

Deformeter / Curvometer

Deformeter

The Deformeter is a mechanical extensometer with a base length of 500 mm. It is made up of two parallel rods which transmit the relative movement of the measuring bolts through support balls to a dial gauge.

The rods are made of invar steel and are constructed to self-compensate for temperature changes.

The handles of the instrument are placed at the same level as the support balls. In this way bending effects from handling and errors in readings are virtually eliminated. The reproducibility of readings in the field is ± 0.002 mm.

A calibration unit, also made of invar steel, allows zero-point calibration at any time.

Curvometer

The Curvometer measures the change in curvature (see F in first diagram on the following page) of a straight or curved structure at a given point.

The device consists of a rigid triangular frame with a mechanical dial gauge which is placed at the center point.

The high rigidity of the frame and the use of invar steel eliminate unwanted deformation which is caused by the handling of the instrument and by non-uniform temperature changes.

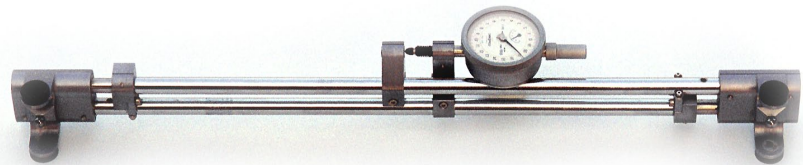
The reproducibility of measurements in the field is ± 0.002 mm.

The measuring bolts

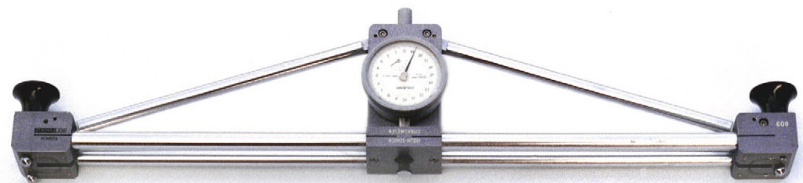
The measuring bolts are made of stainless steel.

For Deformeter readings, two bolts are fixed onto the structure 500 mm apart. With additional bolts, a measuring profile can be monitored.

Two mechanical instruments for in-situ measurement of strain and change in curvature on rock, concrete or steel lining



Deformeter



Curvometer

The Curvometer rests on three measuring bolts, one located at each end of the instrument and one in the middle. The Curvometer measures the distance F (see first diagram on following page) to the middle bolt. The two end bolts have to be adjusted in such a way that the middle bolt is in the mid-point of the measuring range.

Two types of Curvometer bolts to match the curvature of the different structures can be supplied.

The same bolts can be used for mounting the Deformeter.

Installation of the bolts

For both instruments the end bolts are installed at a distance of 500 mm. The third Curvometer bolt is mounted in the middle between the two outside bolts.

The bolts are welded onto steel structures or are fixed with special glue or fast

hardening cement mortar onto concrete, rock or shotcrete.

To protect the bolts from damage, 75 mm diameter protection rings can be supplied.

Data processing

With the Curvo- and Deformeter, curvatures and displacements on the surface of structural components are measured. From these measurements the stress can be calculated. Further numerical analysis leads to the determination of the loading. Other applications of the Curvo- and Deformeter are measurements of tensile and compression strain on supporting beams, struts or columns of structures. Numerical analysis of these measurements provides the normal forces and the moment which affect the structure.

Monitoring

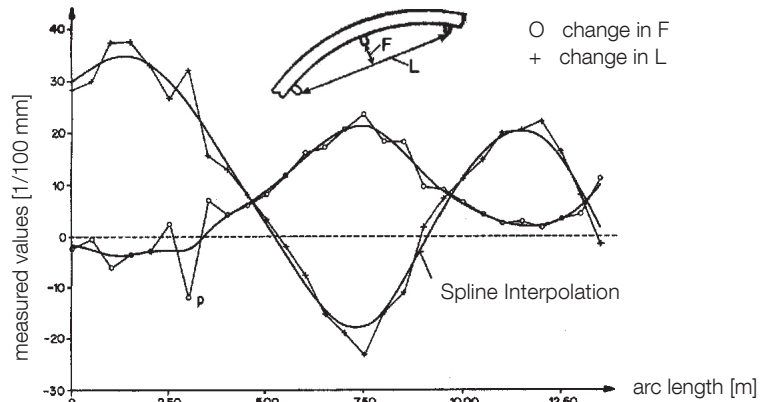
Monitoring of cracks in structures, such as concrete pavements, slabs, tunnel linings, joints or faults in rock with the Deformeter and the Curvometer provides useful information of the spatial behaviour of the structure.

The measuring bolts can be positioned in such a way that the behaviour of the structure can be monitored in one, two or three dimensions.

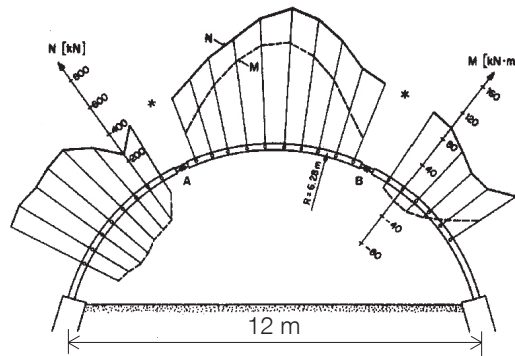
List of items

- Deformeter with calibration unit in carrying case
- Curvometer with calibration unit in carrying case
- Measuring bolts for the Deformeter (Curvo-, Deformeter bolts) and for the Curvometer (Curvometer bolts) to be used on steel or rock, concrete, shotcrete
- Drilling template for strongly curved or rough surface
- Optional: Digital readout unit with printer and data recorder

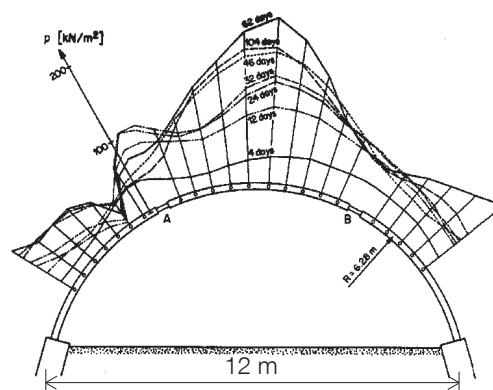
Applications of integrated measuring technique Gotthard Road Tunnel KM 4.330 (Switzerland)



Distribution of the measured values f and l along the arch after 46 days



Distribution of moment and normal force along the steel support checked by N-Q load cells at points A and B (asterisk) after 46 days



Distribution of rock pressure along the steel support for different readings

Solexperts AG

Mettlenbachstrasse 25
P.O. Box 81
8617 Mönchaltorf
Switzerland
Tel +41 (0) 44 806 29 29
Fax +41 (0) 44 806 29 30
info@solexperts.com
www.solexperts.com

References:

- KOVARI K., AMSTAD CH., GROB H.: Displacement Measurements of High Accuracy in Underground Openings, Proc. of 3rd Congress of the Int. Soc. for Rock Mechanics, Denver, 1974.
- KOVARI K., AMSTAD CH., FRITZ P.: Field Measurements in Rock Mechanics, Federal Institute of Technology, Zurich, April 4–6, 1977.
- KOVARI K., AMSTAD CH., FRITZ P.: Integrated Measuring Technique for Rock Pressure Determination, Federal Institute of Technology, Zurich.