

## Striking Gold with Minitab: Newcrest Mining Limited



With Minitab Statistical Software, Newcrest Mining can get an additional load of ore per truck each day from its Cadia Hill mine.

### KEY FACTS

#### ORGANIZATION

Newcrest Mining Limited

#### OVERVIEW

- Australia's largest gold producer
- Over 4,500 employees and long-term contractors
- World's most successful discoverer of major gold deposits, 1992–2005

#### PRODUCTS USED

Minitab® Statistical Software

#### RESULTS

- Quantified factors with greatest impact on haul truck speed
- Adjusting ramp grade improved haul speeds by 2.6%
- Project will save more than \$835,000 in just its first year

Newcrest Mining Limited is one of the world's top 10 gold mining companies and Australia's largest gold producer. Newcrest's Cadia Hill mine, the second-largest open pit gold-copper mine in Australia, produces approximately 300,000 ounces of gold annually. But its low-grade ore requires costly bulk mining and treatment techniques. Newcrest applies the Six Sigma quality improvement methodology and Minitab® Statistical Software to keep the Cadia Hill facility running as efficiently as possible, and to safeguard their prominent role in the gold industry.

### The Challenge

Many times per day, a fleet of large haul trucks descends a narrow ramp to the bottom of the Cadia Hill open pit, where each truck picks up an average of 225 tons of ore to carry back up the ramp to a crushing machine for processing. The speed of the loaded trucks ascending the single-lane ramp varies from 8 to 14 kilometers per hour. Slower trucks, of course, take longer to deliver their payloads to the crusher. Even worse, each slow truck delays all the trucks behind it, hampering the performance of the entire fleet and resulting in a serious loss of productivity. Newcrest Mining tasked Six Sigma Black Belt James Kovac to reduce that variability and increase the average speed of the ascending trucks.

### How Minitab Helped

Kovac and his project team began by identifying the variables that might affect truck speed. They collected data to determine which factors had the most impact, using Minitab to plan their data collection process, determine the sample sizes they needed, and test their statistical hypotheses. They then selected five trucks for on-board data collection. Team members rode along in the trucks over a two-week period, collecting intensive data using laptops, GPS units, and other equipment.

They determined that two factors had a major impact on truck speed: the slope of the ramp, and the trucks' fuel injectors.

The team now began testing solutions—and confirming their results. They altered the grade of small sections of the haul ramp, then measured truck speeds over the altered sections. Comparing the before-and-after speeds with Minitab's 2-sample t-test revealed that the grade adjustments increased truck speed significantly.

The team also devised a clear way to identify faulty fuel injectors. They ran each truck at 700 RPM and measured injector timing between all 16 cylinders. Then they switched off each cylinder in turn, leaving the other 15 to maintain the 700 RPM. If the remaining cylinders weren't significantly affected when one was switched off, that cylinder was underperforming and needed a new fuel injector. The test has now been incorporated into fleet maintenance procedures, using control charts produced by Minitab macros to quickly display results.

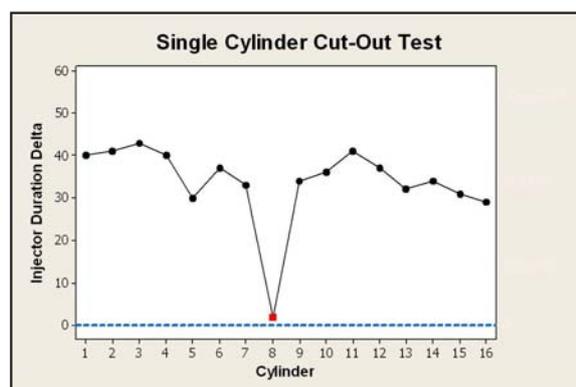
## Results

Minitab's statistical power and easy-to-understand graphics helped Kovac and his team make significant strides in boosting the productivity of Newcrest's Cadia Hill mine.

Using Minitab to plan their experiments and analyze their data at each step, they proved that reducing the grade of the haul ramp from 10.22 to 9.9 percent in the test section resulted in a 2.6 percent increase in truck speeds, and reduced variation in truck speed by 7 percent. Now the entire haul ramp is being checked and improved, and any sections with a grade of more than 10 percent will be reduced to 10 percent or lower. This adjustment is predicted to save at least 8.3 seconds per full uphill trip.

Minitab's analysis of the team's fuel injector data also revealed that 10 percent of the fleet's trucks weren't operating at their peak. As part of developing the new procedures for identifying and replacing faulty fuel injectors, the team found that replacing one injector in one truck improved cycle time by 5.6 percent, enough to result in one extra trip out of the pit per truck per day.

These improvements are making the Cadia Hill Mine more productive, and much more efficient. Newcrest Mining anticipates it will save over \$835,000 in just the first year of implementing these changes, thanks to Kovac and his team, the Six Sigma methodology, and the power of Minitab.



Minitab's powerful graphics quickly and clearly reveal when one of a truck's fuel injectors isn't performing.