Monitoring wear rates in crushers

Maptek™ technology proves to be a cost-effective and safe solution for monitoring wear rates of ore crushers.

Wear and tear in ore crushers can impact fragmentation size, cause damage to machinery and increase power costs. Maptek™ conducted a proof of concept for monitoring crushers components, using I-Site™ laser scan technology and Vulcan™ modelling software.

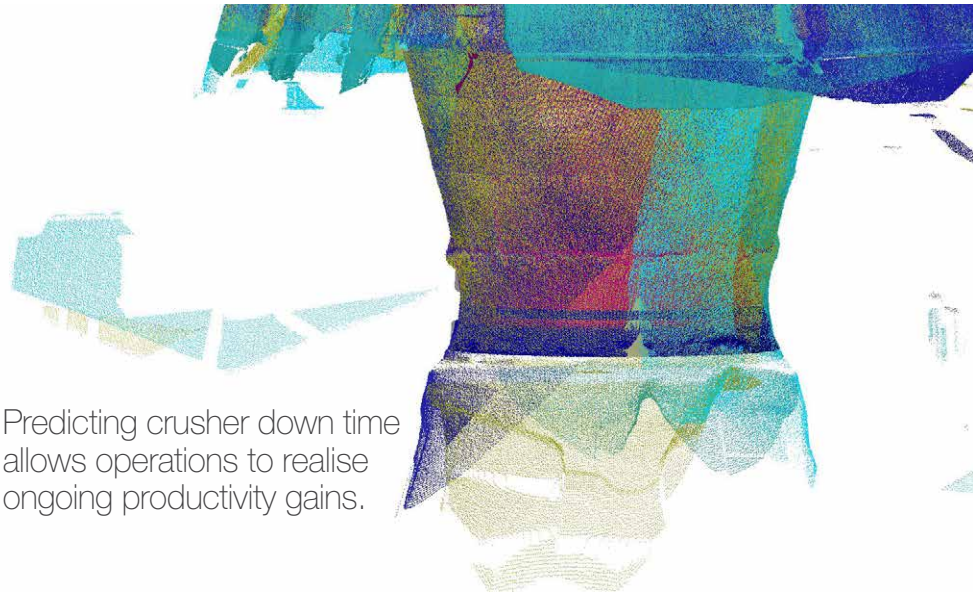
The safe, efficient and accurate solution provides mining companies with data to predict crusher down time and metrics for optimising downstream processes. Applying best practice in the crushing and processing phase can significantly reduce costs in the mining life cycle.

Fragmentation size is controlled by two main crusher components - the lining and the mantle. The interior lining of a rotary primary crusher is designed to absorb the continuous impact of material dumped into the crusher. Over a 10 week period, the lining can wear by as much as 350mm, depending on the material being crushed.

The inside mantle is the main control over fragmentation size, adjusted vertically to maintain a consistent spacing for generating constant fragment size.

The mantle is designed in 4 different sizes depending on the wear profile of the outside lining. The higher the wear rate of the lining, the larger the mantle that is installed.

Being able to accurately predict when to make adjustments is essential for optimising downstream material handling in secondary and tertiary crushing systems.



Predicting crusher down time allows operations to realise ongoing productivity gains.

Safety and time

Safety and time are the main concerns around manual measurements in the crusher compartment.

An infra-red device traditionally would be used to measure wear patterns. Taking measurements from an estimated centre point in the crusher compartment at 50mm vertical spacing in octants could take up to 3 hours for a vertical extent of 2.75m.

Physically entering the crusher cavity exposes team members to dust and noise as well as risks of falling from the side walls. Working at heights requires wearing safety harnesses.

Production must stop when the crusher is shut down, with loss of revenue estimated at US$200,000 per hour. Typically 3 hours is needed to collect manual measurements; if this happens every 10 weeks, it means $3m per annum.

Even though measurements are taken during part of a wider shutdown program, time savings are significant with the Maptek solution.

The solution

Using the I-Site 8200 laser scanner, Maptek demonstrated that the lining of the primary crusher, as well as other downstream crushers, could be scanned in a fraction of the time. It could also be conducted safely and with accurate results.

