

DEVELOPMENT OF A NEW TESTING PROCEDURE FOR THE ASSESSMENT OF RESIN PERFORMANCE FOR IMPROVED ENCAPSULATED ROOF BOLT INSTALLATION IN COAL MINES

In underground coal mining, the resin bond strength between the rock bolt and the strata is one of the critical elements of a roof bolting system and strata reinforcement. It is well known that the in situ roof bolt installation effectiveness varies with changing ground conditions. Yet the Australian coal industry does not have an agreed standard for bolting system competency evaluation and continues to rely on other country's standards, notably British and South African, to evaluate its bolting systems.

In order to establish the Australian testing standards a program of field and laboratory studies was undertaken to examine various factors influencing the effective load transfer mechanism between the bolt/resin and rock. Fifty-four 21.7mm diameter X-grade bolts and standard industry fast setting resin were installed in three mines with different geological conditions and short encapsulation pull tests (SEPTs) carried out. Additional studies included evaluations of the load transfer mechanism and anchorage performance along sections of bolts installed in steel tubes and assessment of sample dimensions influencing resin strength properties. Furthermore, laboratory SEPTs were carried out on bolts installed in an overhead sandstone block mounted above a drill rig under controlled conditions in the Rock Mechanics Laboratory at the School of Civil, Mining and Environmental Engineering, University of Wollongong.

Although the intent of the project is to develop standard resin anchorage testing methods, several learnings about best practice roof bolt installation were discovered that should be passed directly on to industry. They are:

- Bolts installed in holes overdrilled by 50mm resulted in higher load transfer capacity for the given installation time. In particular, improvement in the load transfer capacity occurred near the top end of the installed bolt, where shredded plastic skin material accumulated inside the 50mm of overdrilled hole above the bolt;
- Bolts installed in small 27mm diameter holes performed better than those installed in holes larger than 28mm;
- The use of 300mm long encapsulation length may be the maximum acceptable length for pull testing, but this depends on the type of the rock formation, which has some bearing on load transfer capability of the installation; and
- For standard fast setting resin, bolt installation time of around 10 seconds is acceptable as per recommendation by the resin supplier for this type of resin, overspinning was detrimental to the load transfer capacity of the installed bolt in September.

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To this end, the next and final phase of the project will include the completion of resin properties evaluation and documentation of the procedures for testing various resin properties, which can be repeatable.

The final project (C21011) report should be available in August 2014.

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