PHILIPPINES

PS Logger® testing residual soil for Reclamation Projects in Manila Bay

ALASKA

$148m project at Moose Creek Dam, North Pole

ANGOLA

Hydrogeological Study of the KOH aquifer system

ROBERTSON GEO

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GLOBAL GEODATA NEWS

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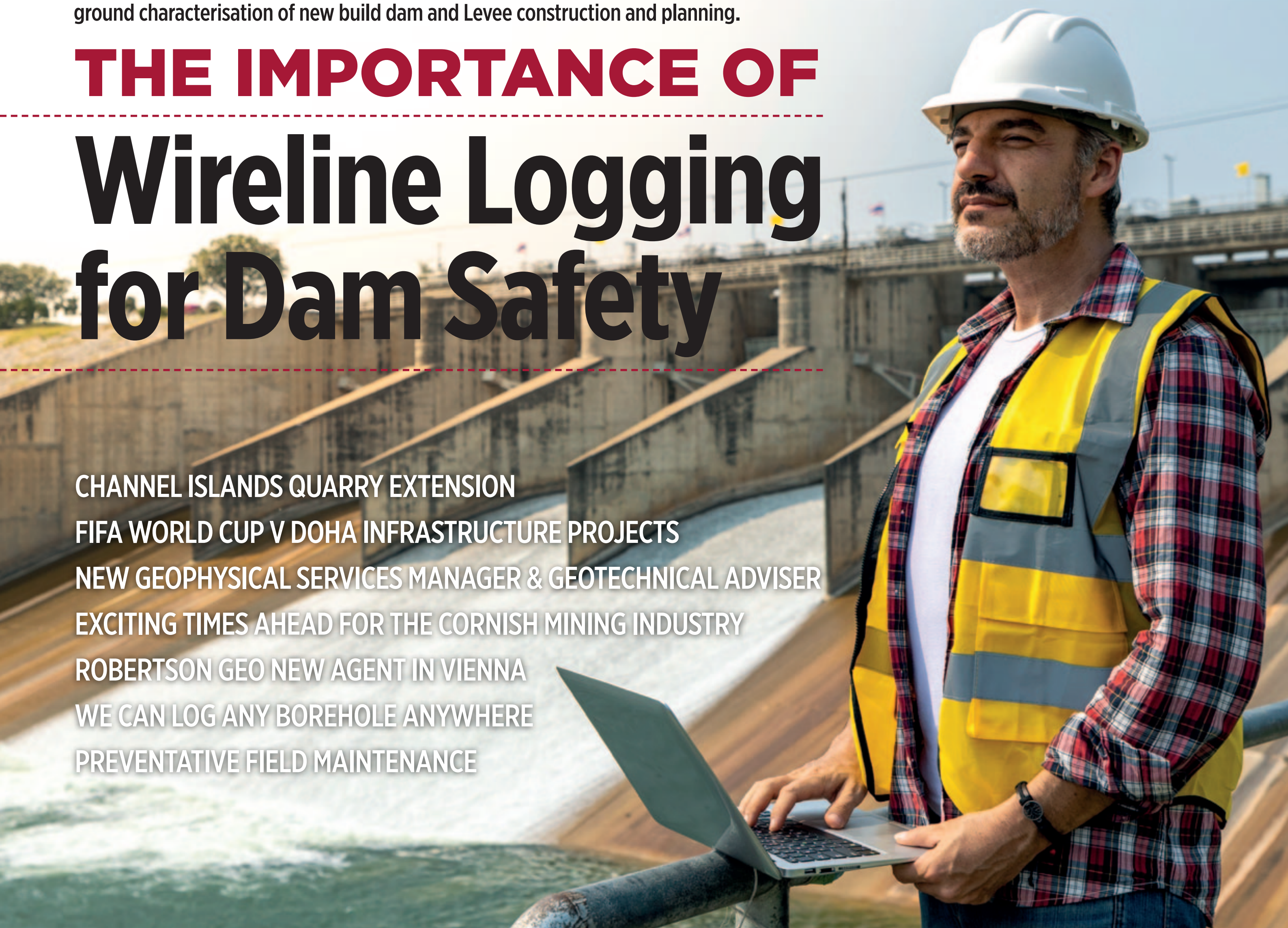
Robertson Geo is a founder member of the Dam Safety Group - in this issue we look at the importance of logging data for regular maintenance and monitoring and the essential ground characterisation of new build dam and Levee construction and planning.

