



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

[www.v-g-s.ca](http://www.v-g-s.ca)

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## NOTICE OF UPCOMING TECHNICAL PRESENTATION

**THURSDAY, FEBRUARY 06, 2014**

**SUBJECT:**                   **Critical State Soil Mechanics: 125 years of history to current engineering use**

**SPEAKER**                   **Mr. Mike Jefferies, P.Eng.**  
**Golder Associates**

Mike is a civil engineer with 35 years of experience, mostly in consulting but ten years of that with “owner” companies. It was this ten years with owners, and in the Canadian Arctic with Gulf Canada Resources in particular, that provided an enormous opportunity to “push the envelope” and which led to the most significant of his contributions to engineering (or, more accurately, engineering science).

A keynote speaker at international conferences on Arctic offshore engineering, hydraulic fill construction, and liquefaction, Mike has published some seventy-five papers ranging across ice loading of offshore platforms through to rock fracture grouting. But he is generally most known for the state parameter approach to soil characterization – an approach that has become one of the most cited innovations of the past twenty-five years of geotechnical engineering.

The state parameter work led to an invitation to write a book on soil liquefaction, now sold-out with a second edition pending. As will be evident from a quick glance at the book, Mike is an exponent of the heresy that geotechnical engineering must be based on applied mechanics, not geology, and that the critical state is fundamental, readily measurable, unique, and something every geotechnical engineer should appreciate.

**CONTENT:**                   There is a widely held perception that ‘critical state soil mechanics’ relates to a particular model of soil behaviour put forward by Cambridge University: “Cam Clay”. This perception is wrong on many counts. This talk will discuss the history of the framework – which starts in 1885 – stepping through all the key developments. Perhaps surprisingly, the mechanics owe at least as much to Cambridge, Massachusetts as Cambridge, England. This is not a trivial historical point as the Cam Clay model contains unnecessary idealizations that limit its ability to replicate real soil behaviour. The talk will move from history to a proper representation of the fundamentals of soil behaviour as captured in the NorSand model; it is also not a case of A vs B, as the Cam Clay framework remains as a special case of NorSand – that is, generalization allows us to move forward without abandoning things that have proved insightful. Of course, the finer points of theoretical soil mechanics is not much use to practical geotechnical engineers... the talk will therefore extend to consider how the understanding from general critical state theory (the state parameter approach) can be used without much more testing than good, current practice and its implementation within the FLAC modelling platform to allow simulation of leading edge geotechnical analysis (illustrated by examples from current projects). A

particular feature of this talk is, that while the intellectual framework has been effectively a US/British university collaboration, it was Canadian consulting experience that provided the breakthrough to move the framework from intellectual curio to practically useful/important.

The talk will be in two parts. The first part – slightly more than an hour - will be of general interest as a synthesis of the history underlying everyday consulting practice (unappreciated as it may be...): very much “the ideas” not “the math”. After a short break, the second part – also of about an hour - will be for aficionados of the subject and discuss using critical state soil mechanics within practical consulting including: numerical integration of the equations (an Excel worksheet will be provided, so download the attached file and bring your laptop); needed aspects of laboratory testing; evaluation of insitu state from SCPTu; and, using NorSand within FLAC. Senior Principals should find the first part interesting and are anticipated to direct their younger engineers to stay for the second part...

## **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:**

- Part 1: 6:30 to 7:40 pm: Critical State Soil Mechanics
- Break, People that cannot stay can leave
- Part 2: ~7:50 to ~9:00 pm, Details on NorSand and implications in practice

**Dinner:** No Dinner is scheduled.