



Proactive solutions



Non-destructive testing of support bolts and anchorages

The condition of a bolt or anchor beyond the head-plate is critical to its performance. However, a visual inspection will not provide a reliable evaluation of integrity, nor can it guarantee that a new installation meets the design intent, on which long term durability and performance depend. GRANIT™ can change that.

Traditional methods of testing rock bolts and cables commonly used in tunnel construction and mining projects are limited, cumbersome, slow and, worst of all, may interfere with the integrity of the anchorage they seek to prove.

Halcrow's GRANIT (GRound ANchor Integrity Testing) changes all that. It's a safe, reliable, repeatable, proven, easy-to-use and award-winning system for testing rock bolts and anchorages where safety and quality are key. Knowledge of these can only lead to enhanced confidence.

At the 2010 New Civil Engineer (NCE) International Tunnelling awards in London, the Halcrow GRANIT system won the coveted Technical



Innovation award. And at the 2011 Tunnels and Tunnelling International awards GRANIT was highly commended.

Here's how GRANIT works

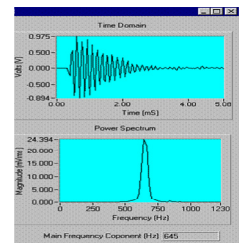
GRANIT initiates testing by sending a series of small controlled impulses through the rock bolt using an electronic solenoid.

Analysis of the captured response can reveal defects such as reduced support element length, whether the support element's design or safe working load has been exceeded and potential corrosion issues along the bolt.

GRANIT's key characteristic is its ability to quantify support element bearing loads and identify defects using non-destructive test methods.

Crucial data is obtained without causing damage to the support elements or interface bonds allowing individual bolts to be repeatedly monitored throughout their life.

Up to 100 support elements can be tested per shift. Once defects have been identified, a remedial program can be devised instigated.



Here's how and where GRANIT is used

■ Iron ore open pit, Australia



Application – condition assessment of 15.2mm cable anchors 20m long

Issue – proposed rehabilitation of a previously flooded open pit with unknown

anchor conditions in a 75degree footwall.

Result – testing allowed the residual capacity of the anchors to be established.

■ The Temple of Apollo Epikourios, Greece

Application – condition assessment of 15.9mm cable anchors

Issue – anchors holding concrete anchor blocks that resist uplift forces of a canopy superstructure have exceeded design life



Result – identification of anomalous cables not performing as designed allowed remedial work to be carried out to ensure continued safe working.

■ Coal mine, Canada



Application – condition assessment of 24mm rock bolts 3m long

Issue – proposed mine expansion within 15m of tunnel likely to impact stability

Result – GRANIT results provided structural safety assurance before expansion began.

■ Hydropower station, Australia

Application – condition assessment of 25mm rock bolts in a concrete flume base slab

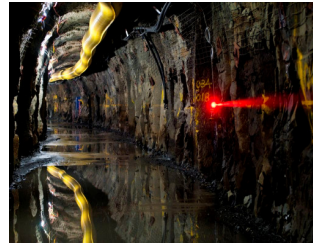
Issue – in service for over 50 years concerns have been raised over corrosion and potential uplift.



Result – the data has provided the client with a condition assessment enabling him to plan remedial and maintenance work.

■ Hydropower station, UK

Application – condition assessment of 24mm rock bolts of various lengths



Issue – rock bolts within the main cavern of an underground hydropower station had exceeded 50 year design life

Result – GRANIT was used to establish its effectiveness at assessing bolt condition, with overcoring proved the reliability of the system.

■ Transverse stressing bars, Australia

Application – condition assessment of 29mm Macalloy bars up to 8m long in various bridge decks



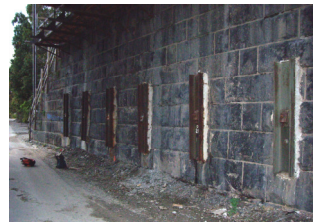
Issue – numerous bar failures had occurred, how many more were at risk?

Result – reliable identification of corroded bars that required replacement.

■ Bridge abutment retention anchors, USA

Application – condition assessment of 25mm retention anchors approximately 15m long

Issue – proposed replacement bridge deck constructed with a greater load bearing on the original abutments



Result – test data established residual capacity of the anchors, so enabling the client to assess the structural stability of the

abutments.

These are a recent selection of projects undertaken. Over 10 years of deployment in many situations has resulted in significant accumulation of data and knowledge regarding support systems.

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