THE IMPORTANCE OF

Wireline Logging for Dam Safety



DAM SAFETY GROUP

*The **Dam Safety Group** (DSG) brings together a group of member companies, both instrument OEMs and service contractors, ideally positioned to use proven geophysical technologies, services and products for Dam and Levee site investigation and monitoring together with seismic monitoring via earthquake early warning and evaluation systems.*

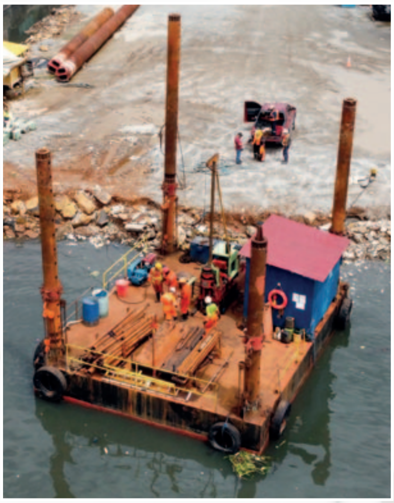
www.damsafetygroup.com

> *Logging was part of the Geotechnical Investigation package of Sol Roche Geotechnical Consultancy Corp. for the project which included boreholes and undisturbed sampling.*

SRGEC

PS Logger® testing residual soil for Reclamation Projects in Manila Bay

PHILIPPINES



The Robertson Geo PS Logger® was used in many different reclamation projects around Manila Bay, it was used to test the properties of the residual soil belonging to the Guadalupe Tuff Formation.

The logging determined the dynamic properties of the foundation soils and/or rocks. The analyses of the test was done to determine the following dynamic soil/rock properties:

- *Elastic Moduli*
- *Poisson's ratio*
- *Vp and Vs profiles*

With the site area located in a relatively shallow water environment (1 to 10m of water), Robertson Geo client Sol Roche used jack up pontoons as a stable platform in which to conduct the PS Suspension Logging. The Robertson Geo PS Logger® probe was deployed using a surface winch with the data being compiled via the Micrologger2, the surface interface system for data acquisition. The PS Logger® is a full waveform acoustic probe, designed to measure compressional and shear wave velocities in soils and rock formations. It operates using indirect excitation rather than mode conversion as in a conventional sonic.

The logging was part of the Geotechnical Investigation package of Sol Roche Geotechnical Consultancy Corporation for the project which included boreholes and undisturbed sampling, Field Vane Shear test and (seismic) Cone Penetration test.

The residual soil layer was characterised by very stiff to hard, dark brownish grey to light brown, sandy to silty clay. It is made of the in-situ weathering and alteration of volcanic ash/tuff as evidenced by the preservation of the relic vesicular texture. Some samples belonging to this layer showed altered/weathered breccia and agglomerates appearance with clasts made up mainly of scoria and glass fragments. Being residual soil in nature, transition to highly weathered and highly fractured brown to brownish grey siltstone appearing as rock fragments.

The weathered rock layers of the Guadalupe Formation is made of:

SANDSTONE (Lappillistone and Lappilli Tuff): Very weak to weak, brownish grey to dark brownish grey, mottled in some parts, silty fine to coarse sandstone. Some parts are highly weathered and highly fractured.

SILTSTONE/CLAYSTONE (altered Volcanic Tuff): Very weak to weak light brown to brown, occasionally brownish grey tuff. Highly weathered and grading to residual soil in some parts.

CONGLOMERATE (Breccia and Agglomerates): Very weak to weak, mottled light brownish grey and dark grey conglomerate. The clasts are made up of sub angular to sub rounded scoria, andesite and basalt fragments embedded in a tuffaceous matrix.

Each distinct layer represents different episodes of pyroclastic emplacement/deposition.

Sol Roche Geotechnical Consultancy Corporation: www.srgec.ph

$148m project at Moose Creek Dam, NORTH POLE, ALASKA

Sub-zero temperatures, short daylight hours, low strength materials choc-full of hard, subrounded very hard glacial till - no problem for H2R Senior Driller and Department Manager Tom Carney and Staff Geologist Josh Daily, impressed contractor and owner alike in this high demand and tight schedule job.

Robertson Geo client H2R Corp is supporting Bauer Foundation Corp by providing verification boring services, down hole video and High Resolution Optical Televiewer® (Robertson Geo Hi-OPTV® deployed with surface winch and support equipment) inspection, and in situ permeability testing including rising and falling head tests.

The **Moose Creek Dam and Floodway** facility includes a 7.5-mile earthwork levee built up to 50 feet above the creek bed. Since 1981, the facility has managed 20 flood events successfully. A 2007 risk assessment identified seepage and piping as a potential failure mode. As a result, the US Army Corps of Engineers (USACE) has contracted for the Moose Creek Dam Safety Modification Project (W911KB21C0030). The safety modification includes a barrier wall installation through the embankment and tied into the existing foundations. The construction methods include a slurry trench cutoff wall and jet grouting where appropriate.

Wireline coring in the low strength soil cement mixture is especially challenging since the existing soils are mostly hard, subrounded metamorphic rock deposited by glacial action in the valley. The aggregates come in a wide range of diameters and readily debond from the cement-bentonite binder, which can cause tool jams and damage to the recovered sample. Even without debonding, the hard aggregates cause rapid tool wear and managing tool life without using an extremely aggressive bit that would compromise the sample quality required the decades of expertise that H2R brings to successfully complete the project.

