Rock Mechanics Laboratory (LMR)
GCB (Ecublens) CH- 1015 LAUSANNE
: 021 - 693 23 25 TÉLÉFAX: 021 - 693 41 53
http://lmrwww.epfl.ch/lmr_f.html; e-mail: lmr@dgc.epfl.ch

ÉCOLE POLYTECHNIQUE
FÉDÉRALE DE LAUSANNE

Time dependent rock behaviour

The effect of time is rarely taken into account in the design of civil engineering projects. However, in the case of cavities and tunnels in rock masses, it is well known that convergences in unsupported openings or pressure on supporting structures continue to increase well after the end of construction and may bring about considerable operating problems, and even may endanger the stability of the structures.
Recent progress in numerical computing and calculation methods, finite element or others, permit the prediction of the time dependant evolution of underground structures if the rheological law of the materials used is known with precision.
In this connection, and in the framework of a CERS project(1) directed by the LSC(2) of the EPFL in collaboration with various private Swiss partners, the LRM is carrying out a study with a first aim of defining a creep law for marly rocks whose time dependent deformation potential is great.

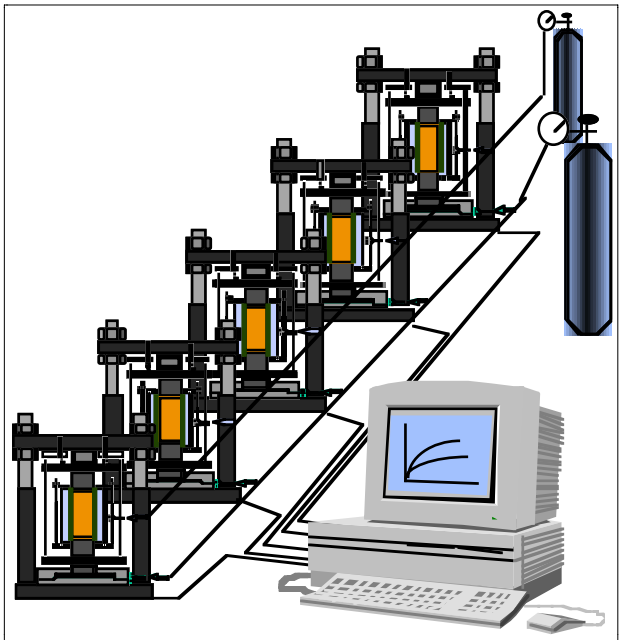

Fig.1 *Test set-up perfected by the LRM to carry out 5 simultaneous identical triaxial creep tests.*

The complexity of this problem is caused by the diversity of the causes which may be at the origin of time dependent deformations. Phenomena linked to water, such as consolidation or swelling, on the one hand, and creep, on the other, which may itself be due to various phenomena (skeleton viscosity, fill material viscosity, particle rearrangement, decrease in the mechanical characteristics, generation and propagation of microfissures) may be cited.
The experimental study carried out at the LRM has a principal aim of describing the creep behaviour of rocks. A highly efficient experimental set-up was developed (Figure 1). Its main characteristic is the ability to carry out 5 simultaneous triaxial creep tests under rigorously identical conditions (with confining stress). The checking of solicitations, data logging and reduction are carried out automatically by computer.

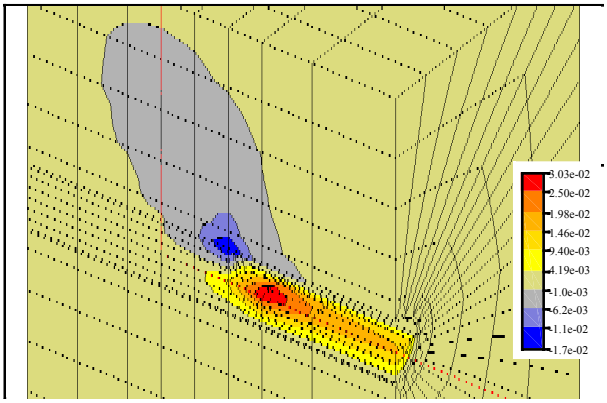

Fig.2 *Convergences during tunnel excavation Example of a simulation with Zsoil.*

Several laws are included in the finite element code ZSOIL[3] and have been verified using in situ measurements from real constructions (Figure 2).

(1) Commission pour l'Encouragement de la Recherche Scientifique.

(2) Lab. de mécanique des structures et milieux continus

(3) Prog. ZSOIL developed by Zace Services Ltd.

Publication

Kharchafi M., Descoeudres F., 1995. Comportement différé des roches marneuses encaissant les tunnels, *Colloque Craies et Schistes,* GBMR, Bruxelles, pp.1.2.58-1.2.67.

MK / May 1997