

Why use Robertson Geo technology for Dam Safety?

The use of geophysical logging techniques for dam inspection and monitoring has long been recognised as critical for structural assessment over the life of a dam.

Subsurface investigation provides detailed insight into the fabric and condition of dam walls, buttresses, foundations, and adjacent infrastructure such as spillways and bypass waterways.

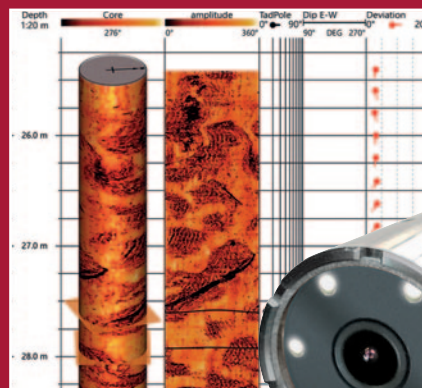
Robertson Geo logging technology, developed over 40 years, provides consistent, fully calibrated data that is essential for the planning, construction, monitoring and remediation of dam structures. The technology is supported by a highly experienced personnel team, specialising in reliable tool production, quality control, accurate calibration, and data acquisition with innovative engineering solutions.

A range of proprietary logging tools can be used to investigate geotechnical, hydrogeological, and structural properties to characterize geological conditions, groundwater scenarios and any impairment of the existing hard structures. These include the use of:

- Acoustic/optical televiewers and borehole cameras for imaging, fracture detection and lithological bed modelling
- Borehole calipers for hole condition quality control
- Probes for determining electrical resistivity characteristics, flow gradients, formation porosities, temperature, and conductivity indicators. These are essential tools for groundwater assessment and examination of nearborehole lithological characteristics

Wireline Borehole Logging

- Characterize ground conditions in terms of condition, stiffness, fractures and lithology
- Gain an understanding of the groundwater conditions
- Investigate the condition of existing structures associated with dams



- *PS Logger® and Formation Density probes for analysis of velocities, small strain moduli and density (FD)*

Robertson Geo borehole logging tools can be accessed internationally through onsite service, full system sales and equipment rental.

Robertson Geo Technologies and the Dam Life Cycle

The vital role of geophysical logging, as provided by Robertson Geo technologies, can be summarized by examining at the various stages in the life cycle of a dam.

Concept: At the feasibility stage a programme of geophysical investigation will invariably be conducted. In addition to areal surveys by surface methods a suite of boreholes will be specified to collect samples and gather geophysical information pertaining to lithology, fractures, stiffness, and hydrogeology across relevant areas of the prospect. More and better data at this stage has the greatest potential for producing cost savings throughout the dam's life cycle.

Design: As the dam design crystallizes, additional data will be required especially in those areas where significant structures will be built. This will generally involve higher density data from further targeted drilling and geophysical data collection to confirm the ground conditions are suitable. This feedback loop is essential for optimising the design of the dam.

Build: For any civil engineering project, not least in dam construction, ground conditions remain the greatest unknown. Where unexpected ground conditions are encountered in the build phase, for example issues with artesian water, further targeted drilling and geophysical investigation may be required in order to solve local problems.

Working Life: Once the dam is commissioned and operational further geophysical investigation may be required as part of a programmed system of checking and maintenance. This will often be in response to feedback from permanent monitoring systems put in place to ensure the ongoing safety of the dam structure. Additionally, as the dam structures age, pilot holes may be drilled into parts of the structure to confirm its integrity. Here televiewers can provide a visual record which is a permanent and legally binding assessment of condition. For

older dams there may be paucity of original information regarding the detailed design of the dam and its associated structures. This lack of information can often be easily remedied by an invasive programme of geophysical investigation into the structures themselves via pilot boreholes.

Events: Could be described as "when things go wrong". The most common events involving dams are:

- *Overtopping - caused by water spilling over the top of a dam*
- *Foundation defects - which includes settlement and slope instability*
- *Cracking - caused by movements such as natural settlement of a dam*
- *Poor maintenance - equipment failures, blockages etc.*
- *Piping - poor control of seepage which can undermine dam structure*

If any of the above events threaten the safety of the dam, then a rapid programme of geophysical investigation may be required to provide additional information to inform the evaluation of potential solutions.

Upgrade/Replacement: Significant upgrades or even complete replacement of the existing dam may be required as the dam ages and requirements change. Geophysical borehole logging can provide a wealth of information to inform the decision-making process.