

Report from Czech and Slovak Society (CSS)

Czech and Slovak Society for Soil Mechanics and Geotechnical Engineering



Prague Geotechnical Days is an event organized every year jointly by the Czech and Slovak Society of ISSMGE, Czech Academy of Science, and Arcadis CZ Ltd. A part of Prague Geotechnical Days is Prague Geotechnical Lecture.

In 2014, the 22nd Prague Geotechnical Lecture was delivered by Prof. Malcolm Bolton of Cambridge University, UK, entitled *Performance-based Design in Geotechnical Engineering*. This lecture argued that any assessment of geotechnical performance must involve ground displacements, and that the traditional approach of specifying safety factors is potentially wasteful or risky. Improvements were proposed through the adoption of Mobilizable Strength Design principles in which the designer explicitly considers the stress-strain behaviour of the ground. Malcolm Bolton thus demonstrated a new approach to slope stability analysis. The second application discussed in the lecture was the construction of deep excavations in soft to firm clay.

The part of Prague Geotechnical Days is a scientific seminar with different topic each year. In 2014, the title of the seminar was *Unsaturated soils in Engineering practice*. The seminar is composed of invited lectures only; in 2014, 6 invited lectures were presented. Unsaturated soils are subject to a broad research interest worldwide. Examples of situations where it is important to consider soil partial saturation at the design stage were introduced by David Mašín from Charles University in Prague, Czech Republic in his lecture *Unsaturated Soil Mechanics in Central European Climatic Environment*.

The next lecture, delivered by Prof. Eduardo E. Alonso from UPC, Barcelona, entitled *Modelling Earth and Rockfill Dams*. The crucial contribution of Unsaturated Soil Mechanics, described some key properties of compacted soils, typically those found in impervious cores of zoned earth dams or in homogeneous fills. Key aspects of the compaction-induced microstructure were outlined and a simple elastoplastic model capable of reproducing them was described. Conceptual deformation mechanisms of fine and coarse granular soils have been cast in terms of workable elastoplastic hardening models and then integrated into a general Thermo-Hydro-Mechanical finite element code (Code_Bright). This code was used in the analysis of a number of case histories involving the behaviour of dams. They were presented in the final part of this lecture. Model calculations were compared with monitoring results.

Some examples of the collapsible behaviour of unsaturated soils have been given by Prof. Pierre Delage, Ecole des ponts ParisTech in the Lecture *Some Geotechnical Problems Related to Unsaturated Soils and Multiphase Geomaterials*. Examples were given of problems associated with the natural loess deposit exposed to precipitation in northern France. Collapse response of the loess and collapse behaviour of the compacted material in the embankment confirmed the importance of properly controlling the possible future water exchanges the soil will be submitted to and the compaction characteristics of the materials used in compacted structures exposed to climatic effects.

In the contribution *Time Dependent Approach in the Assessment of Dikes and Levees* by Prof. Cristina Jommi, Delft University of Technology, the Netherlands, few case histories were presented, in which unsaturated behaviour of the construction soils was characterised, with the aim to better analyse the response of the structure to time dependent hydraulic loads. Few case histories of water defence structures were presented, in which simple unsaturated hydraulic soil models were adopted to analyse the time dependent response to variable hydraulic loads. The results of these analyses confirmed that accounting for time dependent response allows for a more rational dyke assessment, and for possible substantial cost savings.

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Prof. Simon Wheeler, University of Glasgow, UK explained in the presentation *Unified Modelling of Plastic Compression in Unsaturated Soils* how the elasto-plastic constitutive model for unsaturated soil is able to predict the possible occurrence of plastic compression during loading, wetting and drying stress paths. In each case, it was linked to a physical explanation of the process involved. The constitutive model was used to simulate an experimental data set on silty soil which involved large plastic compressions during successive drying, loading and wetting stages.

Michal Snehota from Czech University of Technology in Prague presented *Experimental Investigation into the Water Flow in Near-Saturated Soils*. This contribution was mainly focused on results of extensive series of experiments conducted on undisturbed soil samples (Dystric Cambisol) of two different sizes. RPI experiments on larger samples ($7 \times 10^3 \text{ cm}^3$) were performed with concurrent monitoring of the fluxes, pressure heads (tensiometers), water contents (TDR) and tracer breakthrough (Br- and deuterium) during the RPI experiments. Smaller samples (approx. $1 \times 10^2 \text{ cm}^3$) were used to monitor internal processes during the same experiment by means of non-invasive methods of magnetic resonance imaging. The imaging has allowed visualizing and partly quantifying the bubbles of entrapped air. Internal structure of all samples was visualized by X-ray computer tomography.

A part of Prague Geotechnical Days is a presentation of shortlisted candidates for the Guido Zaruba award and the award ceremony. The price is awarded to young geotechnical engineers and engineering geologists (up to 36 years of age) to highlight special achievements in the discipline. Applications for both high quality research and outstanding solution of practical projects are accepted. The price has been established in 2001; for the year 2013 it has been awarded to Dr. Miroslav Brouček from Czech Technical University for the thesis entitled „Subsurface influenced by ground water flow“.

The second day of Prague Geotechnical Days is traditionally devoted to a discussion-stimulating workshop. The topic in 2014 was *What is wrong with Eurocode 7*. Discussion leader was Prof. Malcolm Bolton. He introduced the workshop with a lecture on Safety, Serviceability and Uncertainty. M. Bolton presented simple formulae for the displacement predictions of various geotechnical structures.

The contribution by Prof. Bolton was followed by Petr Koudelka, who spoke about *Two Weaknesses of EC 7-1: Ultimate Limit State and Earth Pressure Theory*. An acceptable simple solution for the Czech National Annex was mentioned and a new concept of a more reliable and less risky design theory was proposed. Obsolescence of an earth pressure theory of the EC 7-1Code was pointed out. The contribution briefly explained two suppositions of the theory from point of view of contemporary knowledge.

Jana Frankovská from Slovak University of Technology, in her presentation on *Partial Factors, Characteristic Values and Geotechnical Categories*, focused on geotechnical problems connected to soil characterization and presumed values of geotechnical parameters. Audience discussed the role and importance of testing and ground investigation for geotechnical design.

Martin Vaníček from Czech Technical University focused on *Eurocode 7 and Current Development towards the Second Generation*. The presentation was summarizing current works that are undergoing within the CEN TC250/SC7 committee in order to prepare a new generation of Eurocode 7. In particular, new structure of the code and subjects to be added which haven't been covered in the current version were discussed. Development regarding Reinforced earth structures has been presented in more detail. Prague Geotechnical Days were attended by over 120 geotechnical engineers from Czech Republic, Slovakia, Germany, Hungary, Poland, Serbia, Croatia and United Kingdom.

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Figure 1. Opening ceremony of Prague Geotechnical days 2014



Figure 2. The Seminar Unsaturated soils in Engineering practice



Figure 3. Quido Zaruba Award ceremony (Miroslav Broucek, Malcolm Bolton, and Jana Frankovska)

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Figure 4. Prof. Malcolm Bolton - 22nd Prague Geotechnical Lecture



Figure 5. Workshop introduction lecture by Malcolm Bolton

*Jana Frankovská, Chairman of the Czech and Slovak Member Society of ISSMGE (CSS SMGE)
David Mašin, Secretary of CSS SMGE*