Channel Islands Quarry Extension

Robertson Geo Operational Services formed part of a quarry extension project for Granite Products in Jersey.

Boreholes averaging 70m each were logged with the High Resolution Optical Televiewer® and the High Resolution Acoustic Televiewer®, 3-Arm Caliper, Temperature Conductivity and Impeller Flowmeter. The purpose of this geophysical logging was to gather information on the fracture network together with the elevations of groundwater inflows to the boreholes. The results will be used to determine how each borehole will be completed as necessary with monitoring infrastructure.

To detect groundwater flows in the borehole column the team turned to the flowmeter. Logging the probe at a range of speeds allows detection of flowrate. The probe is equipped with lightweight helical impellers mounted on double sapphire bearings. The impellers contain magnets which actuate Hall-effect switches within the probe to detect impeller rotation.

The probe can identify ingress/egress points for flow and from open fractures for geotechnical projects. Combined with the optical and acoustic televiewers the flowmeter can determine the exact depths of these flow points.

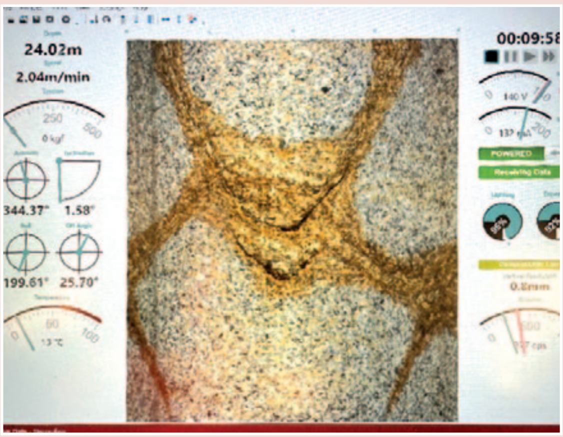


Image shows High Resolution Optical Televiewer® detailing a fracture.

THE IMPORTANCE OF Wireline Logging for Dam Safety

Dams have been an essential part of the development of human civilisation for centuries and operate mostly with quiet efficiency for a variety of purposes.

They are often compound structures with complex ownership models operating within diverse regulatory frameworks. The objective of dam safety is to avoid dam failure whereby the cost of inspection and subsequent geotechnical investigation is minor when compared to the potential cost of catastrophic failure.

Wireline Logging

Globally, most dams were built before the widespread availability of wireline logging for geotechnical investigation. Any significant new dam construction should include a programme of drilling and wireline logging for geotechnical and hydrogeological analysis. For any civil engineering project, the ground conditions represent the single biggest unknown which is especially relevant for dams due to the creation of artificial hydraulic pressures and the consequences of catastrophic failure. Wireline logging can provide valuable ground characterisation data for the design process and will form a permanent record of conditions before the dam was constructed.

Once a dam becomes operational, routine inspection and maintenance of the dam and its associated structures will be necessary to ensure the ongoing safety of the dam. This is applicable for all dams, though the level and frequency of inspection may be dictated by the size or criticality of the particular dam. Whether identified from routine inspection or in response to changes it may be necessary to conduct detailed ground investigation including drilling and the collection of wireline derived data to determine risk or aid rehabilitation. Any engineering assessment of a dam should include geotechnical analysis, as it is estimated that 70% of concrete dam failures are due to geology and 40% of embankment dam failures are due to foundations.

Wireline logging can provide unique data sets in three key areas of ground characterisation for dams, pertaining to structure, strength and hydrogeology.

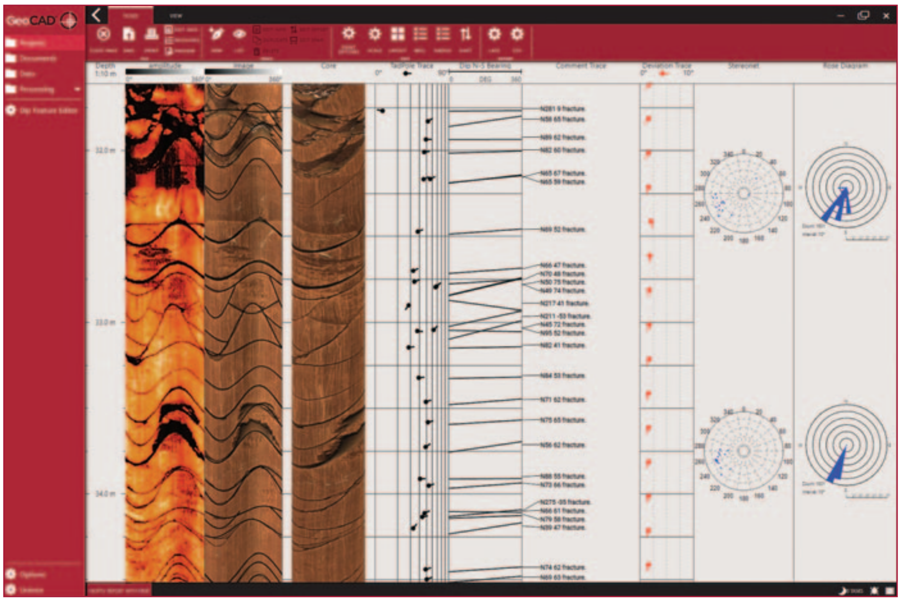
For structure, televiewers produce orientated images of borehole walls with geological features, notably bedding planes and fractures, delineated in terms of dip angles and direction.

