Shotcrete Strain Meter SSM-1

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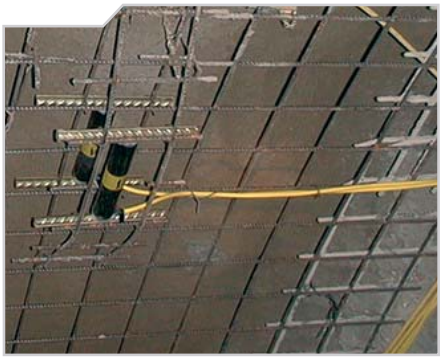
HIGHLIGHTS

- Fast installation and read out
- Reference measurements directly after shotcreting
- No errors due to shrinkage
- Large measuring range thanks to DMS
- Continuous and automatic recording of measurements possible



Strainmeters installed in pairs

Einbau von Dehnungsgebern in der Kalotte

Field of Application

Concrete strain gauges are particularly useful for the identification of compression and strain in shotcrete. The stress and shear forces can be calculated from the measured displacements, based on the stress-strain relationship and the appropriate material characteristics. Underground construction is a significant area of application for concrete strain gauges.

Especially the ongoing monitoring of the shotcrete loads and the subsequent optimisation of the support are indispensable preconditions to efficient and safe tunnel construction. Strain measurements are in addition often used for long-term monitoring of the inner shell of tunnels.

Principle of Operation

Two parallel steel bars, embedded in the shotcrete at a defined distance to each other, distort a central tube when they move relative to each other. This distortion corresponds to the mean compression or elongation of the concrete in between. The distortion is measured by strain gauges. The full bridge strain gauge signal is transmitted to a data acquisition system via a 6-conductor cable.

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Data Acquisition

The data can be read via a portable manual readout-unit or by an automatic data acquisition system. The measured strains in mm/m can be converted to approximate stresses using suitable material characteristics. For this purpose, either existing material parameters for comparable shotcrete mixtures can be used, or the parameters can be determined by special tests.

Apart from long-term tests in a laboratory, tests can also be performed in an in-situ shotcrete test-stand. Using the analysis software, the strains and stresses as well as the torsion and axial forces (if the gauges are arranged in pairs) can be depicted graphically, referenced to the cross-sectional area and as a function of time. The extended flow rate method on which this calculation is based has been implemented in the software.

Taking readings in a measuring section

Technical Specifications

Transverse bars	
Material	Tenax Tx 55, galvanized
Length	200 mm
Diameter	16 mm
Centre tube	
Material	aluminium
Length	160 mm
Diameter	12 mm
Thickness of wall	1 mm
Coefficient of thermal expansion	23 x 10-6 1/K
Strain gauges	
Material	Polyamide
Circuit	fully bridged, 6-conductor technique
Measuring range	+/- 8.000 µm/m
Measuring uncertainty	< 2 µm/m
Nominal resistance	350 Ohm
Coefficient of thermal expansion	23 x 10-6 1/K (temperature characteristic matched to aluminium)
Effective bridge excitation voltage	2 V

The following other data sheets are associated with this data sheet:

Services:	*Geotechnical Monitoring - Installation, Data Acquisition and Evaluation*
Software:	*KRONOS Tunnel Information System*
Systems:	*DAMOS - Automatic Data Acquisition System*