In-situ shotcrete test stand

date: 06/2008

HIGHLIGHTS

- Fast erection and simple commissioning
- Start testing 2-4 hours already after preparing the samples
- Test procedure under in situ conditions
- Low space requirement and no interruption of construction work

Test stand and specimen in a tunnel

Field of Application

The testing equipment serves to determine all the parameters required for the calculation of the stress in the shotcrete, as determined by measurements of deformation of the shotcrete. Shotcrete is one of the most important construction elements of the New Austrian Tunnelling Method (NATM). Determination of the stresses in the shotcrete shell is indispensable when using the observation method and for comparison of the actual loads on the shell to calculated loads.

Formwork for making the specimen (left) and for the shrinkage test (right)

Sotcrete has complex material characteristics with elastic, viscose, visco-elastic, shrinkage and temperature dependent components. The time-dependent strengthening is a function of the history of loading by the surrounding soil or rock. The shotcrete shell generally reaches its maximum loading and therefore lowest safety margin at a distance from the working face of one to five tunnel diameters.

It is necessary to know the material characteristics of shotcrete to realistically compute the stresses from deformation measurements. The rate of flow method is the most demanding among the various known methods. A common factor in all the methods is that they require certain parameters for their calculations. The measurement of these parameters under in situ conditions should start as soon as possible after the shotcrete has been applied (approx. 2 – 4 hours).

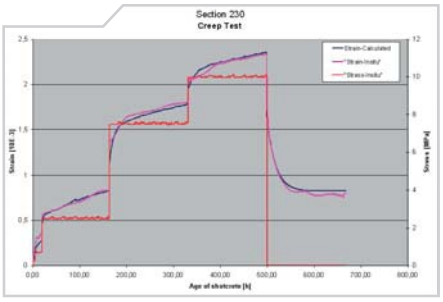
In-situ shotcrete test stand

Principle of Operation and Procedure

A computer-controlled hydraulic cylinder applies pressure to a specimen. The stress curve is in accordance with an expected degree of utilisation of the shotcrete of 50 – 70 %. A formwork which is incorporated in the shotcrete shell separates the vertical areas from the surrounding shotcrete, forming a defined sample shape of 200 x 200 x 400 mm.

The test generally takes 28 days, during which the applied stress, the compression of the sample and the concrete temperature are continuously measured. Complementary to this, the shrinkage is measured on two samples that are not stressed.

The measured relationships between stress, compression, temperature and shrinkage form the basis for subsequent determination of the parameters for the shotcrete.



Evaluation-diagram

Technical Specification

Maximum force	1.000 kN
Lift	50 mm
Test duration	Short period up to 28 days
No. of load application levels to be pre-set	8
Accuracy of controlling the force	< 0,5 % FS
Data storage	20.000 measurements (date/time, load, 3 strain values, temperature)
Measuring range for the strain measurement	4 %
Sensitivity of the strain measurement	1,5 µm/m
Data transmission	via PC/Notebook, EXCEL compatible file format

Test set-up with hydraulic cylinder and displacement transducer on specimen