Seismic tomographic imaging in engineering characterisation of a site in Kuala Kangsar, Perak

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Seismic tomographic imaging (STI) have been traditionally applied in rock mass assessment for the evaluation of their fracture intensity, and the existence of shear and fault zones by various researchers (Saito and Ohtomo, 1989; Gustavsson *et al.*, 1986). However a site for a proposed road realignment project at Kg.

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Jenalik, Kuala Kangsar was chosen to investigate the effectiveness and the accuracy of the STI method in which both granitic residual soil and its rock mass were encountered.

The objectives of this study aim to assist in the assessment of vertical and lateral variability of the colluvium, the weathered granite and the existence of any ground water regime at the site.

Shallow seismic refraction survey with 5 spread lines were initially carried out to obtained a general subsurface profile of the study area. A total of seven boreholes were drilled using water, foam and a combination of foam and bentonite in order to ensure the accuracy of carrying out subsequent tests encompassing the SPT, pressuremeter and the downhole seismic logging. All the seismic data were acquired digitally on both the Bison 5012 and the Geometrics ES 1225 seismograph, while the geophones employed are the vertical P-wave geophone and the hydrophone which are employed inside the boreholes.

The STI field techniques used were combinations of P-wave seismic methods encompassing the surface refraction (SRM), surface-to-borehole (STB) and the crosshole (CH) seismic which were conducted between borehole BH2 to BH6 and extending along the line of these boreholes. Tomographic images from the STB data were first processed followed by the combination of STB and CH data and finally the combination of STB, CH and the SRM data. All the data were processed using curved ray tomography. Comparisons were made to the seismic refraction survey, geological logging, standard penetration test (SPT), piezometer, pressuremeter and the downhole seismic at the same location. The accuracies of all the final STI images processed were compared in relation to the depths encountered from in situ testing and their results tabulated and outlined.

The images from the three STI processing methods show variations in P-wave velocity contours with depth. Of all the results of the three STI images processed, the processing that intergrates all the STB, CH and SRM data was found to be the most accurate in relation to the downhole seismic and the geological logging at the site. However, the presence of a boulder (about 1–2 metres diameter) near BH6 that had been encountered during drilling was unable to be detected in all the STI images which may be attributed to the lack of velocity contrast at the site.