Potential hazards can be identified such as thin shear zones, weak or continuous joints, weathered bedrock, solution features, fault zones, bedrock profiles and volcanic rocks. The image on the right shows an example of the high-resolution images that can be obtained using an optical televiewer showing bedding layers, fractures and wash-out zones indicative of weak formations.

If there is a lack of historical information regarding how foundations were constructed, or if problems with foundations are suspected, televiewers can provide permanent records which are informative and legally binding. For concrete and masonry dams test boreholes can be drilled into parts of the structure to allow for video inspections to detect cracks or other signs of deterioration.

Ground strength can be determined by measuring P and S wave velocities using a sonic probe, and by combining this with density measurements small strain moduli can be calculated in formations and foundations. A borehole geometry probe with x-y callipers can be used for stress analysis which can be useful for characterising hazards such as shear zones or shrink/swell.

Understanding the hydrogeology beneath and in the vicinity of dams is vital to ensure stability, as the artificial hydraulic pressures can induce detrimental effects such as uplift or unwanted seepage and erosion. Hydrogeologists have an array of probes available to them to characterise the subsurface conditions including electric probes to measure resistivity, neutron probes to measure porosity, NMR probes to measure porosity, permeability and transmissivity, temperature/conductivity probes and flowmeters to identify flows and video inspections to investigate ducts and cavities. A combination of these probes can be used to characterise potential hazards including solution features, shrink/swell potential, settlement, and slide potential.

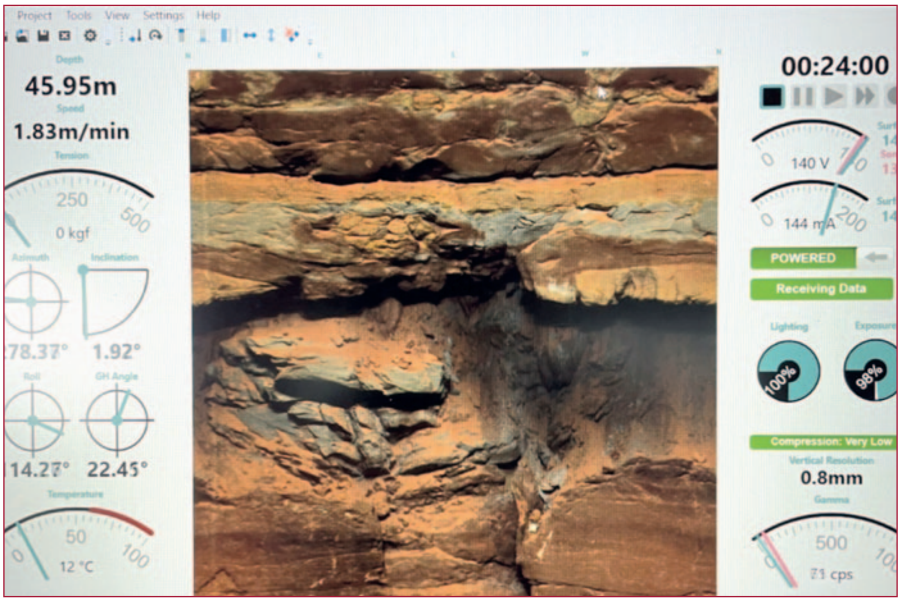


GeoCAD® output showing oriented features from HI-OPTV® and HRAT® televiewers.

Due to sometimes complex hydraulic pressure profiles, any drilling programme conducted in the vicinity of a dam needs a comprehensive risk assessment to be conducted by a competent body to consider the potential for drill induced problems such as artesian blowout, hydraulic fracturing, erosion, contamination, and heave. This should also include recommendations for drill completion and grouting once the borehole investigation is finished.

Dams through Time

The earliest building of dams is attributed to Mesopotamia and the Middle East for control of water levels, with the oldest known being the Jawa Dam in modern day Jordan circa 3,000BC. The use of dams gradually spread across the ancient world to Egypt, India, Yemen, Turkey, and China. By the second century AD the Romans had taken the concept of dams a stage further by creating reservoir dams that would retain permanent water supplies for population centres, aided by their



The clarity of the Hi-OPTV® as illustrated in the above image can clearly identify fractures, voids, bedding, and the changing geology at given depths below ground level.

