



## KEY FEATURES

- Automated, real-time monitoring system
- Dam safety monitoring
- Periodic deformation surveys
- Stability assessment in seismic areas

## Solutions for Safe Dams

### THE ROLE OF MONITORING

Dam safety monitoring is a worldwide statutory requirement. The long term performance of a dam is a necessary factor in the evaluation of dam safety.

Diurnal and seasonal effects, changes in hydrostatic pressure and related water seepage affect the health of dams.

Wall deflection, settlement and heaving, rate of water flow, seepage, temperature, vibration, stress, strain and other significant parameters require monitoring to detect changes in the performance of the dam.

Catastrophic dam failure will threaten life and property downstream. The safe functioning of a dam is an important matter of economic benefit and public safety.

### THE FOCUS OF MONITORING

Structural displacements, deformations, settlements, seepages, piezometric pressure within the structure and its foundation can be monitored by the system.

Seismic or micro seismic vibrations from operation, maintenance and construction activity may cause damage such as cracking of the structure or liquefaction of the dam foundation.

The early detection of potential failure of reservoirs and tailings dams which may dramatically impact the lives and economic activity of downstream communities is yet another monitoring objective.

### TRIMBLE 4D CONTROL

Trimble® 4D Control™ software is the key element of the Trimble Monitoring system. The modular design facilitates an industry specific solution, capturing data from GNSS, optical, geotechnical, seismic, and atmospheric sensors.

The data is processed using advanced, state-of-the-art algorithms, and presented in a powerful, yet user friendly Web Interface. It provides a variety of visualization and analysis tools to identify potential failure scenarios.

Information from different sensor types may be combined with displacement indicators like slope distance change, settlement or lateral movements to detect common failure modes.

A fully featured computation parser can be used to create customized observables presenting information of specific interest to the analyst.

Significant events such as overtopping, rapid water level changes and maintenance and construction activities may be logged and displayed on the charts.

Boolean comparators are used to integrate data from GNSS, optical, geotechnical, seismic, and atmospheric sensors to create complex alarm conditions.

Alarm notifications are issued by email and SMS to selected recipients and the system may also activate audible and visual alarms which may formed part of the mandatory emergency response procedures.

### DESIGNED FOR DEMANDING ENVIRONMENTS

The Trimble Dam Monitoring Solution is designed specifically for the dam engineer and the geotechnical, seismic and survey monitoring analyst.

Intricate data from multiple sensor types is converted into meaningful information from which informed decisions can be made with confidence.

The solution accommodates a smooth transition from periodic monitoring surveys using the Trimble Access™ software and Trimble 4D Lite software into complex automated systems using the Trimble 4D Control software.



### TRIMBLE NETR9® TI-M GNSS RECEIVER

A full-feature, top-of-the-line receiver with an industry-leading 440 channels for unrivaled GNSS multiple constellations tracking performance intended for monitoring applications.

### TRIMBLE REF TEK® STRONG MOTION ACCELEROMETERS

Powerful devices that measure the acceleration of motion of structures as well as subsurface monitoring of the ground.

### TRIMBLE ACCESS MONITORING APP

A monitoring module to guide surveyors through a step-by-step process that speeds up setup, data collection, reporting, and return visits to the same monitoring projects.

### TRIMBLE S8 TOTAL STATION

An advanced total station that combines Trimble FineLock™ technology with long-range distance measurement to provide fast and precise monitoring measurements.

### TRIMBLE 4D LITE SOFTWARE

A cloud-based web application designed with the same advanced web interface and back-end stability as Trimble 4D Control, with the advantage that this is available for the analysis of any form of data time series.

### TRIMBLE DiNi® DIGITAL LEVEL

A digital height measurement sensor for any job site where fast and accurate height determination is required.

#### NORTH AMERICA

Trimble Navigation Limited  
935 Stewart Drive  
Sunnyvale, CA 94085  
USA  
1-888-879-2207 (Toll Free)  
+1 720-887-6100 Phone  
+1 720-887-6101 Fax

#### EUROPE

Trimble Germany GmbH  
Am Prime Parc 11  
65479 Raunheim  
GERMANY  
+49-6142-2100-0 Phone  
+49-6142-2100-550 Fax

#### ASIA-PACIFIC

Trimble Navigation  
Singapore Pty Limited  
80 Marine Parade Road  
#22-06, Parkway Parade  
Singapore 449269  
SINGAPORE  
+65-6348-2212 Phone  
+65-6348-2232 Fax