CABLE BOLT INSTALLATION AT GORDONSTONE

INTRODUCTION

Gordonstone mine is located in the Bowen Basin in Central Queensland, 51 kilometres north-east of Emerald It is owned by a co-venture between ARCO Coal Australia Inc, Mitsui Gordonstone Investment Pty Ltd and MLC Coal Investment Pty Ltd. The mine is operated by Gordonstone Coal Management Pty Ltd, a wholly owned subsidiary of ARCO Coal Australia Inc. (Figure 1)

Initial development of the mine commenced in 1988/89 with the sinking of an exploration drift. The first longwall commenced operation in April 1993.

The German Creek seam is mined - the average seam height is 3m - Gateroads are driven at 5.2m wide with ABM20's. The typical German Creek roof strata consists predominantly of interbedded to interlaminated sandstone and siltstone.

STRATA CONTROL

Not for the first time in Australia, the conditions encountered in the pit were at odds to those initially predicted.

Higher than expected roof deformations were encountered during initial development, and falls in the first installation road and gateroads during extraction of the first longwall prompted serious investigation and a rethink in the strata control strategy.

The investigations revealed significant geological variability with inseam coring of both roof and floor at 200m spacings. Because of the variability the coring was further increased to 50m spacing.

The results of the coring consequently determined the density of cable bolts. At Gordonstone we now have a major cablebolting program in the longwall belt roads and longwall take off areas.

(Sketches of typical cablebolting patterns)

CABLE BOLTING

Cablebolting crews were formed, and we currently run 3 teams of 3 men, with a fourth crew of 2 men who carry out the coring.

Cable bolting rigs were sourced and initially two HR 1500 Twin Motor Proram Ramtracks were purchased followed by a third that has the capacity to dry drill. These ramtracks are a rotary type drill rig which suit our drilling conditions and expose the operators to less noise than similar rotary percussion rigs.

The majority of cablebolts installed at Gordonstone are 10.5m long, twin strand, garford bulb cables, although some 4m cables are used also.

The sequence of events is

- Drill a 55mm diameter hole to 10.5 metres
- Tape a 5mm breather tube to the cable bolt and physically push the cable bolt to the back of the hole
- Insert a 1.5m length of 19mm plastic tubing through which the grout is pumped.
- Pack the collar of the hole with cotton waste to prevent grout leakage
- Mix the grout and pump it into the cable bolt hole via the 19mm plastic tubing

Once the grout has set the plastic tubing and breather hose are trimmed off at roof level and a plate barrel and wedge are fitted over the 200mm single tail protruding from the roof.

Because of the great number of cablebolts being installed by manually pushing them up the holes, a number of injuries started occurring. Most of these injuries were to the back, shoulders and forearms.

ACCIDENT INVESTIGATION

The accident investigation procedure at Gordonstone requires each injury, accident, incident and near miss to be investigated, with corrective actions recommended and those corrective actions to be followed up. It was quite apparent that a mechanical device for pushing these cables was required to take the manual handling out of the process and eliminate the exposure of the operators to the risk of injury.

There are several types of cable pusher available. Some being mounted on the boom of the drilling rig, and some mounted on wheels or tracks.

Initially a pusher was sourced and trialled. It was mounted on a platform and used in conjunction with a set of forks on an Eimco. This proved reasonably successful but was limited to the availability of an Eimco. It was great for pushing cable bolts at take off points or drivehead installations where room was not a problem, but could not push cables alongside the belt in the longwall gateroads where an Eimco could not pass.

THE PROBLEM

The cable bolting was becoming ad hoc. Most teams of course preferring to drill and leave the pushing of the cables to others. Lack of access alongside conveyors nullified the use of the Eimco mounted cable pusher. The injury toll mounted from manually handling and pushing cable bolts.

The cut throughs in the gateroads are at 99m centres, therefore the cable bolts have to be physically dragged through a stopping and along the pillar. Once the holes had been drilled the floor was wet and muddy due to water flushing the cuttings from the drilling.

This in itself posed a major concern as the cables once dragged along the pillar to the site of installation were covered in mud. The mud on the cablebolts then affected the integrity of the cablebolt and the effectiveness of the bond between the grout and the cablebolt.

Manual handling, mud on the cablebolts, the physical effort of pushing these cablebolts causing injury, and the limitations of the size and availability of an Eimco for the pusher that was trialled were the challenge.

THE SOLUTION

I was aware from my exposure to hardrock mining that there were machines in existence that could drill, grout, then push cable bolts as a means of reinforcement in production stopes and permanent openings such as those for crushing stations and workshops.

These machines were not constrained however by limitations of height and width which was the case at Gordonstone where a pusher has to travel alongside the conveyor in the longwall maingate.

(Sketch - Gateroad and belt installation)

The idea of having the cable bolts supplied on a reel, having the cable pushed up the hole then cropped to length was desirable. Such a system would eliminate the manual handling of cable bolts by dragging them through the stoppings and along the belt road to the installation site, eliminate the exposure to physical injury manually inserting the cable bolts, and maintain the integrity of the cable bolt by not dragging it through the mud.

I called a team meeting and with all crews present planted the seed. The input and ownership then flowed from the operators and it was decided we should pursue the matter.

This was not altogether new technology, but the challenge lay in being able to adapt and engineer what technology existed to suit the constraints of a longwall gateroad with a conveyor belt installed.

Armed with enthusiasm and a concept of a reel of cable, a boom that would rotate to the desired angles of installation that the drilling rigs achieve, and an hydraulic guillotine I sought some answers.

