TELEMAC

Mining - Application Note







MINING INSTRUMENTATION & SITE SAFETY MONITORING

PROJECT MANAGERS, DESIGNERS, CONTRACTORS AND OPERATORS ALL AGREE UPON THE NEED FOR A WELL-PLANNED MONITORING, ADAPTED TO EACH INDIVIDUAL EXCAVATION

Monitoring plays an important role in every stage of a mine exploration and operation. It is used to accurately assess geological conditions and quantify certain parameters over time as well as monitoring their rate of change.

At the design phase the use of testing equipment (Laboratory or In-Situ) can determine the geotechnical characteristics of an ore body and surrounding rock mass.

Monitoring is used to accurately evaluate the geological conditions as the excavation progresses. Design hypotheses can be confirmed, the needs of the support structures defined and the optimum moment for instrument installation in accordance with convergence-confinement (NATM) methods can be determined.

References

- Noumea Mine - New Caledonia , 2015
- Block caving in gold mine - Australia , 2015
- San Juan Coal Mine – USA Mine - Peru , 2014
- Bioleaching project in Chile - Chile, 2011
- Esperanza 154 km pipeline leak detection - Chile, 2010
- Olap - Chile , 2013
- Sierra Gorda - Chile , 2013
- Collahuasi Dam - Chile , 2013
- EBPEIII FO Bio Lixiviation - Chile , 2011
- Landfill monitoring project - Chile , 2010
- Ancoa-Linares - Chile , 2010
- Laguna Seca - Chile , 2010
- San Juan Coal Mine - Usa, 2010
- Shur River Tailing Dam - Iran , 2009
- Sar Cheshmeh Tailing Dam - Iran , 2008
- Goro Nickel - New Caledonia , 2006
- Sufco Mine - Usa, 2006
- Kennecott Mine - Usa, 2005
- Mauro Dam - Chile , 2005
- Mines de Potasse d'Alsace- France
- Doyon – Canada
- Kolar Gold Fields – India

MINING INSTRUMENTATION & SITE SAFETY MONITORING

Once the underground mine is in service, long-term monitoring ensures the safety of the access shaft gallery operation over its life span.

In the case of an open pit, as the excavation progresses, the slope stability could be affected creating potential failure. It is therefore necessary to closely observe its behaviour and monitor over time.

Auxiliary structures such as tailing impoundments require a thorough assessment as well as continuous monitoring and control during sitting, construction and operation of the mine to insure the prevention of environmental disasters.

Well-planned and implemented monitoring is an essential component of successful mine construction and operation. Mine monitoring is subject to numerous regulations in many countries and this is adhered by strict administrative standards.

SELECTION CRITERIA FOR INSTRUMENTATION

Four major criteria guide instrument selection:

- Reliability of the measurements obtained (accuracy, resolution, precision and drift)
- Longevity of the instruments supported by numerous references
- Ease of readout automation, essential for efficient data collection and interpretation
- Features of Fiber Optic based instruments like their immunity to electromagnetic interferences and their intrinsically safe technology for coal mine application.

Smartec mine monitoring instruments respond precisely to these four criteria.

Monitoring involves numerous steps including direct or remote visual inspection as well as topographical measuring and instrumentation.

The scope of the monitoring methods employed depends on the potential risk associated with mine and site characteristics.

SITE ASSESSMENT

- Gallery geological conditions
- Access shaft structural behaviour
- Excavation and tailing impoundment stability

AUTOMATED DATA ACQUISITION AND PROCESSING

The collection and analysis of large quantities of data, especially over long distances, requires centralized and automated measuring techniques. Results are more accurate and data can be processed more rapidly thus enabling efficient alarm systems to be implemented when predetermined thresholds are exceeded. It is practically impossible to consider the instrumentation of a major excavation without automated data acquisition systems.



Smartec's SOFO VII / MUST allows data logging and can be readily connected to multi-node networks for real-time monitoring. The SOFO VII reading unit is a universal reading unit able to measure both SOFO (Interferometric) and MuST FBG (Fiber Bragg Grating) sensors. The system is designed for static, long-term measurements. Each channel can be software configured for one of the two technologies.

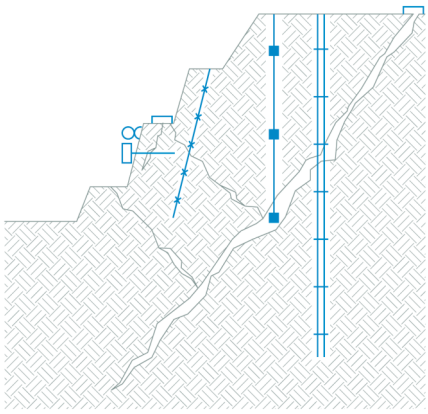


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OPEN PIT (MAINLY WITH ROCTEST PRODUCT)

Objectives:
- Ensure stability of excavation walls
- Monitor the integrity of adjacent structures, if applicable

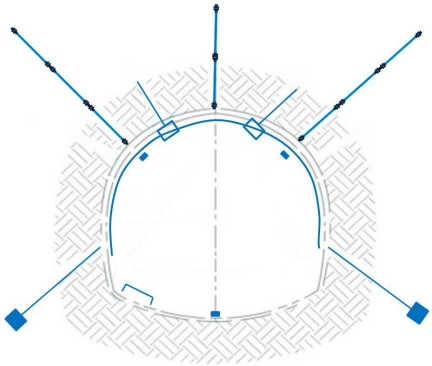
Measured Parameters:
- Load in anchors
- Lateral and vertical movement of the surrounding
- Cracks opening



