

FIELD NOTES

Power Dam and Retaining Wall Monitoring with ILRIS-3D: Safe, Accurate and Complete

A body of water extending for miles behind a hydroelectric dam exerts enormous pressure on the dam and its surrounding terrain. Whether the dam is constructed of gravel, earth or concrete, regular measurements must be made in order to detect any changes in the material holding back millions of tons of water.

Modern surveying instruments, such as total stations and GPS receivers, have made this task easier and less time-consuming than traditional methods, but still do not offer the required point spacing to deliver a comprehensive surface analysis. Three-dimensional laser imaging is the latest technology to be used in this essential monitoring process. Recent developments in computer speed and memory size enable rapid processing of data acquired by 3D laser scanners.

Instead of using several dozen "target" points to monitor movement, users can now rely on a "point cloud" consisting of hundreds of thousands or even millions of points to represent the structure being measured. Targets are not required for this purpose as the laser scanner measures points on any solid surface with a reasonable degree of reflectivity.

Creating solid models from the point cloud results in a very accurate rendering of the structure's surface upon which precise measurements can be made. Comparisons with previous scans can quickly and accurately indicate where changes have occurred on the surface of the dam and whether the structure remains within design and operating tolerances.

Korean Water Resources

Recently, Optech Incorporated undertook two projects that illustrate this new method of power dam monitoring.

Optech's ILRIS-3D laser scanner was used to scan the Hoengseong Dam in South Korea. The surrounding terrain was scanned with a resolution of 1 inch, as were the upstream and downstream sides of the dam. This work was done by one person in less than 4 hours, for a total of 12 scans in 6 set-ups.

The completely hands-off measurement method that laser imaging allows makes dam monitoring an extraordinarily safe and effortless procedure. No surveyors are asked to venture out on the sloping sides of the dam to position themselves over GPS target points or to hold prism poles on checkpoints.



Aligned point cloud image of the hydroelectric dam.

Data Processing

The scanned images were then brought into the powerful InnovMetrics Polyworks IMAAlign™ software module, where they were aligned to each other using only their own features — alignment targets were not required to complete this process.

Once aligned, the combined point cloud image can be brought into an inspection software (such as Polyworks IMInspect™) and used to measure distances between points, measure angles between surfaces, geo-reference the image, create cross-sections, extract contour lines and features and export data to the users' CAD software package in a wide variety of data formats. Additional software modules are available for the creation of refined solid models for further inspection and interpretation.



Cross-sections derived from the point cloud.



