



Instruments for Dam Safety Monitoring







Instruments For Dam Safety Monitoring

The importance of monitoring for dam safety is widely accepted. Monitoring provides the information that is needed to develop a better understanding of the on-going performance of the dam during the construction, impounding and operation phases. Therefore, good dam safety monitoring should be a key part of every dam owner's risk management.

Instrumentation can be used to implement a monitoring system that provides more comprehensive and real time information regarding the on-going performance of the dam.

Geosense instruments have been installed on many dams worldwide as part of dam safety monitoring programmes.



PORE WATER PRESSURE & WATER LEVEL

VW Piezometers
Standpipe Piezometer
Water Level Meter

SOIL PRESSURE

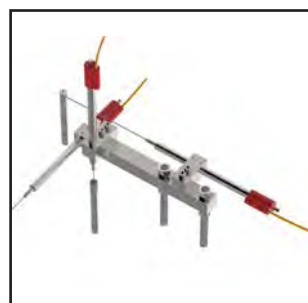
VW Total Pressure Cells

INCLINATION & TILT

Portable Inclinator
In-Place Inclinator
AXMi 3D Inclinator
QJ Inclinator Casing
XC Inclinator Casing
Pendulums
Tilt Meters
Tilt Beams

CRACK & JOINT MONITORING

3D Mechanical Crack Meter
VW Crack Meter 3D
VW Crack Meter
VW Joint Meter
VW Soil Extensometer



Instruments For Dam Safety Monitoring

STRAIN MONITORING

VW Strain Gauges
Rosettes
Zero Strain Container

SETTLEMENT

VW Liquid Level Settlement System
GEO-XM Magnetic Settlement System
AXM In-Place Magnetic Extensometer
Reed Switch Probe

SEEPAGE

V-notch Weirs
VW Weir Monitor
Staff Gauges
Ultrasonic Flow Meter

DATA ACQUISITION

GeoLogger G8 Plus
Remote Smart Mux
Smart Mux Interface
VW Readout VWR01
Telependulum TP-2000

STRONG MOTION MONITORING

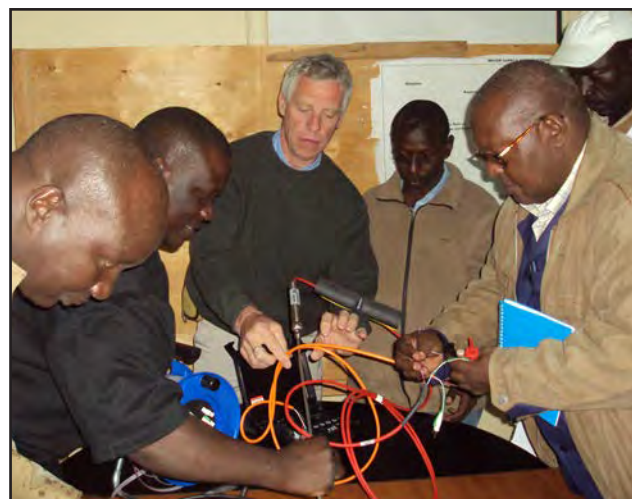
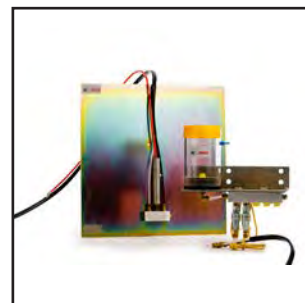
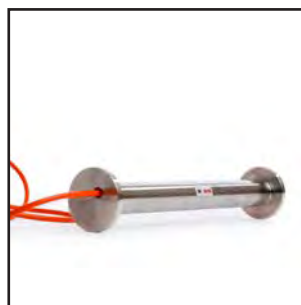
Accelerometers & Recorders

SOFTWARE

GeoAxiom Vista

METEOROLOGY

Weather Station





Baish Dam, Saudi Arabia



Project Summary

NAME: Baish Dam
YEAR: 2016
CLIENT: Ministry of Water and Electricity
MAIN CONTRACTOR: N/A
INSTRUMENTATION: Triad Technical Services
CONSULTANT: Geosense



Overview

The Baish Dam is a gravity dam on Wadi Baish about 35km northeast of Baish in the Jizan Region of south-western Saudi Arabia.

The dam has many purposes including flood control, irrigation and groundwater recharge. The total reservoir capacity of the dam is 192 million m³.

The dam was constructed between 2003 and 2009 and at 106m high on completion, it was the tallest dam in Saudi Arabia. It is owned and operated by the Ministry of Water and Electricity.

Baish dam is one of six dams currently undergoing the change from a manual to a fully-automated monitoring system.

