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Use of Surface Waves for Geotechnical Engineering Applications in Western Sydney

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Current *in situ* methods used to geotechnically characterise the ground are predominantly based on invasive mechanical techniques (e.g. CPT, SPT, DMT). However, information recovered by these techniques are localised to the point at which the test is conducted. Therefore, an adequate number of tests must be conducted at distributed points throughout the site in order to make a fair assessment, rendering the investigation both costly and protracted for an extensive site. Recent trends have seen the adoption of non-invasive 1D and 2D array based surface wave techniques (e.g. SASW, MASW, CSWS, ReMi, etc) for geotechnical site investigations. These techniques have proved to be cost and time effective compared to the conventional invasive mechanical techniques. These techniques rely on the measurement of the phase velocity dispersion curve and its inversion using a theoretical model, to characterise the shear wave velocity (V_s) profile of a site. It is also increasingly recognized that the V_s profile could potentially reveal valuable information on the stiffness and associated geotechnical properties at the near surface. This may be inferred in part from the theoretical definition of V_s of a soil, which is given by V_s = sqrt (G/ ρ), where, G is the shear modulus and ρ is the bulk density. In this equation, the shear wave velocity is a geotechnical property that is theoretically related to the modulus of a soil. This relationship at once supports the notion that it is theoretically justifiable in using the V_s to measure the modulus (or stiffness) of a soil.

Hence, a study has been initiated to investigate the use of the non-invasive Multichannel Analysis of Surface Waves (MASW) technique to provide both a general geotechnical site characterisation and an evaluation of compacted ground. The MASW technique employed in this paper relies on the measurement of active noise generated by sledgehammer hits to the ground and measurements of active noise in the vertical direction are made by using interconnected electromagnetic geophones. The main attributes of this technique are its cost effectiveness and time efficiency when compared to current *in situ* methods. The MASW technique was utilised to infer the stiffness of the ground layers by inversion of the phase velocity wave dispersion curves to derive the shear velocity (*Vs*) profile. The results produced by the MASW technique were verified against independent mechanical SPT and CPT data. Moreover, the present research identifies the MASW technique could be a potentially useful and powerful tool in geotechnical characterisation, and in the evaluation of ground compaction.