DAM MONITORYING - A MODERN METHOD IN ENVIRONMENT ENGINEERING

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Abstract: *Environmental protection, as a relationship of mankind with nature, has evolved in time, as on the awareness of the anthropic activities, with irreversible effects and with dramatic consequences on the modified natural environment. Nothing is static. Buildings and dams settle, bridges flex and vibrate, rock masses shift, mud slides, glaciers flow and volcanoes erupt. Whether by human activity such as mining or by natural processes such as erosion, the world in which we live is continually changing. Management of this change is essential for social and economic advancement. Failure of a bridge can isolate communities and restrict commerce. A landslide can cause financial and human loss, stop mining operations and even impact world mineral prices. Economies and our daily lives are dependent upon the health of bridges, dams, tunnels, elevated road systems, dams, mines and high-rise buildings. Engineers, geologists and other professional are trusted to prevent such disasters. Whether you monitor the movement of a volcanic slope, the structure of a long bridge or track the settlement of a dam; whether you measure, analyze and manage the structures of natural or man-made objects: the monitoring systems provide you with the right solution for every application. Advanced data processing algorithms, together with powerful event management systems ensure that maximum benefit is derived from the measurement information provided by the instruments.Topographic and cadastral measurements have a special importance in the environmental protection research, especially for monitoring the effects of nature's geometrical modifications. Dam monitoring has special importance because through a proper monitoring can be prevented unwanted events, that can be transformed in real social, economical, ecological disasters and therewith partially the design, execution and even exploitation errors effects can be removed. The surveying measurements made at Petrimanu dam have the porpoise to determinate the horizontal and vertical displacements of the marks, regarding environment protection.*

Key words: *environment, sustainability, monitoring, dam, surveying, risk.*

INTRODUCTION

Engineering companies and contractors are facing challenges never experienced before. They are being charged with - and being held liable for - the health of the structures they create and maintain. To surmount these challenges, engineers need to be able to measure structural movements to millimeter level accuracy. Accurate and timely information on the status of a structure is highly valuable to engineers. It enables them to compare the real-world and real time behavior of a structure against the design and theoretical models. When empowered by such data, engineers can effectively and cost efficiently measure and maintain the health of vital infrastructure.

The ability to detect and react to potential problems before they develop helps in the reduction of insurance costs and the prevention of catastrophic failures that may results in injury, death or significant financial loss. A structural monitoring system will help reduce both your current and long term maintenance cost associated with structural movement.

A structural monitoring system reduces risks, as data analysis can be used to aid the understanding of current and future implications of structural movements. Safety and structural integrity concerns can be minimized. Contractors can reduce their risk exposure before, during and after a construction project by continuously monitoring the project as it progresses through its lifecycle. Potential problems can be detected and rectified before a critical situation develops.

MATERIAL AND METHODS

Modern cable-supported bridges carry enormous loads across great distances. By design they are dynamic structures that move due to the loads imposed by traffic, wind, heating and cooling, corrosion and other environmental conditions. Monitoring solutions can be used both during and after construction.

Each year landslides cause millions of dollars of damage and loss of revenue to mines, residential and commercial properties, motorways and railway lines.

In mining, geotechnical engineers are under increasing pressure to increase slope angles in order to improve productivity. This increases the risk of slope failure.

Monitoring systems are an essential part of risk management. By providing the early detection of instability they have prevented slope failures from causing injury, death and financial loss.

Cities throughout the world are becoming denser and higher than ever before. The costs of base materials are rising, driving engineers to develop novel construction techniques. Monitoring systems can provide timely information on any departures from design during the critical stages of construction, such as concrete jetting, deep excavation and support walls. This ensures the integrity of the construction site and the safety of people. Monitoring provides ongoing verification and documentation of the compliance to construction and design tolerances.

New and existing buildings can be affected by daily movements (solar effects, heavy rainfalls), long period movements (settlement) and dynamic movements (resonance, wind and loads). They may also be built in flood or earthquake zones and therefore at risk of being damaged by natural events. Many buildings are aging and their construction materials deteriorating due to time and weathering. A monitoring system can insure the structural integrity of a building by providing continues deformation data over extended periods of time. This can allow appropriated and cost effective maintenance to be conducted.

Large earth fill and concrete dams are a critical infrastructure for continuous water supply and power generation. Loading and unloading forces on a dam cause stress on the structure and must be monitored. The stress can be due to fluctuations in the water level, settlement of the structure, nearby landslides or seismic activity. Early detection of a potential problem allows repairs or remedial measures to be taken before a disaster occurs. Even if repair is not possible, with the early warning of a problem action may be taken to mitigate its effects.

RESULTS AND DISCUSSIONS

In the context of the approached issue, there are presented aspects referring toward the hydro locations on the environment, with tracking the possible destructive effects on it.