The original instrumentation equipment was installed during construction and was entirely manually-read. The Ministry made the decision to upgrade the instrumentation to a modern automatic system including full data logging of all instruments together with alarm trigger levels and data access via the Internet.

Monitoring

After consultation with Ministry Engineers, Geosense designed a system installing new instruments side by side with the existing instrumentation and upgrading several areas to provide a fully-integrated and automatic dam safety monitoring system.

All the new instruments were connected into a data logging system and provide real-time visualisation within the dam control room.

The dam integrity is carried out by monitoring key areas as follows:

Main dam body

Inclination

Galleries

Expansion joints

Seepage

Upstream pore water pressures

Downstream pore water pressures

Dam main drain

Seepage

Dam reservoir

Water level

Dam abutments

Settlement

Seismic monitoring

Products used

- ~ **VW piezometers**
Measurement of pore water pressure.
- ~ **AXMi 3D Inclinometers**
Combined Magnetic Extensometer & In-Place Inclinator for both settlement and inclination profiles.
- ~ **Pendulums & Telependulums**
Measures inclination and horizontal displacement. Automatic readings by TP-2000 Telependulum readout unit.
- ~ **VW triaxial crack gauges**
Measures expansion or contraction in the dam joints.
- ~ **V-notch weir & monitor**
Measurement of seepage flows.
- ~ **Remote Multiplexers**
Allows multiple sensor cables to be connected into one central location for connection to a data logger via one multi-core cable.
- ~ **GeoLogger GL1000**
Multi-channel data logger for remote reading and logging all instruments.
- ~ **Accelerometers & Recorders**
Measures seismic activity for early damage detection.
- ~ **GeoAxiom Vista**
Data visualisation software. All data is fully accessible via the internet.

Kashimbila Dam, Nigeria



Project Summary

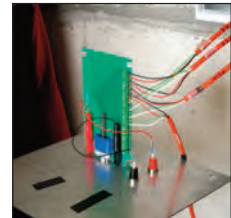
NAME: Kashimbila Dam

YEAR: 2014

CLIENT: Federal Republic of Nigeria/Natra

MAIN CONTRACTOR: SCC Nigeria

CONSULTANT: Aurecon



Overview

Construction of a new multi-purpose 40 Megawatt dam in Taraba State, Nigeria will generate much needed electricity for the country and provide job opportunities, social and economic benefits to people in the area.

The preliminary design was for a dam with a storage capacity of 200 million m³ but this was subsequently increased to 500 million m³.

The main challenges were related to the lack of data in the hydrological and geological studies as well as the project location in the extreme south-eastern part on Nigeria, which required long travel times on very poor roads.

The hydropower station was initially designed with an installed capacity of 18 MW, however, following detailed hydrological modelling and yield analysis carried out by Aurecon, a 40 MW installed capacity was implemented. Aurecon's input on this project led to a more economical design of the dam and an increased installed capacity for the hydropower station.

The dam is expected to be ready for commissioning in December 2014.

Monitoring

Liquid Level Settlement plates were installed at various levels within the embankment dam as the fill material was added. Together with VW Piezometers to monitor the pore pressure, these would provide a good picture of what was happening within the dam fill material during construction.

Geosense Technicians have recently returned from on-site assistance and training provided to the local site team for the Settlement Cells and VW Piezometers.

Products used

- ~ **VW piezometers**
Measurement of pore water pressure.
- ~ **VW Liquid Level Settlement Plates**
Used to monitor settlement or heave in soils and other structures such as embankments, earth and rockfill dams.
- ~ **VW Rotary Switch Terminal Boxes**
For the connection and reading of up to 34 instruments.
- ~ **VW2106 Readout**
Portable readout for use with any vibrating wire sensor.



Shahdag Tourism Complex, Azerbaijan



Project Summary

NAME: Shahdag Winter Summer Tourism Complex
YEAR: August 2013 – Ongoing
CLIENT: Ministry of Culture and Tourism of Azerbaijan Republic
MAIN CONTRACTOR: DiA Holding FZCO
CONSULTANT: Enargeo



Overview

Shahdag Tourism Complex is located in the north eastern of the Caucasus near to city of Gusar which is 180km away from Baku in Azerbaijan. When it is completed, the complex will provide a number of activities for the visitors both in summer and winter period.

The Tourism Complex will be located within the Shahdag National Park, which is known for having an intact ecological system and an untouched flora and fauna.

Monitoring

The most critical section of the tourism complex is the 24m high earth dam which is an artificial reservoir with a 15900m³ capacity which will be used for water storage during the lifetime of the project to provide a continuous water supply for snow production. Therefore a monitoring system is required for both construction control and the long-term performance and overall stability of the reservoir.

