Application of *P* & *SH*-waves for rock anisotropy studies: Genting Highlands case study

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Seismic refraction surveys utilizing *P & SH-waves* were carried out over an abandoned quarry at Genting Highlands in order to study the anisotropy of the bedrock of that site. Shear (S) and Compression (P) acoustic velocities of the subsurface refractor have shown significant variations in spatial distribution of velocity measurements. These variations in velocity values were compiled and then qualitatively correlated with surface fracture surveys conducted during the course of acquiring field data.

Seismic *P & SH-wave* velocity values obtained from in situ measurements have been used for calculating the Anisotropy factor, Slowness factor & Poisson's ratio. The petrophysical parameters computed are then contoured and used for identifying the orientation of fracture zones along the subsurface refractor.

Field Data Acquisition and Processing

Seismic Refraction method is a geophysical tool widely used for routine engineering site investigations (Redpath, 1973) whereby the subsurface structure of the surveying area is inferred from interpretation of the seismic field data gathered from surface measurements. The *SH*-refraction method has found increasing use for seismic anisotropy studies since the velocity derived from such surveys are direction dependent (Danbom and Domenico, 1987).

The survey site is located in an abandoned quarry at Genting highlands, Pahang State, and the survey lines were set up on the floor of the quarry. The lithology of the site is made up mainly of two layers. The top layer consists of aggregate of rhyolite mixed with clayey silty coarse sand while the second layer or bedrock is made up of rhyolite.

The objective of this study is to delineate the topography of the rhyolite bedrock, determine petrophysical parameters of the bedrock (refractor layer) and to identify the orientation of the fractures on the rhyolite bedrock. Surface fractures surveys are also involved in this study, and mapped in details along outcrops exposed in the site.

Seismic Refraction surveys utilizing *P & SH-waves* are carried out on Overlapping Radial Patterns. The Azimuths between survey lines are kept small in order to secure good coverage for the spatial distribution of the Shear wave Velocity as well as the P-wave velocity that are derived from the survey lines.

Field data collected from those surveys are then interpreted using the Generalized Reciprocal Method (Palmer, 1980). The first arrivals of refracted signals are digitally picked (Hatherly, 1980) during processing the data for further accuracy of arrival time measuring and thus decrease the difference in reciprocal time estimated between the off-end shots. The *P-wave* components in the opposite polarity field data records gathered from the Shear wave surveys have been reduced by computer processing before picking first arrivals of the *SH*-refracted signals. The *P-wave* seismic refraction section for line-1 where the topography of the refractor, which is rhyolite bedrock, have been fairly delineated.

Conclusion

The anisotropy of acoustic velocity, measured horizontally along several azimuths within narrow angles between refraction survey lines, provides high quality data that can be used for fracture density studies. Petrophysical parameters derived from the acoustic velocities of *P & SH*-waves assist in locating the trend of fractures.