**Identification of Soft Seams in Slopes Using Full Waveform Inversion of Surface Waves**

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The existence of weak layers or seams filled with soft material presents issues with respect to the global stability of embankments and earthen slopes. These zones often form the path through which slope failure may occur. Evaluating the existence of such soft zones and their geometrical extent is therefore critical when evaluating the stability of slopes or embankments. However, the current state of practice with respect to geotechnical subsurface investigations [e.g., standard penetration testing (SPT) and cone penetration testing (CPT)] often only provides limited spatial coverage to evaluate soft seams. Geophysical methods can potentially improve capabilities, but many of the current methodologies suffer from similar or other limitations. For example, borehole-based methods such as downhole or crosshole seismic testing also only provide limited spatial coverage. The presence of a slope-critical soft zone at the near surface would very likely coincide with stiffness inversions (i.e., stiff over soft conditions) that render body wave methods such as seismic refraction ineffective. Surface wave testing shows promise for this approach, but has seen limited development as an investigative tool to identify critical soft seams in slopes. This may be partially attributable to the spatial averaging introduced by the dispersion wavefield transform and the assumptions of flat stratigraphy during inversion. This study bypassed these issues by examining a full waveform tomographic approach and used surface waves to identify the presence and geometrical extent of a soft zone in a slope. This was accomplished by numerically modeling wave propagation with the spectral element method (SEM). The results demonstrated that despite some artifacts, FWI was able to estimate the location of a weak seam in a slope that could lead to low factors of safety against failure.

**Suggested Topic(s): 9.09 – Slope Stability, Debris Flow and Landslides**

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