The vertical settlement and lateral displacement in the reservoir body will be monitored by a number of borehole locations which include vertical or horizontal inclinometer systems and a number of vertical inclinometer systems combined with a magnetic extensometer system allowing the acquisition of data for both horizontal and vertical displacement from a single borehole.

Products used

- ~ **QJ Inclinometer casing**
For use with portable inclinometers.
- ~ **Portable MEMS inclinometer**
Includes both vertical and horizontal probe for measuring lateral and vertical displacements.
- ~ **Inclinalysis Software**
For analysing the data from vertical and horizontal boreholes.
- ~ **Data loggers**
Multi-channel remote reading & logging.
- ~ **GXM300i**
Magnetic settlement & inclinometer casing system for measuring ground settlement and lateral displacement.
- ~ **Reed switch probe**
For use with GXM300i system.

Zeizoun Dam, Syria



Project Summary

NAME: Zeizoun Dam

YEAR: 2010-On-going

CLIENT: Directorate of Water Resources Hama Governorate

MAIN CONTRACTOR: General Company for Hydro Projects

INSTRUMENTATION: Al Mutawasset

CONSULTANT: Agrocomplect SA, Bulgaria



Overview

The Zeizoun dam is situated on the Orontes river north of Hama in Syria and was originally constructed in 1996 with a capacity of 71 million³ and used for widespread irrigation in the Al-Ghab province .

On 4th June 2002 a failure occurred in the original dam which was completely destroyed and resulted in widespread flooding and damage.

As part of the re-building program a new design with an extensive monitoring system is currently being implemented.

The new dam design includes a much deeper foundation which is intended to remove the weak strata identified as part of the reason for the failure.

A grouting and monitoring gallery is included in the new design, which is located beneath the core foundation.

Monitoring

The dam integrity is carried out by monitoring key areas as follows:

Main Dam Body

Pore water and total soil pressures, settlement and lateral movement within the core. Seismic response of the crest

New Dam Foundation

Water levels under the downstream shoulder
Groundwater levels beyond the dam toe

Existing Dam Body

Pore water pressures within the core

Reservoir Level

Water level, pressure and loading

Dam Abutments

Groundwater levels

New/Existing Dam Connection

Joint movements

Gallery

Seepage
Joint movements
New/Existing Dam Body
Surface movements
Downstream Open Channels
Water level and flow

Products used

- ~ **VW Piezometers**
For accurate measurement of pore water pressure and water level.
- ~ **V-notch weirs**
Accurate measurement of seepage.
- ~ **VW Weir Monitor**
Used with V-notch weirs.
- ~ **Staff gauges**
Measuring water level in dam reservoir.
- ~ **Ultrasonic Flow Meter**
Measurement of flow in open channels.
- ~ **GEO-XM magnetic system**
For measuring ground settlement.
- ~ **Reed switch probe**
For use with the GEO-XM system
- ~ **Inclinometer casing**
For use with portable inclinometers.
- ~ **Portable MEMS Inclinometer**
For measuring lateral displacement.
- ~ **VW Total Pressure Cells**
For measuring total earth pressures
- ~ **VW Soil Extensometers**
For measuring lateral & longitudinal deformation.
- ~ **Data loggers**
Multi-channel remote reading and logging of all instruments.
- ~ **GeoViewer**
Data visualisation software.



Tishreen Dam, Syria



Project Summary

NAME: Tishreen Dam Automatic Instrumentation

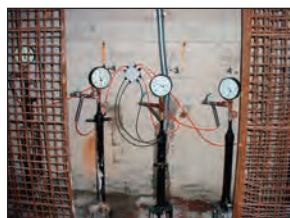
YEAR: 2006

CLIENT: General Organisation Of The Euphrates Dam

MAIN CONTRACTOR: N/A

INSTRUMENTATION: Geosense

CONSULTANT: Geosense



Overview

Completed in 1991 and situated within the Tigris-Euphrates basin, the 630MW hydro-electric Tishreen Dam has a storage capacity of 1.9 km³ and generates 1.6 billion kWh of electricity every year.

The dam is constructed with a chalk impervious core and seepage beneath it controlled by a Bentonite/cement cut-off wall. The complex comprises the main dam, a powerhouse constructed as a gravity dam and a small fuse plug.

The original instrumentation equipment was installed during construction and was entirely manually read.

Due to a serious dam failure in Syria the General Organisation for Euphrates Dam (GOED) decided to upgrade the instrumentation to a modern automatic system including full data logging of all instruments together with alarm trigger levels.

After consultation with the GOED Engineers, Geosense designed a new system installing new instruments side by side with the existing instrumentation and upgrading several areas to provide a fully integrated and automatic dam safety monitoring system.