(Sketch of concept)

The first question was where to start?

The performance of the drilling rigs was the first clue.

- The boom rotation achieved the desired angles of installation for drilling purposes.
- The tracks were reliable and well proven, and spares were available.
- How heavy was a single cable bolt and what weight restrictions would be imposed on the tracks?

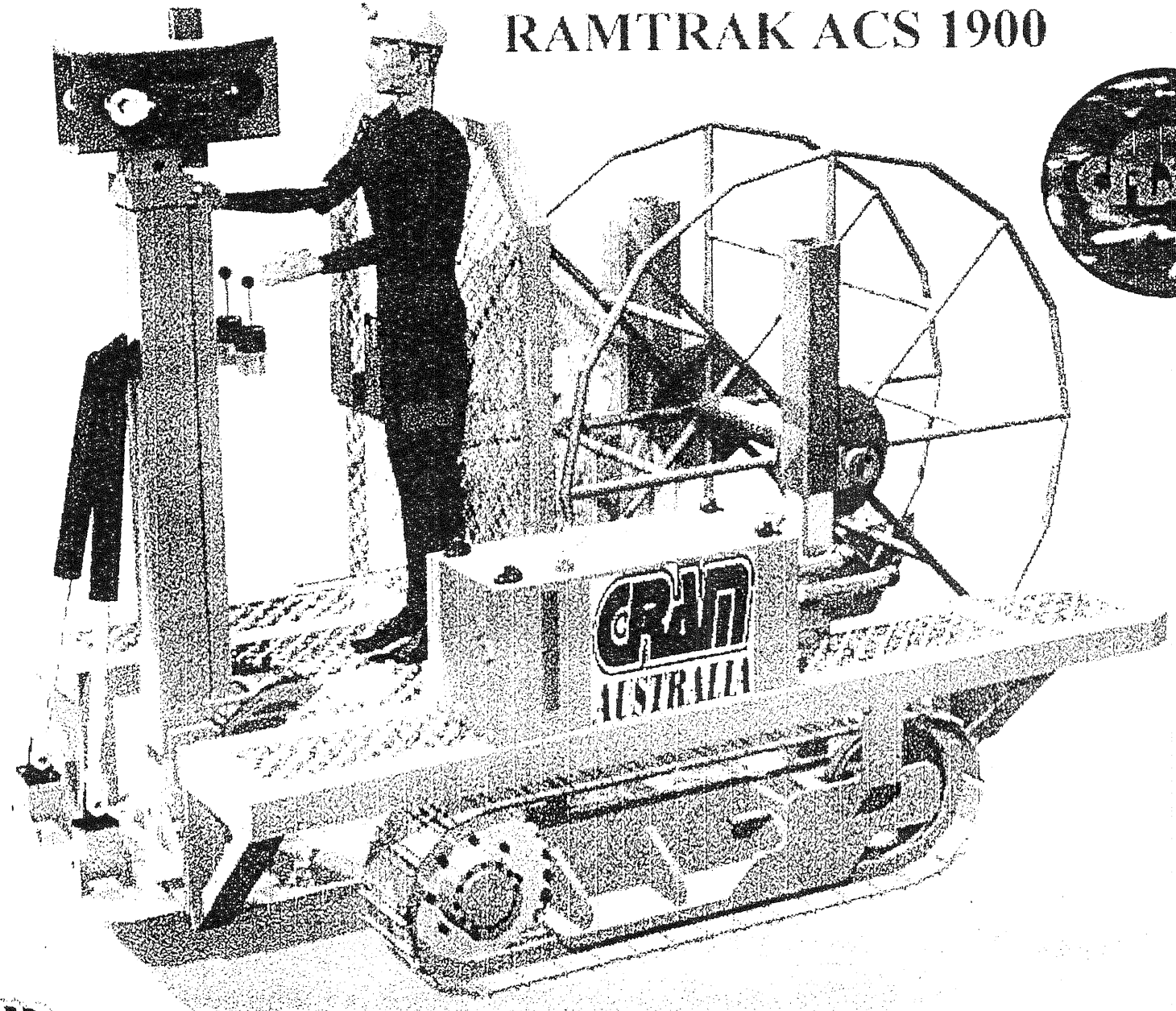
This information was readily available from the manufacturers specifications and at this stage I contacted Brad Neilson from Cram Australia. I had previously been involved with Brad in the development of the dry drilling rig for Gordonstone as well as some other drilling applications.

Brad immediately took up the challenge and a meeting was set up at Cram Australia's Head office in Unanderra NSW. Present at that meeting were representatives from Gordonstone, Cram, and ANI Arnall who supply the cable bolts.

After some work with the design engineers at Cram Australia and ANI Arnall I returned to Emerald with some conceptual drawings of a track mounted cable pusher capable of carrying a reel of 50 x 10.5m twin strand cable bolts with a risk assessment and training package to be available twelve weeks from placement of an order.

Further research and the risk analysis disproved the safe operation of cropping the cables overhead. The immense hydraulic pressure required to guillotine the cables, along with the need to have only one of the twin strands protruding from the roof to accommodate the plate, barrel and wedge forced a rethink. ANI found the solution whereby the single cables are attached to each other by a purpose built joiner and grub screws (see sample) and then rolled onto the reels.

RAMTRAK ACS 1900



RAM-CAD DESIGN SYSTEM

File Name ACS-RAM4.BMP 18/1/95