Evening view of the Hoover Dam in Boulder, Nevada, USA.

development and widespread use of concrete and waterproof hydraulic mortar. Early uses for dams also included providing hydropower for raising water and milling. By the 12th century AD the Netherlands had begun a programme of dam building to manage water levels and to provide protection from sea water ingress in their low lying country. In the nineteenth century advances in materials and the application of mathematical techniques allowed for the construction of masonry and subsequently concrete arch dams. Population expansion in the twentieth century saw the proliferation of large dams throughout the world with notable examples being the Aswan Dam in Egypt (1902) and the innovative Hoover Dam (1936) in USA. Currently it is estimated that there are over 800,000 dams worldwide with around 58,000 being classified as large dams (usually over 15m height).

Classification of Dams

The purpose of a dam is to store or restrict water, wastewater, or liquid materials for any of the following uses: flood control, water supply, irrigation, energy generation, containment of mine tailings, recreation, inland navigation and pollution control. The classification of dams is important, not only for statistical purposes, but also for the potential impact on funding available for investigation and rehabilitation. Dams can be classified in three categories: function, structure, and construction materials.

There are four basic types of dams based on function: storage, diversion, detention, and cofferdams. Storage dams are the most common type and are used to store seasonal rainfall for water supply. Diversion dams have a low head and are used to divert water often into canals and ditches for irrigation. Detention dams are used for flood control by retarding downstream flows. Cofferdams are temporary structures designed to hold back water usually in construction sites. Dam structure can similarly be defined by four types: gravity, arch, buttress, and embankment. Gravity dams require solid foundations and are large structures which use the weight of the dam itself to resist horizontal water pressure and are often found in low wide valleys. Arch dams require solid foundations and sidewalls and are the most spectacular, using curvature to direct forces into steep valley sides. Buttress dams come in many variants, but they all comprise a sloping deck supported by buttresses. By far the most common type of structure is the embankment dam, which is constructed from natural materials, often sourced locally. For construction material the three dam types are: masonry, steel and timber, with the majority of dams of interest being masonry, which includes the use of rock, concrete and earthen materials.

Dam Safety and Maintenance

The expected life of a dam is often measured in decades or centuries during which time many changes can occur which affect its reliable working. Gradual and rapid changes may push the dam beyond its design limits and in the worst case can lead to complete failure. Ultimately, the responsibility for maintaining a safe dam and avoiding catastrophic failure rests with the owner.

Inspection and maintenance of all dams is essential to avoid failure. Risk assessments, which may be a legal requirement for large dams, bring into focus the consequences of catastrophic failure which may include potential loss of life, destruction of property and disruption to businesses, urban areas and agriculture.

To maintain efficient and safe operation of dams, operators and owners should conduct regular inspections using approved dam safety specialists. The level and frequency of these inspections will be in accordance with any local regulations, and as a minimum will include a comprehensive visual inspection looking for changes that have occurred since the previous inspection. Depending on the size and complexity of the dam there may also be regular data collection, sometimes automatic, monitoring water levels, flow rates, structural movements and seismicity. Early identification of the pre-cursors to failure is essential.

The records kept by owners for their dams should include a documented routine inspection and maintenance plan, with data and results forming a legally binding part of a dam history file. In the event of a failure these records will come under scrutiny, whereby deficiencies may have severe legal and financial consequences.

Routine maintenance and inspections can identify potential problems and drive the need for further investigation including geotechnical methods. Geotechnical Engineers, Civil Engineers, Hydrologists and Hydrogeologists now have an array of investigative tools at their disposal, many of which were not available when the dam was built.

In addition to further assessment due to potential hazards identified from routine monitoring and inspection there are many other reasons why a geotechnical assessment may be required. Old dams may have little or no data available and further assessment may be a pre-requisite for proposed rehabilitation. Following an event or incident leading to a near miss or from a risk

Polavaram, Andhra Pradesh / India - December 25th 2018 : National project Polavaram Dam under construction on the Godhavari river, India.

assessment a need for data may be identified. Change of usage or increased local risks as well as non-local effects from climate change or seismicity may also drive the need for a geotechnical investigation. The resulting data can then add into the assessment of the dam's stability and its hydrology and hydraulic characteristics.

Failure Modes of Dams

Dam failure can be defined as the collapse or movement of part of a dam or its foundation so that the dam cannot retain water and the avoidance of dam failure is the primary goal of any dam safety programme. By understanding and analysing the potential risks to a dam, measures can be put in place for mitigation. Potential Failure Mode Analysis (PFMA) is a common methodology used for this purpose. The benefits from PFMA may include recommendations for changes to monitoring programmes, identification of previously unconsidered failure modes, identification of potential failure modes due to mis-operation or human factors and identification of additional data required for the analysis of potential failure modes.

The most common failure mode is overtopping, which occurs when the water level exceeds the top of the dam which can be a precursor to complete dam failure. Water levels can exceed design parameters due to excessive rainfall, flooding and from storm effects caused by wind and waves. Inadequate spillway design or maintenance issues such as blockages may also lead to overtopping.

