



Applying Microseismic Monitoring to Hydroelectric Dams

Microseismic systems were installed at seven hydroelectric dams in Iraq and one hydroelectric dam in China. These systems are used for diverse applications from monitoring vibrations in the dam structure itself to observing the integrity of dam abutments.



Fig. 1: The Haditha Dam in Iraq is the second-largest hydroelectric contributor to the power system in Iraq.

Throughout 2009, ESG successfully incorporated microseismic monitoring systems to hydroelectric dam projects in Iraq and China. Specifically, the Paladin™ Dam Monitoring System was installed in seven hydroelectric dams in Iraq and one at the Jinping Hydroelectric Dam in Sichuan province in China.

Hydroelectric Dams in Iraq

In Iraq, seven hydroelectric dams were equipped with the Paladin™ Dam Monitoring System, including the Haditha Dam shown in Figure 1. All systems were installed by Al Fakhar Engineering Co. Ltd. Each dam has a triaxial force-based accelerometer located at the crest of the dam. This is used to monitor the ground vibration of the crest, and record the effects that any large scale seismic events (earthquakes) may have on the structure of the dam.

By obtaining information from the dam structure, it is hoped that engineers can use this information to quantify the effects that earthquakes may have on these dams. Knowing how dam structures respond to large-magnitude events will influence future dam design and also help operators to determine procedures for when seismic events exceed certain thresholds.

In addition to using accelerometers for dam design threshold monitoring, ESG's Seismic Monitoring system also incorporates low-frequency iSeismographs positioned a few kilometers from the dam near to the edge of the water reservoir. These iSeismographs include triaxial geophones which are installed in shallow boreholes and powered by solar panels. The iSeismographs are positioned to detect and record any seismicity that might be associated with water reservoir operations, particularly raising and lowering the water level in the reservoir. Over time, operators will be able to determine the extent of seismicity that is directly associated with reservoir operations.



Fig. 2: Triaxial geophone installed to monitor hydroelectric dam reservoirs

Hydroelectric Dams in China

In China, ESG has recently installed a Paladin™ Dam Monitoring System at the Jinping I Hydroelectric Dam in Sichuan province. The system is designed to monitor the dam abutments, continually observing the integrity of the structure ensuring that a good seal exists and there is no cracking or separation.

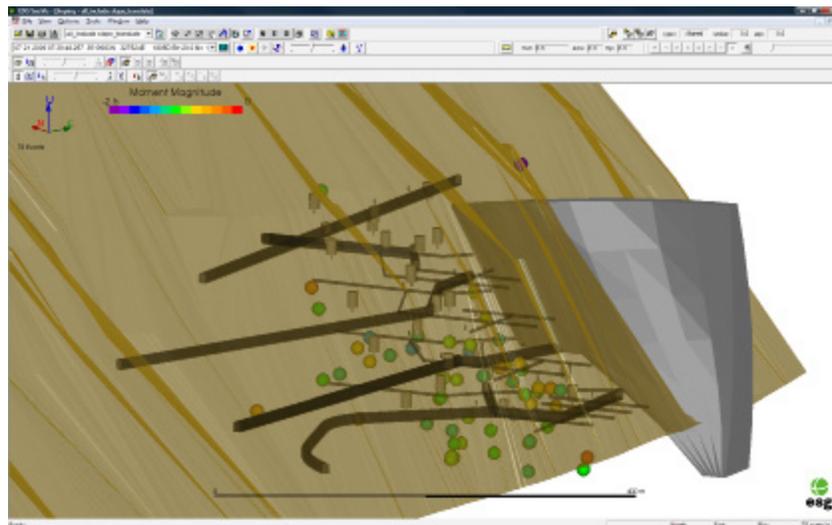


Fig. 3: SeisVis™ screen capture of the Jinping I hydro-electric dam monitoring system