Seepage detection in dams

A fibre-optic sensing based automated seepage monitoring and evaluating system has been developed by HydroResearch in Sweden to help ensure dam safety, utilising instrumentation developed by Silixa.

**Case study: Höjjes embankment dam, Sweden**

A distributed temperature based seepage monitoring system needed to be installed in an earth filled embankment dam at Höjjes, Sweden. As this an older dam improved monitoring was required to bring it up to today’s standards but due to the condition of the dam foundations and high downstream water level, installation of a traditional leak detection system was not possible.

HydroResearch proposed to the dam owner, Fortum, that high accuracy temperature measurements be made using Silixa’s ULTIMA-DTS to interrogate optical fibre cable installed in standpipes in the downstream part of the dam. Four standpipes were installed on the two upper terraces of the dam and eleven along the dam toe. All standpipes were drilled through the downstream fill, the permeable soil layers in the old river bed and approximately 1m into the bedrock. Measurements were made with a fine spatial sampling (0.12m) allowing abnormal water flow to be observed with high resolution in the vertical direction. Using such a technique generates large data sets and to enable effective data collection, HydroResearch’s proprietary web based software (XSeep™) was deployed.

It was established early on that the level of water flow through the dam is low. The seasonal variations were in line with those expected but that significant differences of temperature existed throughout the standpipes indicating differences in water flow. Data continues to be collected.

**Discussion**

The Höjjes project builds on work carried out by HydroResearch at Bergsforsen, Sweden, where measurements have been made since 2005. Additionally fibre optic cable has in recent years been installed in standpipes in the Mica and WAC Bennet dams in Canada, also in cooperation with HydroResearch.

Such detailed insights into dam condition are only made possible by utilising the highest quality instrumentation to provide the precise temperature measurements necessary to detect small changes within the dam. Silixa’s range of DTS products, ULTIMA-DTS and XT-DTS, have been designed to enable the early detection of any increase in flow.