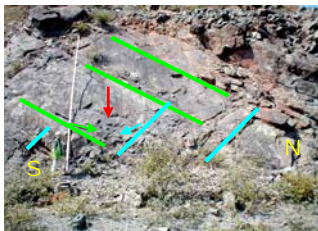




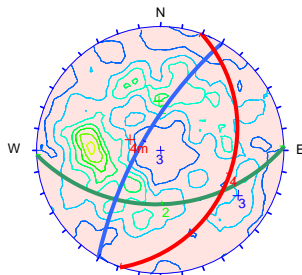
▶ Hard Rock Tunnel Support Design & Implementation



Support Assessment



Scan Line Joint Survey



Blue 72/300, Red 29/109, Green 43/178

Golder RMT offers a comprehensive design service for tunnel construction from the geotechnical assessment of ground conditions through to the support design and implementation.

The service can include assistance with the following:

- ▶ Support consumable selection;
- ▶ On site professional engineers to assess ground conditions on a 'blast by blast' basis; and
- ▶ Geotechnical instrumentation monitoring systems to confirm support performance and ground movement.

Our fundamental approach involves site investigation and empirical initial design for expected ground conditions followed by 'observational' design during tunnel drive so that the level of support is appropriate to the ground conditions encountered. This approach has been successfully used at the recently completed Cliffe Hill Quarry Complex Link Tunnel, where the objective was to provide a cost effective solution to meet the clients requirements.

Site Investigation work undertaken encompassing:

- ▶ Geological mapping/coring;
- ▶ Rock testing;
- ▶ Geotechnical surveys; and
- ▶ Stress measurements, if necessary.

Design works undertaken using:

- ▶ Empirical rock mass classification systems;
- ▶ Kinematic wedge analysis; and
- ▶ Computer modelling.

Support Assessment

The required support can be assessed on a 'blast by blast' basis in order that appropriate levels of support are installed for the ground conditions encountered.

Instrumentation and Testing

To confirm support performance the observational approach involving instrumentation and testing is employed:

- ▶ Short encapsulation pull testing and proof load testing;
- ▶ Installation of extensometers;
- ▶ Instrumented bolts; and
- ▶ Acoustic energy meter surveys for shotcrete adhesion.

RMT018-S/07-09(V2)

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Risk Assessment for Geological Hazards

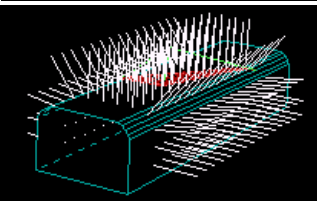
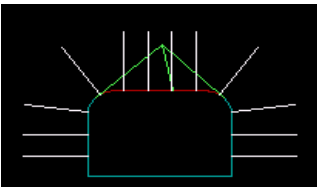
Logging and interpretation of probe holes in high risk areas with appropriate support strategies.

As Built Tunnel Record

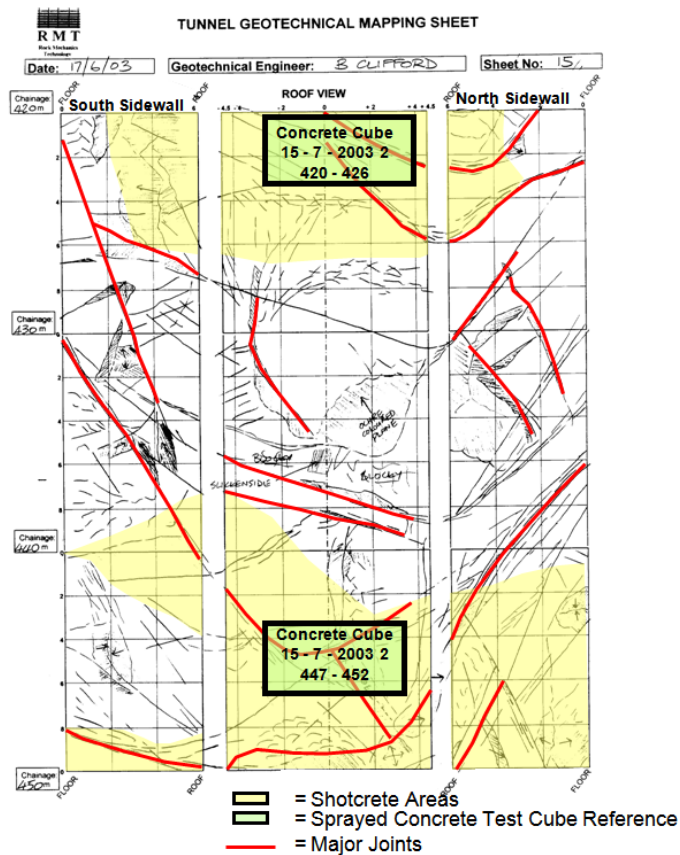
Final documentation with details on the geology encountered and support installed.



Shotcrete Adhesion



Geotechnical Data DIPS™



Mapping Sheet for Shotcreted Areas
(also completed for Joint Dip/Dip Direction and Systematic Rockbolt Support)

For further information please contact:

Peter Altounyan
 Technical Director Consultancy
 Tel: +44 (0)1283 522201
 Email: paltounyan@golder.com

UK Offices: Belfast, Bretby, Chelmsford, Edinburgh, Falmouth, Leeds, London, Maidenhead, Nottingham, Oxford.
Globally: Operations across Europe, Africa, Asia, Australasia, North America and South America.

www.rmtltd.com, www.golder.com