Monitoring

The dam integrity is carried out by monitoring key areas as follows:

Main dam body

Pore water pressures

Dam main drain

Seepage

Dam abutments

Groundwater levels

Power house

Expansion joints

Relief well seepage

Upstream pore water pressures

Downstream pore water pressures

Temperature

Bridge deck

Expansion joints

Temperature

Galleries

Seepage

Upstream pore water pressures

Downstream pore water pressures

Products used

VW piezometers

Measurement of pore water pressure.

Borehole packers

Produce a response zone in a borehole in combination with a piezometer.

VW triaxial crack gauges

Measures expansion or contraction in the dam joints.

V-notch weirs

Measurement of seepage flows.

Terminal switch boxes

For the connection and reading of up to 34 Instruments.

Data loggers

Multi-channel remote reading and logging with solar panel and back-up battery.

Telemetry system

Radio based system to connect the main processing computer with the remote data loggers.

GeoViewer

Data visualisation software which retrieves data from the data logger in near real time and processes the information in either map, profile or graph formats. Trigger levels & alarms can also be set.

Chemususu Dam, Kenya



Project Summary

NAME: Chemususu Dam

YEAR: 2011-2014

CLIENT: National Water Conservation & Pipeline Corp

MAIN CONTRACTOR: FRABO Construction Ltd, NBO

INSTRUMENTATION: Vas Motor Mart

CONSULTANT: Otieno Odongo & Partners



Overview

Chemususu Dam, completed in 2014, is now the third largest dam in Kenya. It is located on the Chemususu River, a tributary of the Tigiri River, some 80kms North-West of Nakuru Town and approximately 15kms West of Eldama-Ravine Town. This is a high altitude site where the crest elevation is 2340m above sea level.

The dam will improve water storage by storing approximately 10.94million m³ and provides an uninterrupted water supply of about 35,000 M³/day to Nakuru Town, parts of Baringo and Koibatek Districts, including Eldama-Ravine Town.

The project included a Rockfill dam approximately 40m high with a crest length of approximately 350m. It has a narrow inclined clay core only, measuring only 20m at its base.

In addition there is a large concrete spillway and an intake/culvert for both water supply and river flow maintenance.

Monitoring

Monitoring of the dam construction integrity and long term safety was carried out by recording measurements in the following key areas:

Main dam foundation

Pore water pressures upstream of the grout curtain.
Pore water pressures downstream of the grout curtain.

Dam core

Contact zone pore water pressures close to the culvert and the core foundation.
Contact zone soil pressures between core and the culvert.
Pore water pressures within the dam core.
Horizontal & vertical loading within the core.
Vertical settlement of the core.
Horizontal movement of the core.

Dam abutments

Groundwater levels

Spillway Wing Walls

Earth and pore water pressures in the core / wing wall contact zone

Surface Movements

Settlement and displacement of the crest and rockfill

Reservoir Level

Water level and loading

Products used

- ~ **VW piezometers**
Measurement of pore water pressure.
- ~ **V-notch weirs**
Measurement of seepage flows.
- ~ **VW weir monitor**
Used with V-notch weirs.
- ~ **GXM300i**
Magnetic settlement & inclinometer casing system for measuring ground settlement and lateral displacement.
- ~ **Reed switch probe**
For use with GXM system.
- ~ **Inclinometer casing**
For use with portable inclinometers.
- ~ **Portable MEMS inclinometer**
For measuring lateral displacement.
- ~ **VW rigid-back total pressure cells**
For measuring total earth pressures.
- ~ **Data loggers**
Multi-channel remote reading & logging.
- ~ **GeoViewer**
Data visualisation software which retrieves data from the data logger in near real time.
- ~ **Reflective targets**
Survey targets for use with total station survey equipment to detect surface movements.



Al Abyad Dam, Syria



Project Summary

NAME: Al Abyad Dam

YEAR: 2010 - ongoing

CLIENT: Directorate of Water Resources Hama Governorate

MAIN CONTRACTOR: General Company for Hydro Projects (GCHP)

INSTRUMENTATION: Al Mutawasset

CONSULTANT: Agrocomplect SA



Overview

The Al Abyad dam is currently being constructed on a tributary of the Orontes river near to Jisr Al Shurghur, between Aleppo and Latakia in Syria.

The dam will provide water storage, primarily for irrigation, in this agricultural area.

The project includes a conventional clay core dam supported by rockfill shoulders. Also included is a large spillway structure with plunge pool and water intake tower with associated discharge culvert.

The dam has a grouting, drainage and monitoring gallery running the full length of the core foundation with access at both abutments and the downstream toe.

Built on a severely faulted rock foundation, this structure has been highlighted for geotechnical monitoring.

