

Dr. Sego is a Professor Emeritus in the Department of Civil and Environmental Engineering at the University of Alberta, Edmonton, Alberta. His industrial experience and research interest focus on the behavior of saline and non-saline permafrost, and special problems with foundations in saline permafrost. He has directed extensive research studying the interaction of offshore Arctic structures and sea ice. Recently he has undertaken research into dewatering of mine wastes using freeze-thaw and separating contaminants from industrial wastewater using spray-freezing technology. He also has directed industrial projects and research directed at using artificial ground freezing.

General Information

Fees Cover five full days of instruction, course notes, textbook, list of references for further study, break refreshments and lunches. Fee does not include lodging or other meals. We do not publish proceedings, and due to copyright laws, course materials are not available for resale after the course.

Cancellation We strongly encourage enrollment in advance as enrollment will be limited and course conduct is also predicted on adequate enrollment. If you cannot attend once enrolled, please notify us immediately. Cancellations will be accepted up to November 1, 2018. After that date you may substitute another person to take your place at the course. This is a limited enrollment course and "no-shows" will be billed the full amount if they have not cancelled prior to November 1st.

Payment Please forward your cheque made payable to The University of Alberta with your registration form. MasterCard, American Express and Visa are also accepted for payment of fees.

Upon receipt of payment your registration will be confirmed by email or fax.

Enrollment Options Enrollment in advance by phone or email is recommended before November 8th, 2018 (Fee \$2,300). After that date, enrollment is available with an additional fee of \$400. If inadequate enrollment is not received by April 21, 2017, the course will be cancelled and payments refunded. Be sure you receive our confirmation before the course or call 780-481-5425. Course participants will receive a copy of O.B. Andersland and B. Ladanyi's book published in 2003. Students will also receive a two-CD set of presentations made at the **Permafrost and Arctic Geotechnology Symposium – Our Canadian Legacy** held November 15 and 16, 2004, in Calgary, Alberta.

Course Location and Accommodation This course will be held in the Donedeo ICE Building located at the University of Alberta.

Campus Tower Suite Hotel: Reservations call 1-800-709-1824 or (780) 439-6060. Inform the reservation specialist that you will be attending the University of Alberta Permafrost Engineering Short Course. 1 Bedroom Superior: \$179.00 + tax. Parking available at \$18.00 + tax per day.

Lister Hall Conference Centre: Reservations call: (780) 492-6056. Inform the reservation specialist that you will be attending the University of Alberta Permafrost Engineering Short Course. New hotel style room: \$109 + tax. Parking available at \$15.00 per day.

Varscona: Reservations call: (780) 434-6111. Inform the reservation specialist that you will be attending the University of Alberta Permafrost Engineering Short Course. The standard rooms are available at \$185 per night. Complimentary parking, deluxe breakfast buffet, evening wine & cheese tasting (except Sunday), Wi-Fi and 24-hour access to Fitness Centre & Business Centre.



The UofA Geotechnical Centre



Phone: 780-481-5425



Mail to:
U of A Geotechnical Center
(Permafrost Short Course)
University of Alberta
Civil & Environmental Eng.
6-201 Donadeo Innovation Centre for
Engineering
Edmonton, Alberta T6G 1H9



Email: sally.petaske@ualberta.ca

Enrollment Form

Course Information

Please enroll me in **Permafrost Engineering**

November 29 – December 4, 2018, in Edmonton, Alberta

Fee: (November 8th, 2018): \$2,300.00

(after November 8, 2018): \$2,700.00

Registration Information:

Name: _____

Company: _____

Address: _____

City/Prov./Postal Code: _____

Telephone: _____ Fax: _____

E-Mail: _____

Credit Card Number _____

Name of Cardholder _____

Billing Address: _____

City: _____ Prov: _____ Postal Code: _____

Expiry Date _____ CSV Code: _____