For embankment dams a common cause of failure is due to seepage. This can occur beneath the dam structure and cause problems due to erosion (piping) or heave from uplift due to the hydraulic pressure. Piping can also occur through the body of embankment dams caused by backward erosion of construction materials. Hydraulic fracturing can also occur if seepage takes place in supposedly impervious materials due to the hydraulic pressure.

For all dams, structural failure can be catastrophic and may be the result of poor design, use of substandard materials, poor workmanship or lack of supervision and maintenance. Structural failure can occur during normal operations but is more likely to result from a specific incident such as flooding, storm damage or seismicity or even during the construction phase or at time of first fill. As a dam ages settlement and the gradual deterioration of materials can increase the risk of structural failure.

Resources and Funding

The construction of large dams raises complex financial questions regarding who will pay the costs. There is no single model for the financing and most commonly each dam will involve a unique approach. Depending upon the scale and impact of the proposed dam many stakeholders may be involved including government, local government, banks, including the World Bank, friendly foreign governments, corporations, and private businesses. In all cases, once constructed, the dam will have an owner who is thereafter responsible for the ongoing safety of the dam.

Acronym	Organisation	Provision
ASDSO	Association of State Dam Safety Officials	Resources for dam safety and funding
USACE	US Army Corps of Engineers	Owns and operates over 700 federal dams
NID	National Inventory of Dams (USACE)	Reference list of USA dams
IWR	Institute for Water Resources (USACE)	Resources for water management
FEMA	Federal Emergency Management Agency	Grants for hazard mitigation
USSD	United States Society on Dams (ICOLD)	Resources for dam safety
FERC	Federal Energy Regulatory Commission	Licenses and inspects hydroelectric projects
NDSP	National Dam Safety Program (FEMA)	Grants for dam safety
HHPDR	High Hazard Potential Dam Rehabilitation	Grants programme administered by FEMA
ASCE	American Society of Civil Engineers	Resources for civil infrastructure

Figure 1: Focus on Funding for Dam Safety in USA.

Ownership of dams lies in the hands of many types of organisations, from national governments through to private individuals. There will national differences in regulatory frameworks and classifications which may affect what resources are available for dam rehabilitation. So how do dam owners find out how to access potential funds available?

For the largest of dams, defined as over 15m in height or between 5m and 15m in height with a capacity over 3 million cubic metres, they will most likely be registered on the International Commission On Large Dams (ICOLD) database. ICOLD has affiliated national committees in over 100 countries, 40 of which have their own websites. ICOLD and these national sites provide useful information and links to partner organisations concerned with dam safety and funding.

The level of grants available for dam safety and rehabilitation will usually be a government decision, though the allocation process can be complicated with allocations often through government and local government organisations and programmes. The qualification for funding may require specific classification, risk analysis and the drafting of an emergency action plan. The need for rehabilitation is often identified by routine inspections by qualified dam safety experts and appointed engineers. These personal may be able to advise on funding available. In most cases the national or local government and regulatory authorities would be a good place to commence enquiries about funding.

For the United States dam owners seeking funding for dam safety improvements and rehabilitation should initially contact their state government's dam safety office for advice. The Association of State Dam Safety Officials (ASDSO) also provides information and guidance on funding. Further resources can be found in the table of organisations above.

With 90,000 dams in the USA and an average age of 60 years the need for federal assistance for rehabilitation has been recognised with funding being made available through the Bipartisan Infrastructure Law. The package is worth $1.2 trillion over 5 years, but the amount available for dams remains unclear, while awards will likely be on a project-by-project basis. ASDSO have estimated that the cost of rehabilitation of the nations non-federal dams is $76 billion. Over the next five years, the Federal Emergency Management Agency (FEMA) will award $733 million through the Bipartisan Infrastructure Law in dam safety grants to states and territories to enhance dam safety and rehabilitate or remove aging dams.

An ongoing allocation of grants available to states is through the High Hazard Potential Dam Rehabilitation programme (HHPDR) administered by FEMA. "High Hazard Potential" is a classification standard for any dam whose failure or mis-operation will cause loss of human life and significant property destruction. This programme provides technical, planning, design and construction assistance in the form of grants for the rehabilitation of eligible high hazard potential dams, with $22 milion awarded in 2022.

The Dam Safety Group (DSG) brings together a group of member companies, both instrument OEMs and service contractors, ideally positioned to use proven geophysical technologies, services and products for Dam site investigation and monitoring together with seismic monitoring via earthquake early warning and evaluation systems.

Further information can be found at the DSG website: www.damsafetygroup.com

Company	Technology	Website
Robertson Geo	Wireline Logging	www.robertson-geo.com
Iris Instruments	Resistivity Imaging	www.iris-instruments.com
Geometrics	Seismic Tomography	www.geometrics.com
GSSI	Ground Penetrating Radar	www.geophysical.com
Kinemetrics	Seismic Monitoring	www.kinemetrics.com

Figure 2: The Dam Safety Group.

