An Innovative Use of Acoustic Televiewer for Characterizing the Preferential Flow Paths in Fractured Rock Aquifer Systems

Po-Yi Chou, Hung-Chieh Lo, Po-Jui Chen, Chien-Chung Ke

Geotechnical Engineering Research Center, Sinotech Engineering Consultants, Inc., TAIWAN

Technical Field of Invention

- The adoption of advanced technique for accounting for the influence of aquifer heterogeneity on subsurface contaminant distribution is needed.
- This invention relates to using acoustic televiewer (HiRAT) for generating the semi-3D rock formation imagery through a simple calculation.
- Detailed information regarding the distribution of weak planes and the preferential flow paths (contribute to groundwater pollution) in the rock formation can be identified.
- The proposed methodology can be imported into a spreadsheet to facilitate critical decisions making on the spot in a short time.

The Prior Arts



Acoustic	Optical
Televiewer	Televiewer
rasonic pulse-	CCD camera
o configuration	measures the
a 0.5–1.5 MHz	intensity of the
transducer	color spectrum
nages can be	Images can be
ected in water-	collected in air-filled
d or light mud-	or clear water filled
lled intervals	intervals
actures can be clearly defined	Direct observation of the feature along borehole wall
ology changes	Affected by

unflushed drilling mud & chemica

Mainly used for

Fracture identification Stratigraphic studies Local stress (break-out) Core orientation Cased-hole studies

The Invention



performs a mathematical process on the acoustic reflection amplitude to obtain a statistic value

for the amplitude log, based on the distribution profile of the amplitude data, a semi-3D image

of rock formation along the borehole sidewall is generated by a spreadsheet program

HOWEVER ...

The conventional 2D image provides very limited information regarding

- the typology of rock formation
- the composition of rock formation
- the variation in geological structure
- the location of the permeable layers



HiRAT uses a fixed acoustic transducer and rotating acoustic mirror to scan the borehole wall, produces a digital, magnetically oriented 2D image

Preferential Flow Path Tracking



Use the built-in function of bubble chart in Excel to perform the pattern generation and output process

data

The amplitude and travel time of the

reflected acoustic signal are recorded simultaneously as separate image logs

Show the central distribution tendency

of the acoustic reflection amplitude



Application and illustration



²⁰¹⁸⁻⁰⁶⁻¹¹ Application TW106122452A granted

Question please contact via poyi.chou@sinotech.org.tw

