**Dense 3D Subsurface Characterisation for Engineering and Safety Performance**

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An adequate understanding of the natural and engineered subsurface is critical to managing geo-risks throughout the mining cycle from feasibility through to operations. Ground models play a key role in reconciling data streams to form an integrated, plausible representation of the subsurface as the basis for decision-making. During natural resource exploration, for many decades, screening techniques have played a powerful role in identifying prospects and informing their subsequent development. Such techniques include airborne surveying and the use of satellite imagery. Subsequently, more detailed, higher resolution targeted investigations are deployed in the form of localised geophysical surveys, direct investigations, sampling and in-situ and laboratory testing. Ground models evolve from rudimentary to advanced as more information becomes available meaning reduced uncertainty and more confidence that the subsurface is understood. Exploration-phase screening data in the form of profiles, surfaces and volumes play a vital role in both providing a holistic perspective of the subsurface and filling the gaps between localised ‘data sticks’. However, generally in geotechnical engineering, risks that need to be managed at later stages during the mine cycle seldomly deploy a similar phased approach to the same extent and often the emphasis is more on direct investigation resulting in relatively sparse ground models comprising a little of something and a lot of nothing. Ambient noise tomography (ANT) delivers a dense 3D distribution of shear wave velocity to useful depths for mapping geotechnical properties and a valuable diagnostic for geohazard mapping. We highlight two common scenarios, tailings dam and open pit mining safety management, that demonstrate a phased screening approach can be deployed usefully at an engineering scale. Integrating initial ANT screening and targeted intrusive investigation significantly increases confidence that the site has been effectively and efficiently characterised leading to the highest levels of confidence in engineering and safety performance.