Hydrogeological Study of the KOH aquifer system in **ANGOLA**

Geophysical logging was of utmost importance to detect clay-free areas for an adequate casing design. The wells design was based on geophysical logging results and a new hydrogeological survey infrastructure was created to conduct further studies soon.

Cunene is a province located in southern Angola that suffers from periodic and severe pluriannual droughts that often cause humanitarian problems and large masses of displaced people.

The project has the goal of understanding the Angolan side of the Kalahari-Ohangwena (KOH) transboundary multilayered aquifer system (Angola and Namibia), located in the sedimentary basin of Cunene. This aquifer system can reach more than 300 meters in thickness and is mainly composed of intercalations of clay and sands. It comprises several aquifers (divided majorly into KOH-0, KOH-1 and KOH-2) with very different characteristics, either regarding flow rates or groundwater quality. The study was especially focused on the deep aquifer KOH-2, which is known to contain freshwater that can be in the future regarded as a potential groundwater supply for the people of Cunene.

After the interpretation of surface geophysics (vertical electrical soundings from the 1960s and time-domain electromagnetics carried out within the scope of the project), a set of boreholes with a maximum 300m depth were planned, drilled, and converted into monitoring piezometers.

Geophysical logging was conducted to identify and characterise the aquifers that compose the KOH aquifer system and to define the screens' location for deep wells so that monitoring of the KOH-2 could be possible soon. Borehole logging surveys in previously drilled deep wells were also conducted.

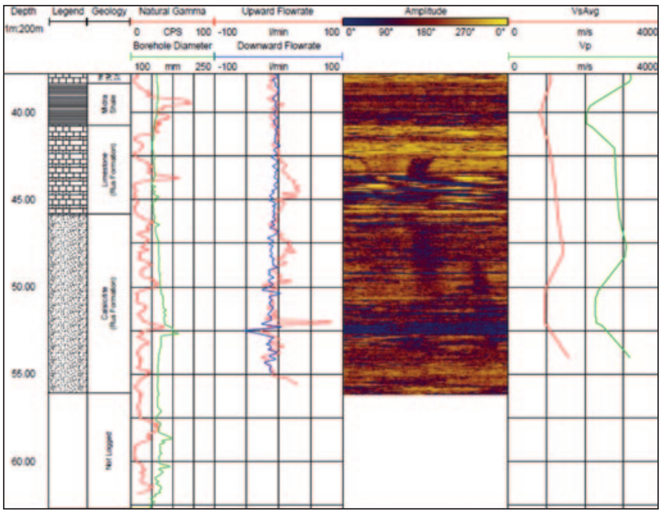
Training was also an important part of the PLANAGEO project. Therefore, a team of Angolan technicians from IGEO and the regional Cunene authority received geophysical logging training as part of a major training program. In the future, the logging equipment will be used by the Geological Survey of Angola (IGEO) and will become part of their skills and provided services.

FIFA World Cup v Doha infrastructure projects

Despite huge crowds and the Football World Cup, Doha continued its infrastructure development projects.

Gulf Laboratories carried out Geophysical logging offshore in one of the most ambitious projects by the government of Qatar. This extensive geophysical logging campaign utilized a comprehensive range of Robertson Geo probes and surface equipment: 3-Arm Caliper, Natural Gamma, HRAT®, PS Logger®, RGeo-eye® and Flow Logging deployed in stressed and unstressed conditions.

The purpose of the project was to establish the lithology, identify the underground fractures condition and its real time condition with help of video logging. Engineering parameters obtained from PS Logger® were useful for the design of the tunnel alignment. The results were highly satisfactory and useful for the project objectives. HRAT® data was very useful for the establishment of the depth of lithological beds precisely below the proposed tunnel depth.

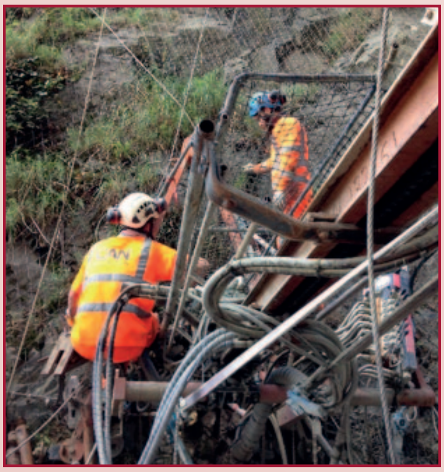


We can log any borehole **...anywhere**

Not every borehole is drilled vertically or is easy to get to.

Due to the requirements of a project - Geotechnical, mining and renewables to name but a few - or simply the raw power of the topography we work in, boreholes can often be in challenging environments. This can lead to boreholes being inclined, horizontal, underground, offshore or deep in a forest and just to make it interesting they can be anywhere from 60mm in diameter up to a few meters in the case of shafts.

