New early warning system for landslide prediction

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The field trial of the new system showing the acoustic monitoring taking place

A new type of sound sensor system has been developed to predict the likelihood of a landslide.

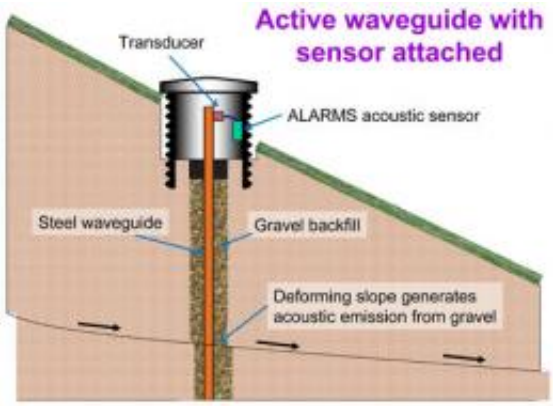
Thought to be the first system of its kind in the world it, works by measuring and analysing the acoustic behaviour of soil to establish when a landslide is imminent so preventative action can be taken.

Noise created by movement under the surface builds to a crescendo as the slope becomes unstable and so gauging the increased rate of generated sound enables accurate prediction of a catastrophic soil collapse.

The technique has been developed by researchers at Loughborough University, in collaboration with the British Geological Survey, through

two projects funded by the Engineering and Physical Sciences Research Council (EPSRC).

The detection system consists of a network of sensors buried across the hillside or embankment that presents a risk of collapse. The sensors, acting as microphones in the subsoil, record the acoustic activity of the soil across the slope and each transmits a signal to a central computer for analysis.



A diagram of the acoustic monitoring system

Noise rates, created by inter-particle friction, are proportional to rates of soil movement and so increased acoustic emissions mean a slope is closer to failure. Once a certain noise rate is recorded, the system can send a warning, via a text message, to the authorities responsible for safety in the area. An early warning allows them to evacuate an area, close transport routes that cross the slope or carry out works to stabilise the soil.

Neil Dixon, professor of geotechnical engineering at Loughborough University and principal investigator on the project, explains how the

system – thought to be a global first – works. “In just the same way as bending a stick creates cracking noises that build up until it snaps, so the movement of soil before a landslide creates increasing rates of noise,” said Professor Dixon.

“This has been known since the 1960s, but what we have been able to do that is new is capture and process this information so as to quantify the link between noise and soil displacement rates as it happens, in real time – and hence provide an early warning,” he added.

The system is now being developed further to produce low cost, self-contained sensors that do not require a central computer. This work, which is being carried out under the second project funded by EPSRC, is focused on manufacture of very low cost sensors with integrated visual and/or audible alarms, for use in developing countries. Ongoing work includes field trials, market research and planning commercial exploitation of the technology.

“The development of low cost independent acoustic slope sensors has only become possible in very recent times due to the availability of microprocessors that are fast, small and cheap enough for this task,” says Dixon.

As well as the life-saving implications for countries prone to disastrous landslides, the technique can also be used in monitoring the condition of potentially unstable slopes built to support transport infrastructure, such as rail and road embankments, in developed countries such as the UK.

Current development work is being funded through Loughborough University’s knowledge transfer account, a fund supplied by EPSRC to help commercial exploitation of inventions arising from its research projects. A commercially available Alarms sensor is expected to be launched in the next two years.

Provided by Engineering and Physical Sciences Research Council