Advances in Geotechnical Limit Analysis and its Practical Application in Limit State Design

The Department of Civil and Natural Resources Engineering at the University of Canterbury is offering a ½ day seminar detailing recent advances in geotechnical limit analysis and their practical application to limit state design.

The seminar will cover the different methods currently available for geotechnical limit analysis, including DLO – a powerful new analysis technique co-developed by the seminar presenter, Dr Colin Smith. The DLO-based LimitState:GEO software will be used during the seminar to illustrate the points being made.

4th June: Christchurch
University of Canterbury, 2nd Floor, Commerce Building, The Coppertop (Room 220)

8th June: Auckland
University of Auckland, Faculty of Engineering, 20 Symonds Street, (Room 403.401)

Presenter
Dr Colin Smith
Senior Lecturer, University of Sheffield UK
Visiting Erskine Fellow, University of Canterbury
Director, LimitState Ltd UK
Background

Computational limit analysis methods now allow the engineer to directly and straightforwardly determine the collapse (or ultimate limit) state for any geotechnical problem geometry without having to resort to conventional incremental methods, such as Non-Linear Finite Element Analysis (NLFEA).

At the same time there is a general shift towards the adoption of Limit State Design (LSD) principles, which explicitly require determination of the ultimate limit state (ULS). This is exemplified by the fact that, during the next 12 months, geotechnical Limit State Design is due to be implemented throughout Europe via the adoption of the ‘Eurocode 7’ code of practice.

This ½ day seminar will outline the latest developments in the geotechnical application of computational limit analysis and design. Available computational limit analysis methods will be discussed, including the powerful new numerical analysis procedure, Discontinuity Layout Optimization (DLO) which was recently co-developed by the presenter at the University of Sheffield, and is now incorporated within the LimitState:GEO commercial software application. (see: www.limitstate.com/geo)

Throughout the seminar, collapse mechanisms for a wide variety of geotechnical stability problems will be used to emphasize the points being made. The broad applicability of computational limit analysis will be illustrated through practical examples, including bearing capacity, slope stability, retaining structures and reinforced soils, together with applications involving soil mechanics, rock mechanics, and seismic loading.

The practical use of computational limit analysis in limit state design will also be addressed with reference to the key principles embodied in Eurocode 7 and the change in design philosophy that this brings.

Attendees will receive a bound copy of the presentation slides and copies of relevant publications.

Who should attend?

The seminar will be of interest to practicing geotechnical engineers and designers, and to researchers and educators who wish to update themselves with the state of the art in Computational Limit Analysis and the move to Limit State Design.

Seminar objectives

After the seminar, participants should:

- Gain an understanding of the various limit analysis methods available, including discontinuity layout optimization (DLO), and their range of applicability.
- Appreciate the changes in philosophy between existing design codes and Limit State Design (LSD) codes such as Eurocode 7.
Programme

13:00 – 13:15  Registration

13:15 – 14:30  Lecture 1 - Computational Limit Analysis in Geotechnics:
   - Introduction
   - Background to Limit Analysis
   - Computational Limit Analysis: available methods FELA, MOC, DLO
   - Limit analysis – parameter sensitivity and analytical validity
   - Practical examples (I): bearing capacity, slope stability, retaining structures

14:30 – 15:00  Coffee / Tea break

15:00 – 16:15  Lecture 2 - Application to Limit State Design:
   - Ultimate Limit State design to Eurocode 7
   - Factors of safety and overdesign factors
   - Partial factors, application to actions, resistances and materials
   - Advantages and disadvantages of the different Eurocode design approaches
   - Practical examples (II): reinforced soils, rock stability, seismic loading

16:15 – 16:45  Summary and discussion

16:45 – 17:00  Closure

Registration

The seminar fee is $56 GST (incl). The registration fee will cover notes and refreshments. To book a place, please fill out the accompanying registration form and return it to:

F:  03-3642-758
E:  Catherine.OShaughnessy@canterbury.ac.nz

About the presenter

Dr Colin Smith graduated from the University of Cambridge with a first class honours degree in Engineering in 1987. He joined the Cambridge Soil Mechanics research group in the same year and completed a PhD in 1991. Following 2 years as a research associate at Cambridge he then joined the University of Sheffield in 1992 where he is now a Senior Lecturer. He currently holds a Visiting Erskine Fellowship with the Geotechnical Research Group at the University of Canterbury, Department of Civil and Natural Resources Engineering.

He has lectured on the principles and application of Eurocode 7 for the past 10 years, focusing both on the functioning of the code and the changes in philosophy from preceding design codes. His research and consultancy work encompasses theoretical and numerical limit analysis techniques in geotechnics, combined with physical modelling work on soil structure interaction. He is the co-developer of the novel Discontinuity Layout Optimization (DLO) numerical limit analysis technique and is the author or co-author of over 65 research papers, reports and book chapters. He was a recipient of the 2007 Institution of Civil Engineers’ Baker Medal and sits on the Editorial Advisory Panel of Geotechnique.

He is also a Director of LimitState Ltd, a company he co-founded in 2006. The company specialises in the development of novel ultimate limit state analysis and design software applications which make use of research methods developed in the University. This notably includes LimitState:GEO which will be used during this seminar.