Monitoring

Monitoring of the dam construction integrity and long term safety is carried out by recording measurements in the following key areas:

Main dam body

Pore water pressures in the core
Settlement in the core

Dam gallery

Seepage
Pressure relief
Foundation pore pressures

Dam abutments

Groundwater levels

Intake tower

Reservoir water level

Products used

- ~ **VW piezometers**
Measurement of pore water pressure.
- ~ **Standpipe piezometers**
Simple measurement of groundwater levels.
- ~ **V-notch weirs**
Measurement of seepage flows.
- ~ **V-notch weir monitor**
Used in combination with V-notch weirs.
- ~ **Staff gauges**
For measuring water level in dam reservoir.
- ~ **GEO-XM**
Magnetic system for measuring ground settlement.
- ~ **Reed switch probe**
For use with GEO-XM system.
- ~ **Data loggers**
Multi-channel remote reading and logging with solar panel and back-up battery.
- ~ **GeoViewer**
Data visualisation software which retrieves data from the data logger in near real time and processes the information in either map, profile or graph formats. Trigger levels & alarms can also be set.

Gordiyen Dam, Iran



PROJECT SUMMARY

PROJECT NAME: Gordiyen Dam

PROJECT DATE: 2015

CLIENT: East Azerbaijan Regional Water Authority

CONTRACTOR : Azar Ettefag

CONSULTANT: Faraz AB

INSTRUMENTATION SPECIALIST: Larzeh Sakht Savalan



OVERVIEW

Gordiyen Dam is located 20 Km South East of Jolfa (East Azerbaijan Province) in Iran.

The dam provides water to the Potable & Industry. Gordiyen Dam is an earthfill dam, with a clay core. It is 1420 m in length and 40 m high and impounds a 23,000,000 m³ reservoir.

MONITORING

Monitoring of the dam construction integrity and long-term safety is carried out by recording measurements in the following key areas:

- Main dam body
- Pore water pressures in the core
- Effective stress in the core
- Inclination in the core & shell
- Settlement in the core & Shell
- Groundwater levels
- Foundation
- Pore water pressures in the rock
- Groundwater levels
- Dam main drain
- Seepage

PRODUCTS USED

VW Total Pressure Cells

For measuring total earth pressures

Balarud Dam, Iran



Project Summary

NAME: Balarud Dam, Iran

YEAR: 2015 - on going

CLIENT: Khuzestan Water & Power Authority

MAIN CONTRACTOR: OMRAN MARON

INSTRUMENTATION: LARZEH SAKHT SAVALAN

CONSULTANT: DEZAB



Overview

Balarud dam is located in Khozestan Province, 27km north of Andimeshk. It is an earthfill dam with a central clay core, 1070m in length and 77.5m high. It provides water for irrigation, potable water, industry and hydro power. It impounds a 131,000,000 m³ reservoir and its plant capacity is 4Mw.

Monitoring

Monitoring of the dam construction integrity and long-term safety is carried out by recording measurements in the following key areas:

Main dam body

Pore water pressures in the core
Effective stress in the core
Inclination in the core & shell
Settlement in the core & shell
Groundwater levels

Foundation

Pore water pressures in the rock
Groundwater levels

Dam main drain

Seepage

Products used

- ~ **VW piezometers**
Measurement of pore water pressure.
- ~ **VW Total Pressure Cells**
For measuring total earth pressures.
- ~ **Standpipe piezometers**
- ~ **3D Mechanical Crack Meter**
- ~ **Remote Smart Mux**
- ~ **Smart Mux Interface**
- ~ **Portable MEMS Inclinator**
- ~ **V-notch weirs**
Measurement of seepage flows.
- ~ **Staff gauges**
Water level in dam reservoir.
- ~ **GEO-XM**
Magnetic system for measuring ground settlement.
- ~ **VW Readout VWR01**
Measures all types of vw instruments.
- ~ **G8 PLUS Data Logger**
- ~ **Geoaxiom software**
- ~ **Weather Station**



Belobin Dam, Iran



PROJECT SUMMARY

Name: Belobin Dam, Iran

Year: 2017 - on going

Client: Zanjan Regional Water Authority

Main Contractor: Zangan Pershia

Instrumentation: Larzeh Sakht Savalan

Consultant: Arkan Rahab



OVERVIEW

Belobin Dam is located south of Zanjan Province, 11 km from Halab city. It is an earthfill dam with clay core, 325m in length and 59m high. The dam provides potable and industry. It impounds a 53,780,000 m³ reservoir.

