High-frequency seismic reflection measurements for imaging internal structure of a sabo dam damaged by a huge debris flow

*Tomio INAZAKI[1], Hiroshi Kisanuki[2], Takanori Ogahara[1], Takeshi Shimizu[1], Naoki Fujimura[1]

1. Public Works Research Institute, Tsukuba Central Institute, 2. PWRI (Present address: OYO Corporation)

We conducted high-frequency, high-resolution seismic reflection measurements on the rear face of a sabo dam which had been damaged by a huge debris flow attack in July 9, 2014. The debris flow swept away the top 5 m part of the dam and segmented the dam body into several blocks associated with horizontal cracks. Estimated surface dislocation was at most 20 cm.
iezoelectric type high-frequency accelerometers were pasted on the surface at 10 cm intervals, and manual hit using a rock hammer was employed for generating high-frequency signals. High-performance data acquisition systems were also employed to obtain high-resolution and high sampling seismic data. Minimum sampling rate was set to 2 microseconds. We set 5 horizontal lines and 1 vertical line on the rear surface during December 2014 to April 2016. Relative height was about 5 m between the first and the last horizontal line. Assuming the RMS velocity to the constant value to 2,500 m/s, which was the typical S-wave velocity of concrete, we processed the dataset to reconstruct migrated depth sections. Clear flat reflection events appeared at 10 m and 7 to 5 meters. The former or deeper reflection event was correlated to the frontal face of the dam. The latter events were possible to be correlated to a horizontal joint which had dislocated the dam body caused by the debris flow attack. A gently dipping reflector, which started from the point just the survey line intersected a vertical fracture, was recognized in the lowest depth section.
In conclusion, field measurements demonstrated that high-frequency and high-resolution seismic reflection surveying was helpful to image the internal fracture distributions in a damaged concrete dam body.

Keywords: Sabo dam, debris flow, seismic reflection survey, high-frequency accelerometer

