A STUDY OF SOIL-PIPE FLOW AND INTERNAL EROSION BY ACOUSTIC TECHNIQUES

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Abstract: Internal erosion of soil pipes can lead to embankment failures, landslides, and gully erosion. This talk presents a lab study using both active and passive acoustic techniques to monitor and assess a soil pipe flow and internal erosion event. In active test, the phase slope method was employed to measure the P-wave velocity of soils under noisy and ever-changing conditions. The study showed that the variation of the P-wave velocity reflected the ongoing internal erosion processes such as the onset of soil pipe flow, the buildup of hydraulic pressure, the evolution of saturation, the variation of hydraulic pressure due to the change in flow rate, as well as aftermath events such as drainage, and relaxation. These observations can be analyzed and understood by using the concept of the effective stress and its relationship with the P-wave velocity. In passive measurement, water flow sound was recorded by a sensor buried inside the soil and close to the pipe. Three signal processing algorithms were applied for the water flow sound analysis, which revealed the common temporal characteristic of the water flow sounds. The passive study suggested that the soil pipe flow can be identified and assessed from the noise levels in terms of TD-RMS and FD-RMS and from the contrasts of the power spectrum image.

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