UNDERGROUND MINE

Objectives
- Ensure the stability of the excavations
- Monitor the integrity of the gallery

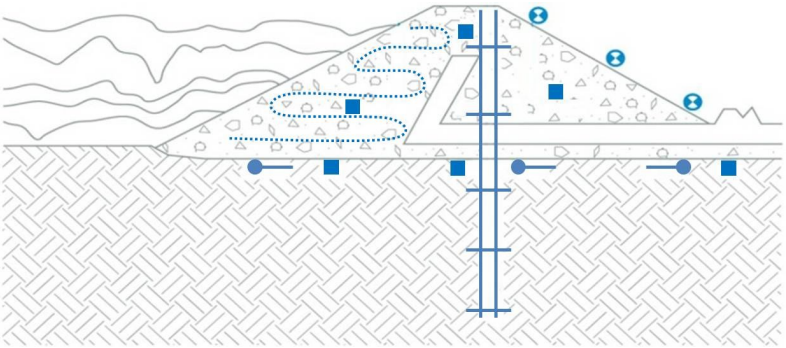
Measured Parameters
- Convergence
- Deformation of the rock mass around the excavation
- Stress of rock mass

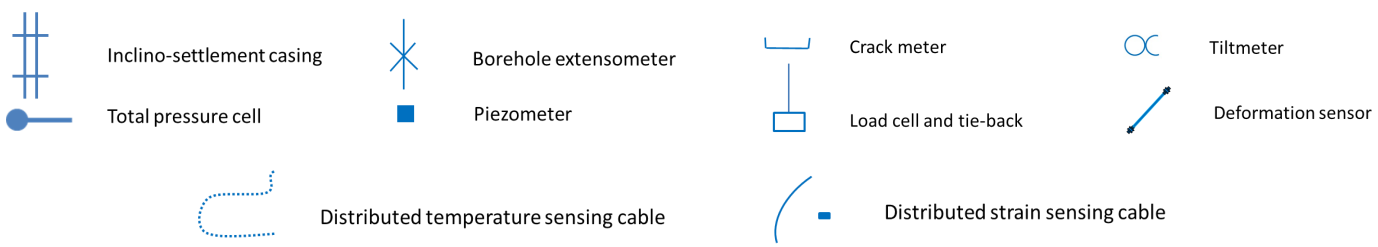


TAILING IMPOUNDMENT

Objectives
- Verify general stability of structure
- Ensure that infiltration does not create internal erosion (piping) which may have sliding effects or cause rupture

Measured Parameters
- Pore pressure within the foundation
- Seepage flow through the dam
- Total and differential deformation
- Lateral and vertical movement

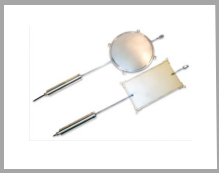




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Fiber Optic Piezometer
FOP Series



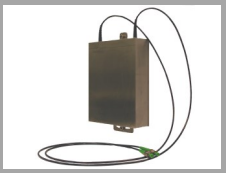
Fiber Optic Total Pressure Cell
TPC



Load Cells
VH, ANCLO, HYDLO



Long-base Extensometer
SOFO & MUST deformation gauge



MUST tiltmeter gauge



Inclinometer Probe
PROFIL



Fiber Optic Distributed Temperature System
DiTemp



Fiber Optic Distributed Strain System
DiTest

MINING INSTRUMENTATION & SITE SAFETY MONITORING

Smartec

Smartec belongs to Nova Metrix group and is the leading supplier of fiber optic solutions for geotechnical and structural instrumentation. Expert in all fiber optic technologies, Smartec proposes the best solution for any requirements.

Based in Switzerland, Smartec markets a new generation of products and services, developing, producing and commercializing structural monitoring systems, which are especially adapted to civil and geotechnical engineering, automotive, oil & gas industries and other demanding applications. We promote SHM to increase knowledge and decrease uncertainties about structural behavior, to improve safety and to optimize management. We cooperate with building owners, professionals and scientific communities.

Available Application Notes

- Mining instrumentation & site safety monitoring. Roctest ver.
- FO Leak Detection for Dams and Dikes
- Dam & Dike Instrumentation and Safety Monitoring
- Tunnel Instrumentation & Structural Health Monitoring
- Bridge Instrumentation & Structural Health Monitoring
- Building Instrumentation & Structural Health Monitoring
- Historical Monument Instrumentation
- Geotechnical and Structural Monitoring
- Nuclear Power Plant Instrumentation
- FO Movement Detection in Tunnels
- FO Leak Detection for Chemical Plants
- FO Leak Detection for Pipelines
- Storage Facility Instrumentation

Telemac SAS
10, avenuea Eiffel
77220 Gretz-Armainvilliers,
France

Phone +33 1 64 06 40 80
Fax. +33 1 64 06 40 26

Email info@telemac.fr
Web www.telemac.fr

Telemac SAS reserves the right to make any changes in the specifications without prior notice