**Comments on the Garford yielding cables**

The St Ives Gold Geotechnical Team has been reviewing and working on dynamic capable ground support systems in the last two years. Critical reviews were conducted of the prevailing theories, the available yielding support elements, the testing methods, and the practices. Observations and assessment of rockbursts at Junction and other mines both in Australia, South Africa, and Canada, led to our believe that there is a need to re-examine the development of dynamic capable ground support systems. It was in this context that We have set up a R&D project and engaged Garford to develop alternative workable and viable support elements.

Over the last 18 months, three types of cables have been designed, manufactured, tested and trailed. The Garford yielding cable Mark III have been tested extensively in a laboratory in Perth and CRIS in South Africa; and in situ at Junction. The laboratory tests consist of 1) static pull tests of the cables without grout and 2) dynamic loading at the Terratek hydraulic test machine at CSIR (reports 2001 and 2002). Both tests suggest satisfactory performance according to the design criteria (reports). In situ pull tests were recently conducted at Junction, 5 x 3m 15.2mm yielding cables and 1 x 18mm yielding cable were installed into the side wall of the 711-4 S/P. After seven days of cement curing the cables were pull tested and the load and displacement measured. These latest in situ pull tests indicated that the yielding anchors slipped at the designed static loading, 12-15t for 15.2mm 25 t capacity cables and 19t for 18mm 30 t cable (and their yielding loads are 20t and 25t, respectively).

It was concluded from these tests that a production scale trial use of the cables are warranted at Junction, as these yielding cables would at least perform better than the de-bonded cables currently used. Steps are in place to further test and select matching surface fixtures, such as more suitable wedge and barrels, appropriate steel plates and washers, DE plates and straps. Experience suggests that these surface fixtures often have more important roles than the bolts or cables during dynamic loading from a rockburst or strainburst.

The rock mass responses and disintegration or fracturing during the rockburst or strainburst often result in fine fragmentation and disintegration of rock mass, possibly within a fraction of a second (Ortlepp 1997). Generally, the rapid disintegrating and moving rock pieces may not “see” the existence of the bolts or/and cables installed within the rock mass whether they are fully grouted or de-bonded. There are ample observations after rockburst damage that very few bolts or cables were broken, instead these bolts or cables extruding from the damaged excavation surfaces.

In the case of the Garford yielding cable, which is de-bonded from collar to the end anchor, or for any de-bonded bolts or cables, the load transfer from the disintegrating rock pieces onto bolts or cables would solely rely on the surface fixtures to achieve. If one or more of the surface fixtures, such as plates,

wedge and barrel, washer, mesh and straps, fail prematurely, fall of ground can still occur regardless the type of bolts or cables.

Secondly, if shearing occurs along the length of the cable, the yielding anchor at the end of the hole may not be mobilised and hence shear failure of the cable would be likely. This type of failures have been observed in 70% of the rockburst damage and failures in South Africa mines (Güler et al 2001).

It is therefore prudent to evaluate the potential failure modes and the potential extent of rockbursts before selecting a support and reinforcement system that is appropriate for the local conditions.

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