

DAM OWNERS:

Without Satellite Data, You're Operating in the Dark



Until now, dam owners have had to rely on infrequent manual inspection and legacy monitoring techniques that leave them effectively operating in the dark. With the American Society of Civil Engineers (ASCE) giving over 91,000 US dams a D-grade rating for safety, and the estimated cost of rehabilitating dams whose failure would threaten human life currently at approx. \$45 billion, experts predict there will be a major incident costing human lives within a couple of decades. Despite this, many dam owners are still unaware of new continuous monitoring technologies, choosing instead to rely on infrequent manual inspections that leave them effectively operating in the dark.

Dam collapse is a very real danger and there is no room for complacency. The US, Laos, Brazil, Bulgaria and India are just some of the countries that have seen disasters, leading to loss of life and extensive damage. It is clear that dam owners must now make urgent decisions about which continuous monitoring technologies to implement, if they are to successfully reduce the risk of asset failure and optimise capital expenditure.

This article looks at the pros and cons of various traditional reservoir embankment and dam monitoring techniques, from an operational and risk prevention perspective. It also explores the most advanced monitoring solution of all: geospatial technology, which uses satellite data to help dam owners shine a light on what's happening between manual inspections, so that they can prevent potential failure.

Shining a Light on Monitoring Blindspots

MANUAL DAM INSPECTIONS

Most dam owners use in-person inspection teams to survey infrastructure. Theodolite surveys provide precise results and are still essential when following up on any flagged potential weaknesses, but need to be supplemented with continuous monitoring in order to avoid large data gaps between surveys.

Manual inspections usually require a minimum of two people per team, including a qualified chartered surveyor. This can prove to be very expensive, especially for dam owners with multiple assets or with infrastructure in remote locations. As a result, inspections can be infrequent, making it difficult for engineers to analyse trends or pick up on slight movements that could indicate weakness.

To compound the problem, many companies are losing knowledge as experienced engineers and site inspectors retire or move on. This loss of knowledge is a particularly dangerous trend when assets are at real risk of failure and higher rainfall is placing additional strain on infrastructure.

IN-SITU PIEZOELECTRIC SENSORS

Piezoelectric sensors, installed along the walls of the dam, measure slight movement and can be extremely accurate, providing very insightful granular data. However, sensor units are expensive, cannot offer retrospective measurement, and can be difficult to install on less accessible parts of the dam. In addition, it is difficult to know where to place sensors for optimal coverage as well as requiring ongoing maintenance.



DRONES AND LIDAR

Drones and LiDAR technology are often used in conjunction with one another to supplement the data provided by manual inspections. In theory, drones could be deployed regularly, but at great cost. In reality, they are deployed infrequently and still suffer from their inability to measure movement to the same degree of accuracy as satellites, nor do they offer retrospective data.



Illuminating Insights: The Power of Geospatial Analytics

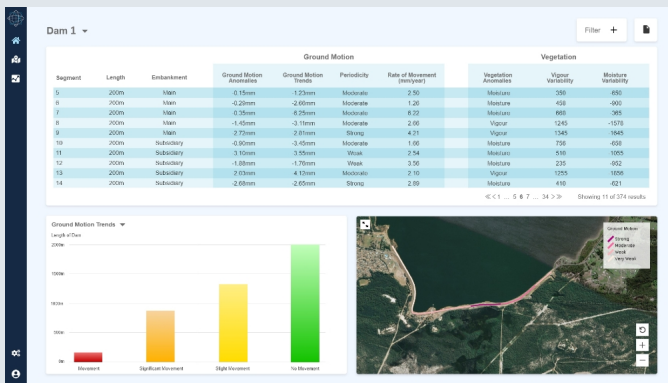
Geospatial dam and reservoir monitoring technology provides high frequency, analytical insight of assets, including historical incidents - something that is simply not possible with traditional monitoring techniques. This allows for the prompt identification of rapidly evolving problems and enables prioritisation of high-risk areas for inspection. Dam owners can therefore ensure necessary mitigation work is undertaken to prevent failure that could be caused by ground movement, water seepage and vegetation growth.

Drawing upon a repository of historical data, the advanced geospatial models perform risk analyses to look for trends and highlight the risk areas which need deeper investigation. This provides dam owners with a detailed view of all assets and the ability to assess changes over time. No data is required from the dam owner in order to implement a geospatial system, it is collected and analysed remotely and the analytics can be integrated easily with pre-existing infrastructure.

Multiple assets can be monitored, even those situated in remote locations, and the service identifies sections of the dam with potential high risk to help dam owners point their inspection and maintenance teams to precisely the right place. This targeted approach not only lowers the health and safety risk to crews, by reducing the amount of work necessary in dangerous locations, it also optimises their productivity when they get there.

Rezatec's Unique Geospatial Solution

Rezatec's Reservoir Embankment & Dam Monitoring service empowers dam and reservoir operators to dynamically manage structural motion and vegetation changes remotely - at scale. The geospatial analytics service reduces the need for non-targeted manual inspections by providing a detailed historic and current view of structural movement for all your dams - even across inaccessible locations.



Multiple data points combine with advanced analytics to deliver the most frequent, accurate insights on unusual changes in ground motion and vegetation change, giving you the power to see developments between routine structural surveys. This makes it possible to build a complete risk profile for all assets across wide areas and draw up a timeline for an asset - developing a detailed picture that can help shape policies and prioritize investments.

Dam owners are sent automated alerts for urgent issues, and can use the system's retrospective data to monitor even the smallest non-elastic movements and long-term deformations with millimetre accuracy. No other solution is able to accurately highlight exact risk areas using unique historical analysis in this way, making it possible for you to deploy your investigation and maintenance resources to the right place at the right time.

In summary Rezatec's comprehensive dam and reservoir monitoring system can:

- ✓ Build a full risk profile of all dams using historic & current data
- ✓ Track changes between routine structural surveys
- ✓ Enable you to Deploy resources to the right place at the right time
- ✓ Gather all required data remotely

More information about the service is available on the Rezatec website:
<https://www.rezatec.com/services/infrastructure/dams-reservoirs/>



Additional Sources Used:

<https://www.motherjones.com/environment/2019/07/the-dam-truth-the-91000-dams-in-the-us-earned-a-d-for-safety/>

https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/290819/scho0811buaw-e-e.pdf