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Evaluation of Dam Seepage Problems Using Geological and Geophysical Methods, Republic of Korea

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The precise safety assessment for seepage detection in reservoirs dam and embankments started in Korea in the late 1990's(Song et al., 1999). There are 68,000 agricultural-based facilities and 19,590 locations need to be maintained periodically in Korea. First class facility to conduct regular safety assessment every five years is 1,016 locations and second class facility to conduct safety assessment if necessary is 18,574 locations. Reservoirs are accounted for 90.5 percent of the whole target assessment facilities. Recently, due to the continued adverse weather and earthquake events of countries adjacent to the Korean peninsula, the many lives and untold property damage were occurred eventually.

We have performed the electrical resistivity method to delineate leakage pathways through the abutment of earth fill dams located in Korea. Electrical resistivity survey is one of the oldest and most popular geophysical techniques in electrical exploration. By applying electrical resistivity survey to investigate the condition of the core material, we could expect to get information on the variation of the electrical anomaly pattern due to the saturation of the soil. The objective of survey was to delineate the weak zone of the dam wall and estimate the status of core zone. In other to evaluate the engineering geological properties of the soil deposits, two boreholes a dam were drilled to the bedrock that exceeds the height of the dam. A large set of field tests including standard penetration tests(SPT) and in-situ permeability tests were carried out along the boreholes. Also, a series of laboratory tests were conducted on the undisturbed soil samples obtained using the split-spoon sampler and thin wall tube sampler to determine their engineering characters. Electrical resistivity obtained from the results of the survey is a physical quantity associated to the electrical properties of the ground and can vary from locations to locations. Mostly it is affected by grain size, porosity, permeability and clay mineral contents of ground. Therefore it is very important to examine the properties of the soil of dam sites for safety assessment. So we have the measured resistivity values of undisturbed soil samples which were obtained using the single tube core barrel together with the split-spoon sampler of SPT.

As a result of these studies, seepage pathways have been identified in the most of the dam by using the electrical resistivity method and the safety level of the dams can be estimated. It may indicate that the deficiency of fine particles like soils may cause an increase of resistivity value, and results in the weakening of the core material, which appeared as low N values. And it may lead to the failure of the reservoir dam due to piping and excessive seepage through the core zone.