CASE STUDY

Improving Excavator Productivity

Wilkie Creek Coal Mine, Surat Basin, Australia

Site Profile

Wilkie Creek mine is located in the Surat Basin of south-east Queensland. Mining commenced in 1994, with Peabody acquiring the operation in 2005. Current production rate is 2.3 million tonnes of thermal coal. The open-cut operation utilises excavators, loaders, dozers and trucks to mine the coal. Product coal is then railed 250 kilometres to the Port of Brisbane to be exported to Japan, Taiwan and Korea for use in the power generation industry.

Four seams of coal ranging from 1 metre to more than 4.3 metres thick are mined individually. The coal from each seam is hauled by truck from the pit and stockpiled individually. The coal is crushed, sorted and washed.

Wilkie Creek mine has two active pits, namely A and B. The blasting activities take place in Pit B in a hard cap rock band and the fresh mudstone/siltstone 'greys' areas. Approximately 25% of the overburden at Wilkie Creek is blasted, with the remainder being weak free-diggable material.

The Situation

Cap rock at Wilkie Creek mine is typically 8m thick and forms the top part of the overburden. Cap rock is a medium strength siliceous weathered sandstone that overlies very weak weathered tertiary clays that are dug unshot and prone to 'bulling'. It is relatively high strength rock and the excavation productivity in this area is poor especially in the initial cut through the stemming horizon. Blasting at the cap rock area is carried out using 165mm drills at 5.5x6m drill pattern. ANFO was used as a bulk explosive product. Initiation system was Exel™ non-electric system. The excavator productivity was relatively poor in the cap rock even after blasting, resulting in the mine had to use a D11 dozer to rip the cap rock through the stemming zone in order for the EX2500 excavator to dig it.

Technical Solutions

SHOTPlus-i™ and SABREX™ softwares were used for the design and blast modelling purposes. SABREX™ is a blast modelling tool that allows predicting fragmentation and displacement for a given blast geometry and rock conditions. It allows user to compare a number of design alternatives and suggests the best alternative for improved fragmentation and rock displacement.

Figure 1 shows the fragmentation results from benchmark and a chosen design alternative. The model suggests an improved fragmentation when the pattern is reduced to 4.7 x 5.5. Furthermore, stemming length was decreased to achieve a better scaled depth of burial for fragmentation.

Having determined the new pattern, the design was implemented using SHOTPlus-i™ software. New delay timings which are appropriate for the rock conditions were also applied.

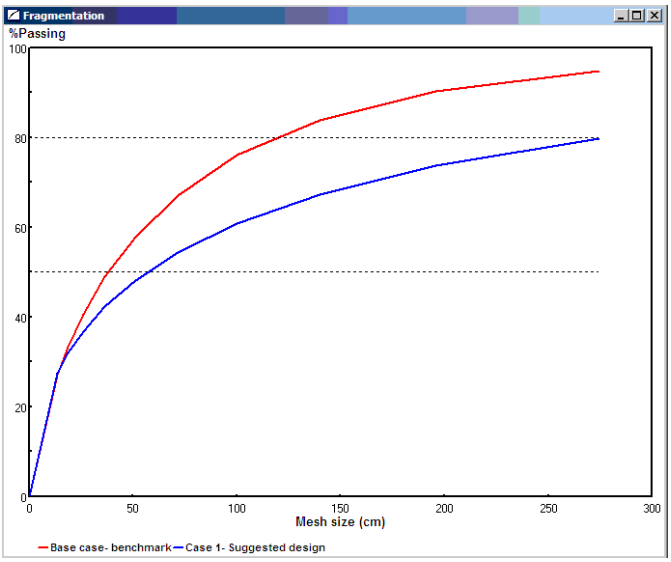

Figure 1: Fragmentation prediction

The uni tronic™ Electronic Blasting System was chosen as a safe and an affordable electronic system that is significantly more advanced than conventional nonelectric initiating systems, with the timing flexibility and accuracy needed to deliver above requirements (safety and improved excavator productivity).

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The Result

The uni tronic™ Electronic Blasting System was used to fire the modified blast. The blast consisted of 552 holes. Average hole depth was 8m and ANFO was used a bulk blasting agent. The modified design resulted in better surface expression and more excavator productivity which led to significant cost savings on site. Excavator productivity has improved from 876bcm/hr to 1,044bcm/hr which translates into 19.7% increase in productivity. Furthermore, the mine doesn't require a dozer to rip for the excavator to achieve such high dig rates.

Another advantage of using the uni tronic™ Electronic Blasting System was that misfires seen in the past have been eliminated. To date no misfires have been reported. Several non-communicating (NCO) detonators have been reported, all of which had back-up detonators in the same hole and they were fired safely.

Acknowledgements

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