MONITORING

Monitoring of the dam construction integrity and long-term safety is carried out by recording measurements in the following key areas:

Main dam body

- Pore water pressures in the core
- Effective stress in the core
- Inclination in the core & shell
- Settlement in the core & shell
- Groundwater levels

Foundation

- Pore water pressures in the rock
- Groundwater levels

Dam main drain

- Seepage

PRODUCTS USED

VW piezometers

Measurement of pore water pressure

VW Total Pressure Cells

For measuring total earth pressures

Standpipe piezometers

3D Mechanical Crack Meter

Portable MEMS InclinoMter System

For measuring lateral displacement

Remote Smart Mux

Smart Mux Interface

V-notch Weirs

Measurement of seepage flows

Staff gauges

GEO-XM

Magnetic system for measuring ground settlement.

VW Readout VWR1

Measures all types of vw instruments.

G8 PLUS DataLogger

GeoAxiom software

Bidvaz Dam, Iran



Project Summary

NAME: Bidvaz Esfarayen Dam, Iran

YEAR: 2016 - on going

CLIENT: North Khorasan Regional Water Authority

MAIN CONTRACTOR: GALA

INSTRUMENTATION: LARZEH SAKHT SAVALAN

CONSULTANT: TOOSAB



Overview

Bidvaz Esfarayen Dam is located in the North East of Khorasan Shomali Province, 20km from Esfarayen city. It is an earthfill dam with clay core, 104m in length and 80m high. The dam provides potable & industry. It impounds a 52,900,000 m³ reservoir.

A new cut-off wall is under construction upstream of the dam.

Monitoring

Monitoring of the dam construction integrity and long-term safety is carried out by recording measurements in the following key areas:

Main dam body

Pore water pressures in the core
Effective stress in the core
Inclination in the core & shell
Settlement in the core & shell
Groundwater levels

Foundation

Pore water pressures in the rock
Groundwater levels

Dam main drain

Seepage

Products used

- ~ **VW piezometers**
Measurement of pore water pressure.
- ~ **VW Total Pressure Cells**
For measuring total earth pressures.
- ~ **Standpipe piezometers**
Simple measurement of groundwater levels.
- ~ **Remote Smart Mux**
- ~ **Smart Mux Interface**
- ~ **V-notch weirs**
Measurement of seepage flows.
- ~ **Staff gauges**
For measuring water level in dam reservoir.
- ~ **GEO-XM**
Magnetic system for measuring ground settlement.
- ~ **Reed switch probe**
For use with GEO-XM system.
- ~ **VW Readout VWR01**
Measures all types of vibrating wire instruments.
- ~ **G8 PLUS Data Logger**
- ~ **Geoaxiom software**



Project Summary

NAME: Golgohar Tailing Dam, Iran

YEAR: 2013-2015

CLIENT: Golgohar Mining & Industrial Co

MAIN CONTRACTOR: AB & KHAK

INSTRUMENTATION: LARZEH SAKHT SAVALAN

CONSULTANT: MEHR AB POYESH



Overview

Golgohar Dam is located 53Km South West of Sirjan in the Kerman Province in Iran.

Commissioned in 2011, Golgohar Dam is an earthfill dam, with a clay core. It is 795m in length and 25m high. The dam has seven sections needing instrumentation.

The dam was constructed for environmental protection in order to reserve tailing materials resulting from the iron mine concentration process.

Monitoring

Monitoring of the dam construction integrity and long-term safety is carried out by recording measurements in the following key areas:

Main dam body

Pore water pressures in the core
Effective Stress in the core
Inclination in the core & shell
Settlement in the core & shell
Groundwater levels

Foundation

Pore water pressures in the rock
Groundwater levels

Dam main drain

Seepage

Products used

- ~ **VW HD Piezometers**
Measurement of pore water pressure.
- ~ **Standpipe Piezometers**
Simple measurement of groundwater levels.
- ~ **Portable MEMS Inclinator System**
For measuring lateral displacement.
- ~ **Terminal Box**
- ~ **Smart Mux Interface**
- ~ **V-notch Weir**
Measurement of seepage flows.
- ~ **Staff gauges**
For measuring water level in dam reservoir.
- ~ **GEO-XM**
Magnetic system for measuring ground settlement.
- ~ **Reed switch probe**
For use with GEO-XM system.
- ~ **VW Readout VWR01**
Measures all VW instruments.
- ~ **CR1000 Data Logger**
- ~ **Soil Extensometer**

Joghan Dam, Iran



Project Summary

NAME: Joghan Dam, Iran

YEAR: 2009

CLIENT: East Azerbaijan Regional Water Authority

CONTRACTOR: ALAND AB

INSTRUMENTATION: LARZEH SAKHT SAVALAN

CONSULTANT: OMRAN PAZHOHESH RAHVAR



Overview

Jogan Dam is located in 16Km South West of Bostan Abad on the Asb Abad Chai River (East Azerbaijan Province) in Iran.

