Site Monitor 4D

Automated Slope Monitoring System

A state-of-the-art monitoring system using advanced laser scanning technology with powerful, simple-to-use software
Next Generation Management Tool for Slope Monitoring Systems

Focus on monitoring DATA not on monitoring SYSTEMS

There are different server options available:

1. Laser Scanner and SiteMonitor Software
2. GeoServer (All sensors and software)
3. CatchR only (Monitoring sensor and software)
SiteMonitor4D is a well-established monitoring solution which gives the user the ability to exploit the potential of laser scanning for measuring change.

**Key features:**

**Flexible**
- Used for monitoring large open pits, small satellite pits and volume measurements
- Portable self-contained system can be moved into areas of limited access
- Range up to 6,000m

**High Resolution**
- Measures a 140mm grid over a highwall every 30 minutes (at 1,000m range)
- Rapid and complete coverage of visible surfaces

**Accurate**
- Geo-referenced data, better than 10mm accuracy
- 140mm measurement footprint at the typical 1,000m range
- Automatic atmospheric correction

**Safe**
- Reflector-less measurements
- No requirement for prisms
- Monitoring possible through wire mesh and vegetation

**Simple**
- Automated operation
- Wizard based workflows
- Minimal training required
- Data easily exported into other software packages

“SiteMonitor4D gives us the opportunity to capture large scale data with little human interface. This gives us time to focus on the detailed information in a dynamic, fast moving, production environment.”

Frans Benade, Anglo American Platinum
SiteMonitor4D is a state-of-the-art system that measures and monitors the stability of rock faces and landslips.

Developed in partnership with mining surveyors and geotechnical engineers, it provides a simple to use, reliable solution that has the flexibility and performance to function in a wide range of monitoring applications.

SiteMonitor4D consists of two functional systems:

**Acquisition Module**

Designed for **Mine Surveyors** who are responsible for the accuracy and reliability of the measurements.

The module controls the scanner, collects the raw data and undertakes geo-referencing of the data. This is then sent via a remote link to a database in the mine office.

**Analysis Module**

Designed for **Geotechnical Engineers** to examine and analyse the monitoring areas, allowing them to make correct decisions quickly and decisively to prevent or mitigate any risk of slope failure.

Make critical decisions with confidence in real time

Safe, reliable operation in all weather conditions

Displacement overlain on photograph.

Melting snow apparent as -ve displacement can be removed.

Substantial movement rock face in this area.

Sections showing progressive movement.

Graph of displacement trend.
The SiteMonitor4D Analysis module creates a streamlined workflow for geotechnical and structural engineers.

Raw data cannot be interfered with at this stage and data integrity can always be preserved.

Data can be loaded locally or from a remote database via the internet.

A variety of tools are provided to inspect the data including:

- 2D and 3D visualisations,
- Horizontal and vertical cross-sections, and
- Range, displacement and displacement rate graphs.

A more detailed understanding of the slope movements can be gained using additional data (e.g. from weather stations or other monitoring systems) by incorporating them into the graphs.

Alerts can be emailed or sent via SMS (Text message) to the operators if movement is detected, an alarm is triggered, or an error occurs.
### Continuous Mode

In this scenario, the laser scanner would be set up in a protective housing, with a mains power supply and a stable pillar on which it can be mounted. A number of reflectors installed around the monitoring region(s) enable the Range Correction Factor (RCF) to be calculated and the stability of the scanner to be monitored.

If the scanner needs to be moved, the reflectors allow the monitoring project to be resumed at a later date.

Once a scanning schedule is defined, the software can run automatically without further operator intervention. All data is transmitted live to an office-based computer running SiteMonitor4D Analysis, allowing rapid evaluation by surveyors and geotechnical engineers.

### Periodic Mode

**Used in a number of scenarios:**

- The scanner can be removed between surveys if continuous monitoring of a site is not required
- The scanner may be removed between surveys for security or discretion

Following the quick setup of a monitoring project, subsequent data collection surveys can be carried out by simply setting up the scanner, scanning a number of control points (to provide an orientation and a range correction factor) and re-scanning the areas of interest.

Data gathered during periodic monitoring can be transmitted back to SiteMonitor4D Analysis on a remote link or downloaded by the operator when the field work is complete.

Two types of SiteMonitor4D installation:

- **Measurement Range:** up to 6000m
- All of the data collected by SiteMonitor4D is geo-referenced.
Global Monitoring Centre

3D Laser Mapping operates a Global Monitoring Centre to remotely monitor mining operations for an international network of SiteMonitor4D installations.

Monitoring data is continuously streamed to our Global Operations Centre where experienced support technicians scrutinise information to ensure each system is operating correctly and the data presented to the onsite engineers can aid and support critical decision making. Offering 24/7 remote support, our clients are confident in the quality of the data that is presented to them.

How It Works

SiteMonitor4D uses a different approach to conventional surveying methods;

A grid of points completely covering the area of interest is defined. These points, or nodes, do not need any kind of target - they are theoretical locations, defined only in the coordinate system of the scanner. When an area is measured, the scanner returns to each of the nodes and takes a range measurement.

All SiteMonitor4D systems incorporate scanners designed for the harsh mining environment. The modular nature of SiteMonitor4D allows the system to be configured according to the specific site requirements.

For large open pit mining operations, a range of up to 6km will be more important than speed of acquisition.

For smaller open pit mines and engineering works, a measurement rate of 122,000 points per second and accuracy up to 4mm will be preferable over long range performance.

No requirement for prisms

Careful planning of the SiteMonitor4D installation has been proven to improve the accuracy and repeatability of measurements over and above the manufacturer’s specifications for the laser hardware.

Management can check the status from any location with internet access.
3D Laser Mapping employ a team of highly technical, laser scanning experts with many years of experience in the mining industry.

Unrivalled Training and Support
Available to client’s world-wide. Dedicated training courses run throughout the year by our experienced engineers and on-site training can be arranged where required.

SiteMonitor4D User Community
Free to attend user conferences are held internationally and give clients the opportunity to listen to case studies presented by other SiteMonitor 4D users, share best practice with other industry professionals and have access to one-to-one support and advice.

Dedicated Website for Mining Professionals
Available with a secure site containing training resources, online support and industry news available to all clients.

System Audits and Consultancy
3D Laser Mapping offer clients the option to review their current slope stability monitoring systems and provide advice and recommendations on improved and dedicated solutions to fit the purpose.

World-wide contact details for sales and support

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