Controling Block Movement of Coal During Overburden Blasting

Project Summary

GEOLOGICAL CONDITIONS AND MECHANISMS THAT PROMOTE COAL LOSS DURING OVERBURDEN BLASTING WERE IDENTIFIED AND GUIDELINES TO MINIMIZE MOVEMENT WERE DEVELOPED

Large open pit coal mines consume a significant volume of explosives in removing the overburden above the coal. Many mines use cast blasting to reduce the quantity of waste material handled by draglines. This technique utilizes the explosive energy to cast a portion of the overburden into the spoil pile without the need for subsequent handling. Cast blasting can also lead to an increase in blast induced coal loss unless the blast design is appropriately developed to minimize this negative impact. A recent industry survey has indicated that 85% of mines interviewed had blast induced coal loss problems to the extent of 5 – 15%.

Some factors leading to coal loss are uncontrollable, but several blast design factors can be controlled and as DynoConsult demonstrate, they have a significant influence on the final result.

DynoConsult has been working with the industry to develop solutions to minimize coal loss over the past 18 months via an Australian Coal Association Research Program (ACARP) Project. The actual blast designs used were objectively assessed for their impact on coal loss. New design recommendations are currently being developed and will be implemented at two sites during 2003 to validate the expected reduction in coal loss.

One of the sponsors of this project is a coal mine in the Hunter Valley. Measurements made at the mine showed that they were losing up to 45% of their highest quality coal seam through the blasting process.

DynoConsult has assisted this mine with interim changes to the blast design, which were implemented and monitored by the team. These interim changes resulted in an improvement in recovery of 30% equating to significant financial benefits to the mine.

Background

DYNOCOULT IS DELIVERING VALUE TO THE COAL INDUSTRY THROUGH APPLYING BLAST DESIGN KNOWLEDGE TO SPECIFIC BLASTING APPLICATION PROBLEMS

DynoConsult commenced the ACARP project on Controlling Block Movement of Coal during Overburden Blasting in February 2002. This project is relevant and important to the entire open cut coal mining industry, as most mines have problems with blast induced coal loss. This can significantly impact the mines economics in terms of reduced mine revenue and marginal profit. Mining operations are continuously under pressure to produce coal at the lowest possible cost, therefore it is critical that ROM recoveries are maximized. This can be partially achieved by minimizing coal loss during the drilling and blasting process of the operation.

Sponsors of this project include a coal mine in the Bowen Basin Queensland, and one in the Hunter Valley (pictured below). As participating sponsors, each mine was required to provide both financial and human resource assistance to conduct the project. This was achieved through the provision of a mine site champion, relevant mine data and resourcing during the fieldwork related phases of the project.
Controlling Block Movement of Coal During Overburden Blasting

Project Goals/Summary

BOWEN BASIN AND HUNTER VALLEY MINES SEEK SOLUTIONS TO BLAST INDUCED COAL LOSS - PARTICULARLY WITH CAST BLASTING PRACTICES

Components of these objectives include:

- Reviewing historical information from the mines that experience block movement of coal during overburden blasting
- Investigating the block movement of coal through blast monitoring at selected mine sites
- Identifying the predominant mechanisms and geological conditions that promote the movement
- Model the mechanisms and simulate block movement of coal for different geological conditions and blast designs
- Develop and demonstrate alternate designs and guidelines to reduce block movement of coal
- Develop generic models and guidelines for the industry to manage/control the movement

Both mines have historically had problems with blast induced coal loss, in particular with cast blasting practices. The area of concern for the Bowen Basin site has been losses associated with an 8-9 meter seam of high quality coking coal. For the Hunter Valley mine, coal loss has been prevalent with the upper seams in the seam ‘composite’.

The 1 meter thick seam (directly underneath the overburden layer) is the highest quality coal seam being uncovered, mined, processed and sold by the operation. Significant losses have occurred with this seam and the objective is to improve the recovery of this critical seam. Recommendations for alternate designs developed from the Benchmarking and Modeling Phases will be field tested, assessed and benefits determined in the Validation phase of the project.

Preliminary and interim recommendations for change at the Hunter Valley mine have shown significant improvement in ROM recovery (30%). Details of the project are described in the respective Interim Reports and ACARP Review Meeting project update presentations. Copies of these documents are available on request.

Technology Applied

DYNOCONSULT UTILIZED A NUMBER OF TECHNOLOGY TOOLS DURING THIS PROJECT:

- Laser profiling to measure front row burden distances
- Digital still photography for highwall mosaic development
- High speed digital photography to develop overburden and coal movement velocity profiles
- Mine survey techniques to develop coal models for ROM recovery determination
- Bench Blast model used to estimate coal loss and cast percentage

Value Added

THE MOST RELEVANT AND DIRECT MEASURE OF BENEFIT IS A REDUCTION IN COAL LOSS OR INCREASE IN RUN OF MINE (ROM) RECOVERY

These measures are quantifiable through the application of standard mine survey techniques and used as the basis for reconciling plan versus actual coal mined for a given strip or block. DynoConsult has been consulting with the mines to demonstrate the benefits of the project. There is also the downstream benefit to the customer in terms of mine economics. If an operation can mine more coal for the same quantity of overburden material removed, cost savings to the operation are inevitable.

The most significant benefits at these sites will be realized for the two mine sponsors of this project during the Validation Phase. This phase will involve the implementation and assessment of alternate designs to reduce coal loss at the two mines. The value adding potential for the two mines was estimated at the conclusion of the base lining studies and were found, with little additional cost, to be significant for both operations (up to $2 million per year). The potential financial benefits for each mine were derived in terms of additional marginal profit generated from a reduction in coal loss or increase in recovery.