Commissioned in 2006, the dam provides water to potable & industry. Jogan Dam is an earthfill dam, with a clay core. It is 179.5m in length and 37.75m high. The Dam was constructed using 0.55Mm³ of materials. It impounds a 3,000,000 m³ reservoir.

Monitoring

As part of a rehabilitation programme, existing instruments were upgraded to allow for automatic readings to be taken.

In addition, seepage monitoring was added to detect any change in water flow through the dam.

Products used

- ~ **Terminal Box (Auto & Manual)**
Provide a central location where multiple instruments can be read.
- ~ **V-notch weir**
Provides a method of measuring volumetric. Since the geometry of the top of the weir is known and all water flows over the weir, the depth of water behind the weir can be converted to a rate of flow.
- ~ **VW Weir Monitor**
Automatically measures the height of water behind the V-notch weir



Karam Abad Dam, Iran



Project Summary

NAME: Karam Abad Dam, Iran

YEAR: 2016 - on going

CLIENT: West Azerbaijan Regional Water Authority

MAIN CONTRACTOR: SAZ AB KIYAN PAD

INSTRUMENTATION: LARZEH SAKHT SAVALAN

CONSULTANT: ZISTAB



Overview

Karam Abad dam is located in West Azerbaijan Province, 20km from Poldasht. It is an earthfill dam with clay core, 1991m in length and 43m high. The dam provides Potable & Industry. It impounds a 53,700,000 m³ reservoir.

Karam Abad Dam was built to create a reservoir dam to store the excess water from the reservoir of Aras Dam at a rate of 5.30 cubic meters per second. Using the Ganbar Kundi pumping station in the vicinity of the reservoir of the Aras Dam, the result is the development of agricultural land.

Monitoring

Monitoring of the dam construction integrity and long-term safety is carried out by recording measurements in the following key areas:

Main dam body

Pore water pressures in the core
Effective stress in the core
Inclination in the core & shell
Settlement in the core & shell
Groundwater levels

Foundation

Pore water pressures in the rock
Groundwater levels

Dam main drain

Seepage

Products used

- ~ **HD VW piezometers**
Measurement of pore water pressure.
- ~ **VW Total Pressure Cells**
For measuring total earth pressures.
- ~ **Standpipe piezometers**
- ~ **Remote Smart Mux**
- ~ **Smart Mux Interface**
- ~ **Portable MEMS Inclinator**
- ~ **V-notch weirs**
Measurement of seepage flows.
- ~ **Staff gauges**
For measuring water level in dam reservoir.
- ~ **GEO-XM**
Magnetic system for measuring ground settlement.
- ~ **VW Readout VWR01**
Measures all types of vw instruments.
- ~ **G8 PLUS Data Logger**
- ~ **Geoaxiom software**
- ~ **3D Mechanical Crack Meter**
- ~ **Weather Station**

Kalgan Chai Dam, Iran



Project Summary

NAME: Kalgan Chai Dam, Iran

YEAR: 2011 - on going

CLIENT: East Azerbaijan Regional Water Authority

INSTRUMENTATION: LARZEH SAKHT SAVALAN

CONSULTANT: NAHAD AB



Overview

Kalgan Dam is located south west of Bostan Abad on the Kalgan River (East Azerbaijan Province) in Iran.

Commissioned in 2006, the dam provides water to the Potable & Industry. Kalgan Dam is an earthfill dam, with a clay core. It is 456m in length and 65m high. The dam was constructed using 1.0 Mm³ of Materials. It impounds a 22,000,000 m³ reservoir.

Monitoring

Monitoring of the dam construction integrity and long-term safety is carried out by recording measurements in the following key areas:

Main dam body

Pore water pressures in the core
Effective stress in the core
Inclination in the core & shell
Settlement in the core & shell
Groundwater levels

Foundation

Pore water pressures in the rock
Groundwater levels

Dam main drain

Seepage

Products used

- ~ **HD VW piezometers**
Measurement of pore water pressure.
- ~ **VW Total Pressure Cells**
For measuring total earth pressures.
- ~ **Standpipe piezometers**
- ~ **Remote Smart Mux**
- ~ **Portable MEMS Inclinometer**
- ~ **V-notch weirs**
Measurement of seepage flows.
- ~ **Staff gauges**
For measuring water level in dam reservoir.
- ~ **GEO-XM**
Magnetic system for measuring ground settlement.
- ~ **Reed switch probe**
For use with GEO-XM system.
- ~ **VW Readout VW2106**
Measures all types of vw instruments.
- ~ **G8 PLUS Data Logger**
- ~ **Geoaxiom software**



Nian Dam, Iran



PROJECT SUMMARY

PROJECT NAME: Nian Dam

PROJECT DATE: 2017-2018

CLIENT: Hormozgan Regional Water Company

CONTRACTOR : Didas construction Company

CONSULTANT: Moshanir Consulting Engineers Co.

