

GEOHART Consultants non-destructive rock reinforcement testing capability:

- Rockbolt integrity testing and analysis
- Roof support assessment & review

It is acknowledged that traditional pull out tests currently used for rock reinforcement quality testing have an important role to play in determining critical bond lengths for static and quasi static ground support designs.



However, they are not considered an accurate tool for the detection of compromised rockbolt systems used for ground control in underground mining and civil construction industries.

Mod-Shock Non-Destructive Rockbolt Test

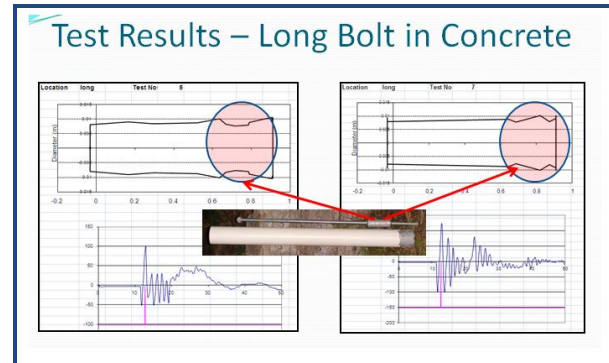
This non-destructive rock reinforcement integrity testing analysis is conducted using a complex "Stress Wave Analysis" package based on the processing of clear seismic signals imparted into the rock reinforcement element that is being tested. The seismic signals are processed by "Fourier Transform" into various criteria which can be used to produce models of the element such as mechanical admittance, frequency spectra and velocity which are all used in the final modelling of the rock reinforcement element under analysis.

The Mod-Shock System for Mining Background

Non-Destructive rock reinforcement integrity testing conducted at three Australian Mines (i.e. Western Australia, Queensland and Victoria 2008-2009) have shown that the testing method has the potential to detect

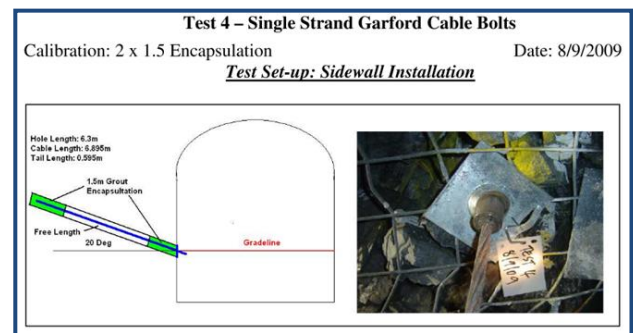
defect rockbolts. More than 150 bolts comprising 40 rebar type bolts, 100 Cable Bolts and 12 Splitsets were tested to confirm the validity of the test.

Early calibration tests using the Mod-Shock non-destructive rock reinforcement testing system confirms pockets of poor grouting.

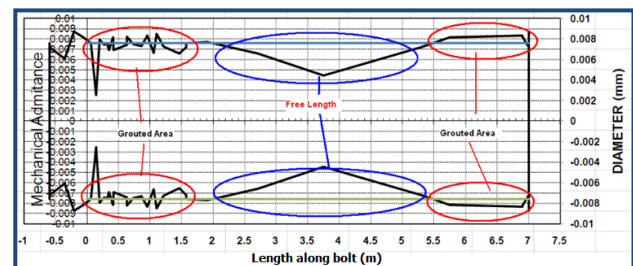


Poor grout installation - solid rebar.

Calibration tests on poorly grouted single strand cable bolts completed at George Fisher Zinc Mine, Mt. Isa provides the necessary confidence to assess cable bolt conditions (*Hartman et al, 2010*).



Poor grouting - cable bolt.

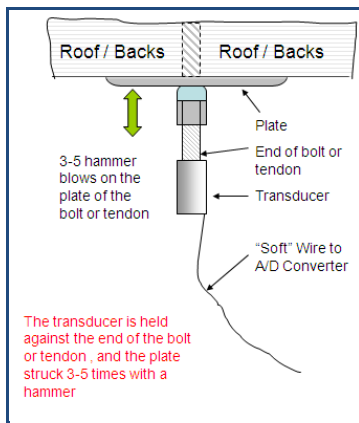


2D Plot showing grouted areas and free length.

The Mod-Shock integrity testing is considered to be a "QA" geotechnical risk management tool / test which can identify bolts that may have some deficiency; be it in poor anchorage (low grouting) or loss of cross section of the bolt (e.g. bolt diameter decrease due to corrosion). The test is cost effective and large populations of bolts can be tested in a short period of time.

The Test

The test is carried out on site using equipment including a notebook computer with testing software, analog/digital converter, transducer and tapping device.



Test set-up.

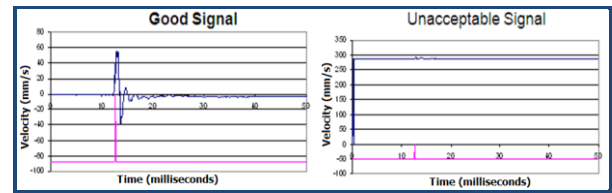
The transducer is held against the bottom of the test bolt and the software program informed that a test is about to take place. The plate is struck 3-5 times with a hammer.



Bolt and transducer.

If a satisfactory signal is received through the transducer, the next bolt is tested, otherwise the bolt is re-tested. It may take several

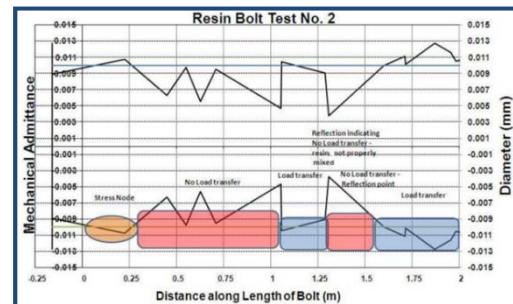
attempts to get a good signal.



Signal obtained from transducer.

Analysis and Reporting

The analysis provides a 2D model of the bolt under test and a number of criteria such as the "Stiffness" of the bolt are shown which is compared to two models of fixity (full column vs end anchored grouting/resin installation) of the bolt.



Typical plot of results.

Specific Services

- Typical bolt Lengths (m) confirmation.
- Detection of poor grouting / resin installation.
- Corrosion or loss of volume detection.
- Unit can be provided to operation for site testing. Geohart can then analyse data and provide a report

