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 then 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. Only approx 25% of the overburden at Wilkie Creek is blasted with the remainder being weak free-diggable material.

The Situation

The first cast shot at Wilkie Creek was planned in the B pit strip 21 East ‘greys’ area (Figure 1) in September 2009. The ‘greys’ are a relatively competent, soft-medium strength fresh mudstone/siltstone rock mass that exists between the base of weathering and the top of coal.

The mine wanted to cast as much as possible to the void and achieve relatively high dozing productivity to uncover the coal efficiently in order to meet CHPP washing requirements.

Figure 1: First cast shot area at Wilkie Creek Mine (B21E Block 4)

Technical Solution

Enabling technologies in this project were:

- SABREX® software - fragmentation/rock displacement modelling tool
- DMC® software - an advanced blast modelling software to model rock displacement
- SHOTPlus-i® software - blast design software
- Uni tronic™ electronic blasting system

A few design alternatives were evaluated using DMC® model and the optimum design was implemented using SHOTPlus-i® design software. Pre-blast survey (face points, crest, toe), top of coal and drill surface points were imported to the software. The design parameters (drill pattern, stand-off distance, loading parameters) determined by blasting models (SABREX® and DMC®) were used in this software.

Front row holes were positioned according to the surveyed face profile. Average face angle was found as 58.2±4.7. Face angle was found to be quite shallow and varying between 50 and 66 degrees. The drilling contractor with 165mm drills was able to drill at a maximum of 10 degrees. Due to drill and face angle constraints, heavy burdens were observed which are expected to limit the cast results.
A blast with 259 holes was designed at a powder factor of 0.40 kg/m³. Blast volume was approximately 162,000 bcm. All holes were designed at 10 degrees. The Unimatic™ electronic blasting system was used to achieve effective cast timings that could not be implemented using standard non-electric delays.

The blast was simulated using the DMC model and the cast was predicted as 8.3% (Figure 2).

The cast analysis based on post-blast survey data showed that average cast was 11.1% which is slightly higher than the value predicted by DMC (8.3%). Furthermore, the center of prime block has moved to 11.1m.

Subsequent DMC® simulations were carried out, and as a result, the following recommendations have been made:

- As it was shown that the higher the face angle the more the cast is, 70 degree face angle is suggested for the future highwall designs.
- As the higher the drill angle the more the cast is, it is recommended to increase the drilling angle to 20 degrees.
- Larger diameter (229mm) is better suited for cast blasting for improved cast and cost.

Cost analysis showed that designs with larger diameter blast holes lead to reduced mining cost and faster coal recovery rate.

The overall result of the first cast shot was excellent and Peabody Wilkie Creek Mine is continuing to see benefits of this project.

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