Robertson Geo Operational Services have a highly skilled team of engineers (qualified to work at heights, offshore, 4x4 trained etc) and the most comprehensive range of equipment and support services to meet client needs and get the job done!



You will find our engineers logging horizontal boreholes and deep underground.

For boreholes with no vehicle access we can deploy our portable mini winch system.

And if its difficult to get there, we'll get there!

Robertson Geo Operational Services are committed to ensuring all clients experience minimal down time on-site.

To achieve this there are many integral maintenance systems in place, one of them being the upkeep of Probes and Equipment. Preventative field

Preventative field maintenance

maintenance is key to ensure that the logging is carried out as efficiently as possible and ultimately the data acquired is at its optimal quality.

Depending on the location and local geology, many boreholes encountered will be logged through clay bands. If the probes are not thoroughly inspected and cleaned after logging such holes the clay can become moulded into the mechanical moving parts causing probes to seize, Caliper tools being the prime example. Such occurrences will cause delays in the logging operation if not dealt with in-situ.

A two-person team ensures logging can still be performed simultaneously to the equipment being maintained to the highest standard pre and post logging of the borehole. Field maintenance is just the tip of the iceberg, more in depth inspections are conducted routinely back at the Robertson Geo Operational Services HQ. **We pride ourselves on the maintenance and job ready status of all our equipment.**

Logging engineer cleaning out the Caliper tools, the conductivity cell of the Temperature Conductivity probes and the probe centralisers on site.

NEW Geophysical Services Manager and NEW Geotechnical Adviser

Since 2016, Robertson Geo Operational Services (RGS) has seen significant growth under the management of Graham Comber, with RGS now firmly established as the independent global leader in Offshore Wind Geophysics.

Graham has decided on a change of pace and is stepping down from his management role, moving to a part-time role with Robertson Geo as our **Geotechnical Adviser**. He will primarily be tasked with leading the company's technical marketing efforts and the creation of a comprehensive suite of new product manuals that advance the support and education of our end users.

We are pleased to announce that **Ian Jones** has been promoted to fill Graham's shoes as **Geophysical Services Manager**. As many will know, Ian began working for Robertson Geo straight from university, some 14 years ago. Starting out as a Logging Engineer and working up to Geophysics Supervisor in 2018, he has seen and gained experience in all aspects of the role and is ideally suited to manage RGS and lead its continued growth globally.

Ian Jones - Geophysical Services Manager

"I'm excited for the future with our young and enthusiastic logging team and look forward to the challenges ahead, You can find RGS Logging Engineers working across the world on offshore drilling vessels, forests, swamps, mountains and many other challenging locations.

Lets all wish Graham all the best with his new role and thank him for the fantastic job he has done to set RGS on the right path. We will be building on his great work."

Graham Comber - Geotechnical Adviser

"In 2008 I joined Robertson Geo as a field engineer for borehole logging across geotechnical, mining and renewables sectors worldwide. Six years on and I was leading our logging department, managing the team of engineers as we rapidly expanded.

Working on OWF development has been particularly satisfying as RGS continues to contribute to the exponential growth of this vital industry. I am a little sad to be leaving the team behind, but I leave the management in the safest pair of hands with Ian, my time has been a thoroughly enjoyable experience working with great people both inside and outside of the team."

Exciting times ahead for the **Cornish Mining Industry**

Famous for its base metal and tin production Cornwall still boasts untapped reserves of a range of metals including Lithium, Tin, Copper, Tungsten, Lead, Zinc and Silver.

There was a buoyant feel to the conference as mining representatives updated on their exploration progress, estimated potential reserves and plans for development. Investor interest was also high as the UK moves to source critical minerals from UK companies to mitigate reliance on imports.

The event was fully supported with speakers from across the resurgent mining industry. Local mining presentations included Cornish Lithium Ltd, Cornish Metals Ltd, Cornish Tin Ltd and Tungsten West in addition to the Camborne School of Mines and the Cornwall and Isles of Scilly LEP. Contributions from mining companies included British Lithium and Anglesey Mining plc.

Robertson Geo New Agent in VIENNA

BFGeosupply EQUIPMENT & SERVICES

Together with my business partner I have founded BFGEOSUPPLY in 2013 in Vienna, Austria with the objective to deliver cost effective well logging, wireline, and slickline solutions for our customers within the oil, gas, geothermal, water, mining, and geotechnical industry. We are present throughout the continent, focusing on Central and South-Eastern Europe.

I graduated in 1997 from Belgrade University in Applied Geophysics with a focus on Well Logging and acquired an MBA from Intl. Postgraduate School of Management in 2017.

We are very proud to have become part of the Robertson Geo global agent network and offer excellent services to our existing and new customers throughout the region. It is our pleasure to start our cooperation with the utmost confidence in its technical expertise and support.

Check us out on our site:
www.bfgeosupply.com

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ROBERTSON GEO
Unlocking Your GeoData

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