Figure 1: Petrimanu dam

The Petrimanu storage lake made on the Latorita River gathers most of the waters caught in the southern headrace network (without those accumulated in the Galbenu and catchment Însiratele) from a 236 km^2 surface. There are 28 catchments, the gallery length is of 55,416 m, and the caught flow is of 5,384 m^3/s. As a total the southern network has a number of 31 catchments along the water course, the headrace length of 67.551 m out of which 745 m crossings and it catches a flow of 7,514 m/s.

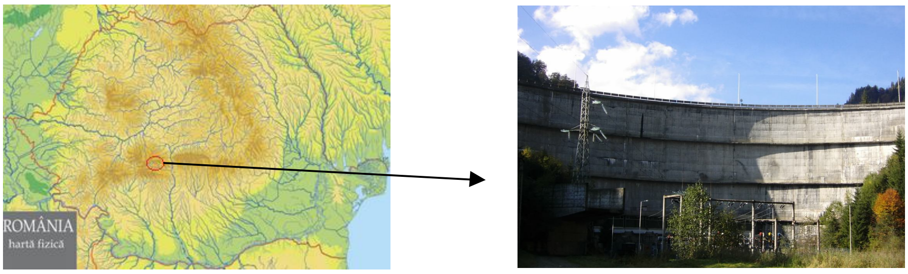

Figure 2: Petrimanu dam

The Petrimanu dam is a concrete arch dam, 49 m high, a crown length of 190 m (crown level at 1,134 mdM), it embedded a concrete volume of 56.000 m^3 and it creates a 2,500 mil m^3 storage lake.

The pumping station Petrimanu directs the accumulated flow at a 185 m height, to a gallery from which it falls by gravity into the main storage Lake Vidra, gathering on its way the waters derived from Galbenu and the catchment Înşiratele.

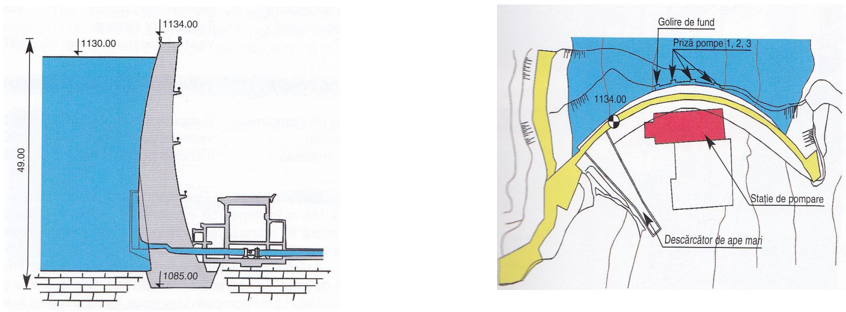

Figure 3: Petrimanu dam- Cross section and Overview

The surveying measurements made at Petrimanu dam have the porpoise to determinate the horizontal and vertical displacements of the marks. The displacements are obtained from the difference between coordinates, respectively heights determined on the initial measurement and the actual measurement. In figure 4 there are presented the displacements of one landmark from Petrimanu dam, from different surveying cycles.

CONCLUSIONS

Dam monitoring has special importance because through a proper monitoring can be prevented unwanted events, that can be transformed in real social, economical, ecological disasters and therewith partially the design, execution and even exploitation errors effects can be removed.

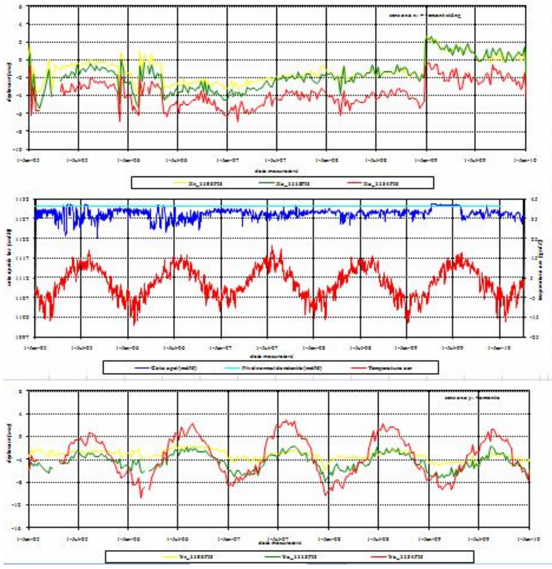

Figure 4: Petrimanu dam- mark displacements

Monitoring this kind of constructions is made both physical methods and topographic methods. The advantage of physical methods is that through the used gear they are providing information about the monitored construction behavior at small time intervals (hours, days, weeks). This information has a relative character because the measurements are made on certain construction elements reported to other construction elements. The topographic methods have an absolute character because the measurements are executed towards the construction independent reference system.

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