INSTRUMENTATION SPECIALIST: Larzeh Sakht Savalan



OVERVIEW

Nian Reservoir dam project is designed to prevent seasonal flooding and for the collection of water for agricultural purposes.

It is a clay core earth-fill dam with the height of 27.3m and crest length of 510m with four radial spillway gates and an inflow of 4630m³/s surface water, artificial feeding intake and semi-deep discharge system.

It is located 70km from Bandar Abbas.

Latest work includes the installation of Geosense sensors to automate existing sensors which were installed during dam construction.

MONITORING

Monitoring of the dam construction integrity and long-term safety is being carried out by recording measurements in the following key areas:

- Main dam body
- Water pressures in the core shell
- Inclination in the core & shell
- Settlement in the core & Shell
- Groundwater levels

All existing VW sensors were double checked using the VWR1 readout unit.

PRODUCTS USED

Stand Pipe Piezometer

Measurement of pore water pressure

Inclinometer Casing

For use with portable inclinometers

Dip Meter

Portable MEMS Inclinometer system

For measuring lateral displacement

Reed switch probe

For use with the GEO-XM system

VW Readout VWR1

Measures all types of vibrating wire instruments

G8 PLUS Data logger

Remote Smart Mux 12 CH & 6CH

A modular multiplexer that allows the management of multiple sensors as part of a remote or automatic data acquisition system.

Smart Mux Interface



Sarcheshmeh Tailing Dam, Iran



Project Summary

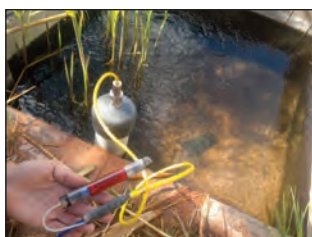
NAME: Sarcheshmeh Tailing Storage Dam, Iran

YEAR: 2011

CLIENT: National Iranian Copper Industries Co.

INSTRUMENTATION: LARZEH SAKHT SAVALAN

CONSULTANT: ATC Co. & MEWE Co



Overview

Sarcheshmeh Tailing dam is located in the Sarcheshmeh. The dam was constructed to reserve 1,000,000,000 tons of tailing materials resulted copper mine concentration process. It is an earth fill dam with a clay core, 1500 m length and 75 m high, and reservoir volume is 123,000,000 m³.

Monitoring

Automatic monitoring of seepage was identified as being a requirement to ensure the long term integrity of the dam and allow water quality measurements to be made.

Changes in seepage volumes and water quality could be quickly identified and checked with changes in reservoir level and filling activities.

Products used

- ~ **V-notch weir**
Provides a method of measuring volumetric. Since the geometry of the top of the weir is known and all water flows over the weir, the depth of water behind the weir can be converted to a rate of flow.
- ~ **VW Weir Monitor**
Automatically measures the height of water behind the V-notch weir



Shamil Dam, Iran



PROJECT SUMMARY

PROJECT NAME: Shamil Dam

PROJECT DATE: 2017-2018

CLIENT: Hormozgan Regional Water Company

CONTRACTOR : Didas construction Company

CONSULTANT: Moshanir Consulting Engineers Co.

INSTRUMENTATION SPECIALIST: Larzeh Sakht Savalan



OVERVIEW

Shamil Reservoir Dam project is designed to prevent seasonal flooding and for the collection of water for agricultural purposes.

It is a clay core earth-fill dam with the height of 32.3m and crest length of 1200m. It has a surface water intake and deep discharge system, underground pumped storage type is situated upstream of the dam.

It is located 70km from Bandar Abbas.

Latest work includes the installation of Geosense sensors to automate existing sensors which were placed installed during dam construction.

MONITORING

Monitoring of the dam construction integrity and long-term safety is being carried out by recording measurements in the following key areas:

Main dam body

- Water pressures in the core shell
- Inclination in the core & shell
- Settlement in the core & Shell
- Groundwater levels

All existing VW sensors were double checked using the VWR1 readout unit.

PRODUCTS USED

Stand Pipe Piezometer

Measurement of pore water pressure

Inclinometer Casing

For use with portable inclinometers

Dip Meter

Portable MEMS Inclinometer system

For measuring lateral displacement

Reed switch probe

For use with the GEO-XM system

VW Readout VWR1

Measures all types of vibrating wire instruments

G8 PLUS Data logger

Remote Smart Mux 12 CH & 6CH

A modular multiplexer that allows the management of multiple sensors as part of a remote or automatic data acquisition system.

Smart Mux Interface



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V1.2 04/2018