Site Profile

Jacobs Ranch Mine is a large surface coalmine located in Wyoming’s Powder River Basin and is the site of an Orica Advanced Mining Solutions (AMS) project to improve blasting performance.

The mine utilizes a truck and shovel operation to move in excess of 100,000,000 bank cubic yards of overburden annually. The overburden removal fleet consists of 4 - P&H 4100 shovels loading 240-ton capacity haul trucks.

The Situation

The AMS project goal was to improve overburden blast performance, and to measure progress through changes in shovel productivity. The Accu Weigh Production Monitoring System, a product of Drives and Controls Systems, is utilized to obtain shovel performance data. The software records information for each truck loaded during the shift, including: payload, dig time, swing time, total cycle time, number of buckets, and dig energy.

For this project, the plan was to change the shovel blast designs, one parameter at a time, then compare the productivity of the shovel in each test area, to its productivity in the corresponding baseline area.

Technical Solutions

Initially the project focused on one of the shovels, a 4100 XPB. This shovel, equipped with a 120-ton capacity bucket, is capable of two-pass loading each haul truck. On a typical shift, the shovel moves over 400 truckloads of overburden, each of which is stored as a separate data record by the shovel monitoring system.

The first phase of the project focused on the accuracy of the blast hole drilling. For this phase, the baseline period lasted 16 days and the test period lasted approximately one month. During the baseline period, the blast hole depths were found to be inconsistent. This condition was reviewed with the mine’s drillers, emphasising the importance of having the bottom of the explosives column at the planned elevation. The only change between the baseline area and the test area was a significant improvement in the drill depth accuracy.

Information about the hole collar locations and the shovel floor grade was obtained by GPS survey. Loaded hole depths came from the blast crew’s loading sheets. Shovel location information was obtained from the mine’s dispatch system.
The Result

Data was collected and filtered to remove records in which the shovel location could not be adequately determined, as where records as records that contained incomplete or questionable data. The final database contained 12,900 records. A preliminary shovel productivity comparison between the baseline and the test areas indicated a 0.4% productivity improvement resulting from the improved drill depth accuracy.

Further review of the database showed that numerous operators ran the shovel during the testing period. Variances in operator performance coupled with a relatively small test area in relation to the production rate of the shovel made comparisons difficult. Because of this, not all of the operators ran the shovel in both the baseline and the first phase test area.

To account for the differences in operator skills, the productivity in the two areas was compared by considering only the performance of operators who had run the shovel in both of the areas. Additionally, the individual operator productivities were all weighted equally to eliminate a potential bias caused by unequal amounts of operating time.

Comparing shovel productivity data using only equally weighted, common operators, showed that the improved drill depth accuracy actually yielded an 8.1% shovel productivity increase. This result stresses the ability of operator skill level to skew production calculations, and emphasises the importance of properly filtering data for analysis. Addressing these issues allowed the mine to realize an improvement 20 times higher than initially calculated.

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