MULTICOMPONENT NEAR-SURFACE SEISMIC INVESTIGATION FOR INFRASTRUCTURE DEVELOPMENT

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High-resolution seismic investigation plays a key role in the characterisation of the near surface for infrastructure development including structural and stratigraphic mapping, detection of geohazards and the determination of geotechnical properties. Traditional approaches to investigation commonly involve separate acquisition phases for the acquisition of distinct elements of the recordable wavefield namely reflected, refracted and surface wave components.

The advent and improvement of single receiver 3C broadband micro-electro mechanical systems (MEMS) in the exploration sector has led, with some minor adaptations, to increasingly common deployment in the near surface to help solve engineering problems. Capture of the complete wavefield (3C, broadband) has a number of benefits relating to field effort, cost and the quality of the geophysical deliverables:

- Georeferenced seismic reflection, refraction and surface wave data can be acquired simultaneously – cost-effectively shortening the overall programme and HSE exposure;
- The data are broadband meaning maximising the available temporal resolution for better reflection imaging and refraction tomography;
- Sv and Sh components can be recorded for shear wave imaging;
- The data are broadband meaning lower surface wave frequency content that improvesdepth penetration for screening of geotechnical properties;
- Two Rayleigh wave components are recorded simultaneously for more robust Vs estimation (better inversion constraints and joint inversion);
- Love wave component can be recorded in lieu of Rayleigh wave data.

With reference to a number of case studies, this paper describes how a 3C broadband data acquisition approach, allowing complete wavefield capture, has being used in a number of site characterisation applications include nuclear and oil and gas infrastructure developments. In parallel with the growing need to develop genuine 3D/GIS ground models for subsurface risk management, the development of cost-effective 3D 3C in an engineering context remains an aspiration.