

NEWSLETTER

# CREEP OF GEOMATERIALS



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EDITOR: PROF. GUSTAV GRIMSTAD



## FROM THE EDITOR

Prof. Gustav Grimstad, NTNU



The EU founded CREEP project (PIAG-GA-2011-286397) is now in its final year, and an interesting year it has been so far. The creep project reached a milestone when the final conference was held at

Chalmers in August. Secondments from academia to Deltares and NGI has been successful and in the academic sector, we are looking forwards to harvest from the research carried out in collaboration between institutions through these secondments. As we await the final technical reports and publications of the project, this newsletter focuses mostly on the events organized by the consortium in the last year. However, I can already share some great news on the frozen soil model. One: the model will become available with the next version of the finite element (THM) code of PLAXIS, released in 2016. Two: the research on frozen soil at NTNU will continue with the SAMCoT ([www.ntnu.edu/samcot](http://www.ntnu.edu/samcot)) project. The ambitious plan is in the end to make a model working for unsaturated frozen soils.

## CREEP IN THE PUBLIC



## THE SECOND CREEP SCHOOL

NTNU was the venue of the second creep school in September 2014. The school was again a great success and feedback from the participants were generally good. The school attracted 20 participants in addition to the six lecturers. Below the group picture, you will find the program for the school. We hope to offer the creep school also after the CREEP project. In such case, we hope to see you in 2016.



Monday the 15th:

Introduction: **David Muir Wood**

Creep in clay: **Hans Petter Jostad** – From “classical” to “current practice”

Creep in peat: **Cor Zwanenburg** – Motivation and explaining the current practice and the ongoing developments.

EVP modelling: **Zhenyu Yin**

**Gustav Grimstad** – Advanced creep models and some pitfalls in creep modelling

Tuesday the 16th:

**Gustav Grimstad** – Implementation and use of creep models

**Hans Petter Jostad** – Introduction to hands on exercise and finally student exercise in computer lab.

Wrap up: **Jelke Dijkstra**

If you did not attend and would like to learn more, the lecture notes are available through the CREEP website.

## JANUARY WORKSHOP

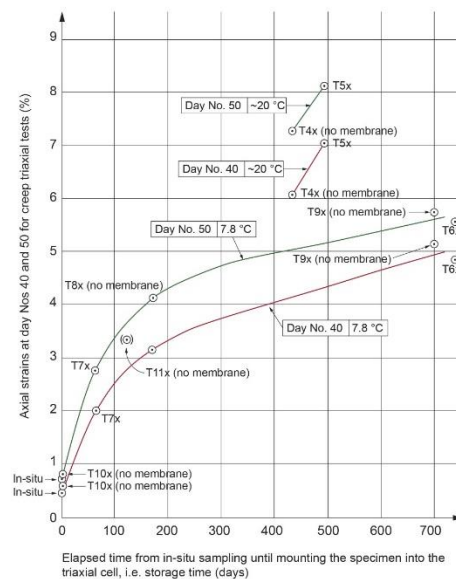
Prof. Hans Petter Jostad, NGI



The 8th of January 2015, the annual CREEP workshop (the third WS of CREEP project) took place at NGI in Oslo. The WS attracted 50 participants mostly from northern Europe and the Chinese partners.

The workshop consisted of an intensive program focusing most on soft clay. In addition, the progress on peat and frozen soil models were discussed. Several presentations were aimed at parameter determination and laboratory and field-testing. One interesting presentation on the Onsøy test fill regarding the effect of temperature and storage time in creep tests given by Toralv Berre (NGI) is highlighted here. This presentation gave us an important reminder that we are working on natural materials where distinguishing between “true” material behavior and “disturbed” material behavior is truly difficult.

All presentations from the Workshop are available on the CREEP website.



Effect of storage time and test setup for long-term tests (50 days) on Onsøy clay, compared to field data, Berre (2015)

## FINAL CONFERENCE

August 24th – 25th, Chalmers University of Technology hosted the conference on creep and deformation characteristics of geomaterials. The aim of the conference was to provide an international forum for presenting and discussing the latest developments in monitoring, analyzing and managing long-term deformations in geotechnical engineering. The conference aimed at active discussion on key topics facilitated through invited keynote lectures. In addition, the partners of the CREEP project presented some of the highlights of their research program, achieved through intense collaboration between industry and academia. The results included new numerical tools for modeling large boundary value problems, new rate-dependent constitutive models, and validation of boundary value problems using results from real field applications.

