

Investigating Artificial Levees

CASE STUDY

Artificial levees are critical components in flood defenses. Structural defects in these levees can seriously compromise their effectiveness. In Hungary, where one-third of the country is protected by a 4,200 km long levee system, GSSI's SIR® 3000 GPR unit with a 200 MHz and a 270 MHz antennas were used to investigate these levees.



Performing a fracture assessment to detect leakage zones in the concrete.

Credit: Szeged University

"GPR is strongly suggested here to survey parts of the levee as it gives a more realistic image of the subsurface settings of the study area. The GPR survey was conducted using SIR 3000 control unit (Geophysical Survey Systems Inc.) attached to a 200 and 270 MHz center frequency antennas in the survey wheel mode. Each GPR profile had a length of 100 m. Profiles were successive, meaning that the endpoint of one profile is the starting point of another profile.

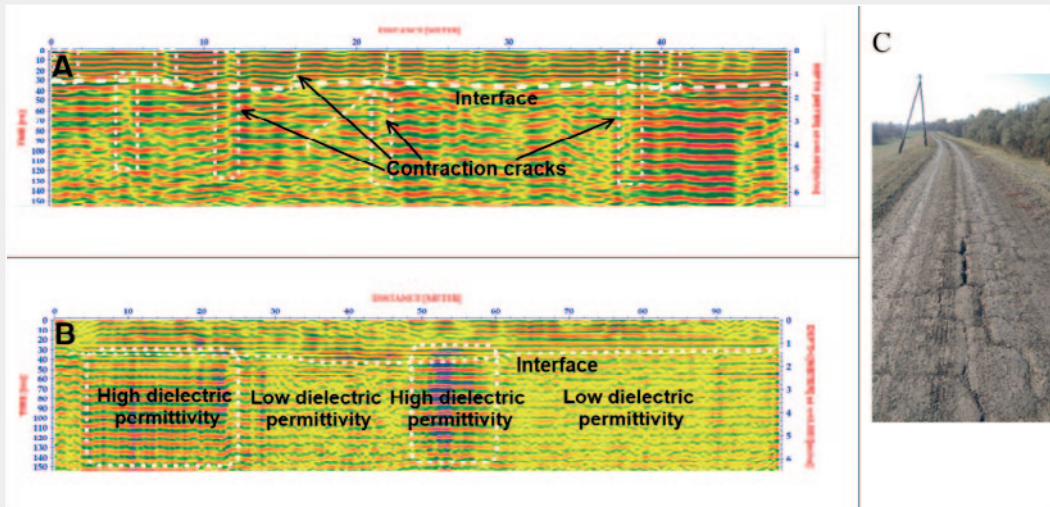
After processing, the GPR profiles were analyzed in detail to identify interfaces and to record different types of anomalies. Anomalies were then categorized and evaluated in terms of flood risk. The spatial distribution of the different categories was analyzed in relation to other parameters referring to levee health. Besides mapping structural differences and defects, changes in levee composition were also assessed, mostly by investigating the attenuation of signals."

Diaa Elsayed, PhD student at Szeged University, Hungary.

A complete profile of the levees was formed from 100 meter length individual GPR profiles. From this, six different types of anomalies were identified and categorized according to their flood risk. Their spatial distribution was mapped and changes in levee composition were also assessed. The spatial distributions and frequency of anomalies were found to correlate with flood occurrences, demonstrating the capabilities of GPR in anticipating flood risks.

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Representative profiles for the identified GPR anomaly types: A) contraction cracks, B) remarkable changes in dielectric permittivity, and C) Photo showing the contraction cracks on the levee crown.

Credit: Szegeed University

"In large earth dams, there is a dam core, filter, support embankment and slope lining. These structures vary on a case-by-case basis. Water always seeps through the dam, under the dam and around it. Problems arise when internal erosion begins, i.e., the flow of water is so great that it takes away ground material and forms corrosion in the dam structure. Noticeable deviations in GPR profile are a consequence of these kinds of problems. These are the undesirable findings we try to locate. Therefore, dam owners can plan for the right type of repair. In our opinion, GPR is a cost-effective tool for risk assessment."

Terho Mäkinen of Suomen Maatutkapalvelu.



Inspecting an earthen dam.

Credit: Suomen Maatutkapalvelu