

ADVANCED GEOPHYSICAL MONITORING OF UNSTABLE SLOPES – TOWARDS IMPROVED EARLY WARNING AND RISK MITIGATION

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Conventional approaches for earthwork condition monitoring, such as walk over surveys, remote sensing or intrusive sampling, are often inadequate for predicting instabilities in natural and engineered slopes. Surface observations cannot detect the subsurface precursors to failure events and identify failure only once it has begun. On the other hand, intrusive investigations only sample a small volume of the subsurface and hence are likely to miss small scale deterioration processes in heterogeneous ground conditions.

In the context of ageing infrastructure assets, remote condition monitoring using geophysical methods has been identified as one of the most cost-effective techniques to improve the understanding of asset degradation and performance, while requiring fewer site visits. We present data delivered by a novel, pro-active infrastructure monitoring and evaluation (PRIME) system. It is built around low-cost electrical resistivity tomography instrumentation, combined with integrated geotechnical logging capability, and coupled with data telemetry. An automated data processing and analysis workflow is being developed to streamline information delivery.

The hardware component of the system has been operational at a number of field sites associated with a range of natural and engineered slopes for up to two years. We report on the monitoring results from these sites, and focus on an operational railway cutting, which has a history of slope instabilities;

a relict landslide is situated in the center of the monitoring area, which is grass-covered in contrast to surrounding densely vegetated woodlands. Our results show that resistivity, and thus moisture dynamics, show significantly higher amplitudes in the vegetated than in the grass-covered part. This may lead to faster deterioration, as the material cycles between states of very low saturation, where desiccation cracks are likely to occur, and full saturation. These insights into the moisture dynamics will aid engineers in designing infrastructure slopes and intervention strategies for unstable slopes.