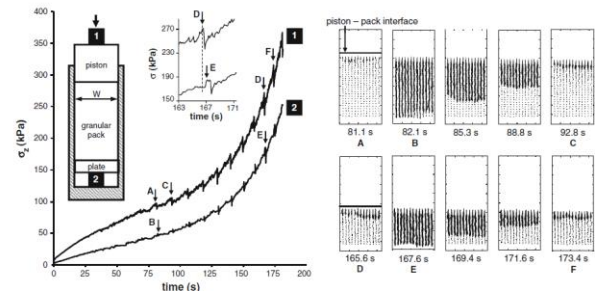
Keynotes speakers:

- Prof. Pierre-Yves Hicher (École Centrale de Nantes, France) – **Experimental study of viscoplastic mechanisms in clay under complex loading**

Prof. Hicher gave a nice start to the conference, building up from experimental evidence towards modelling principles. By performing relaxation phases at different level of stress reversal, he found evidence for necessity of a double kinematic hardening mechanism.

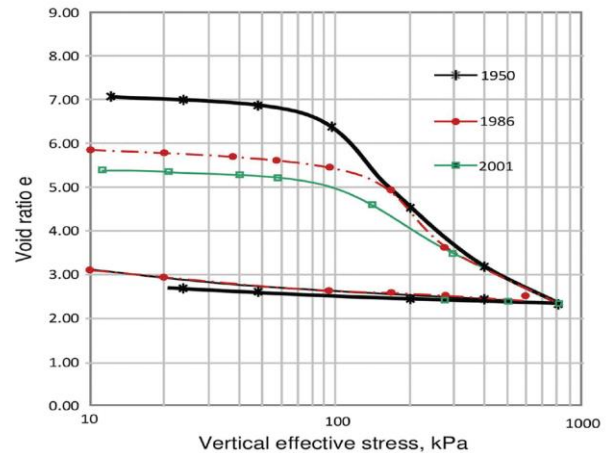
- Prof. Itai Einav (The University of Sydney, Australia) – **Material Creep, characteristic times, and patience**

This lecture created a lively discussion especially regarding the experiments on the periodic propagation of localized compaction in a rather special brittle granular material (i.e. Rice Krispy).



Stresses measured at opposite boundaries (labeled 1 and 2; left) and selected DIC vector fields (right) gathered during loading of a constrained granular pack with  $v = 1.27$  mm/s. (Valdes et al. 2012)

- Prof. Efraín Ovando-Shelley (Universidad Nacional Autónoma de México, Mexico) – **Creep effects on the clays from Mexico basin**



One-dimensional compression curves obtained from oedometric tests performed on samples retrieved from the same site and the same stratum at different dates. (Ovando-Shelley et al. 2007).

The presentation gave an impressive overview on the settlement related difficulties experienced in Mexico City. The total subsidence over the last 100 years in Mexico City, with respect to a reference point outside the lake zone, is now more than 8 m in some areas. Given that, the soils are geologically very young and are notorious for their extremely high water content and compressibility, the Scandinavians soft clays were almost “ashamed” of themselves.

- Prof. Kenneth Runesson (Chalmers University of Technology, Sweden) – **On the computational modelling of strain rate effects in high temperature alloys**

The last keynote moved the topic into the stiffer materials in the final two sessions (frozen soils, stiff clay and rock). Prof. Runesson looked at things from a slightly different perspective coming from the alloy technology side. We hope that his keynote inspired the young researchers to take a step backwards and look into the fundamental building blocks in the models for geomaterials.



Research fellow J.-P. Gras (Chalmers) presenting his work on parameters describing soil structure and anisotropy for CREEP-SCLAY1S



To sum up the conference was a great success and offered an arena for lively discussion and learning

environment due to its cross field/material creep related presentations (ranging from peat to alloys).

For more details on the conference and the presentations:

The proceedings will be public available through Chalmers publication system, as will all the presentations through the creep website.

Based on the four pages extended abstracts that you will find in the proceedings, the committee plan to nominate some of the presenters to write a full article for a special issue of the European Journal of Civil Engineering. The papers will subject to a separate peer review.



INTERNATIONAL  
CONFERENCE  
**ON CREEP**  
AND DEFORMATION  
CHARACTERISTICS IN  
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24-26 August 2015,  
Gothenburg, Sweden



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## UPCOMING EVENTS

The sixth International Symposium on Deformation Characteristics of Geomaterials, from November 15 to 18<sup>th</sup> in Buenos Aires [International Society of Soil Mechanics and Geotechnical Engineering (ISSMGE), Technical Committee TC 101]. In the creep session, we will present several of the project results to the geotechnical society.

As the project moves into a final dissemination phase, Reports and Publications will become available.

**For more information please visit us at:**

<http://www.ntnu.edu/creep>