Moreover, the detailed 3D laser scan data can be applied to analysis outside the original scope of the study.

Laser scanning was conducted with the scanner mounted on the dust collar alongside the crusher compartment. Scanning was completed in less than 30 minutes. Staff did not need to enter the crusher.

A 3D triangulation model of the crusher lining before operation was built from design parameters to establish a benchmark for calculating wear patterns. The model was divided into horizontal and vertical segments so that results could be easily related to what was happening in the crusher. Loading positions and various vertical design components of the lining were also referenced.

Scan data was compared to the modelled design data to create a wear profile. Tools in I-Site Studio and Vulcan allowed various metrics to be extracted, with the main focus on wear patterns for each quadrant.

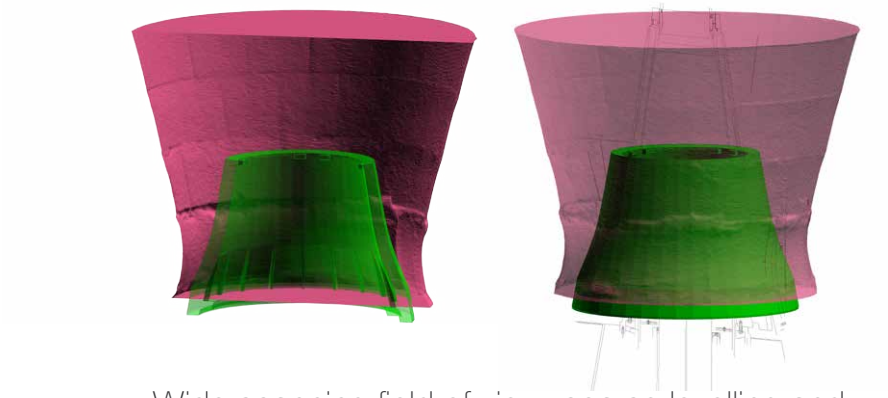
As expected, the highest wear occurred at the bottom of the crusher lining, where the actual crushing takes place. Further evaluation was needed to determine if crushing occurred consistently throughout the lining and to assess its impact on wear rates.

Using Vulcan 3D solid tools the entire model was shelled into vertical and horizontal segments. This allowed comparison of both thickness and distance from centre points. The Survey Radiations function showed the distance from the centre point of the crusher of both the design and the actual scanned area.

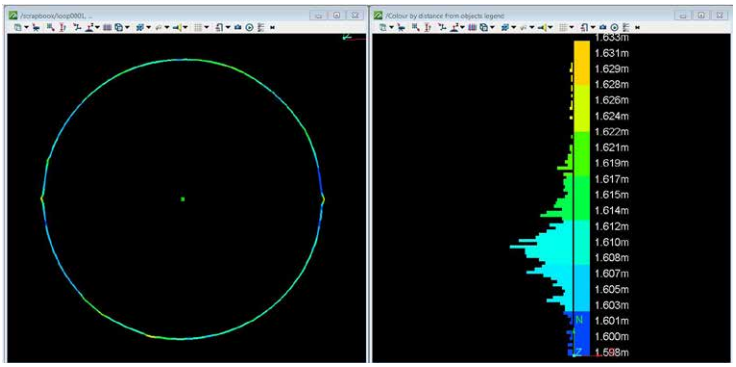
Further analysis

The study revealed uneven wear on the crusher lining. Quadrants where material was tipped into the crusher showed higher wear. Data for one quadrant indicated that trucks were not stopping parallel to the crusher dump box, exacerbating wear at this point.

Wear in the lower section of the crusher was greater at the join in the lining. Allowing material with increased fragment size to pass through this area has potential for impact on downstream processing performance.



Wide scanning field of view, coarse levelling and 8mm minimum accuracy make the I-Site 8200 system ideal for crusher survey.



Wear to the crusher lining can be easily seen by comparing the distance from the centre point of the crusher to the lining before and after operation

A dramatic reduction in time spent measuring the crusher lining, combined with a significant increase in accuracy of data captured by I-Site laser scan technology, allows advanced analysis of data and more effective decision making.

Ideal scenarios

Reducing down time of crushers allows mining operations to effectively increase revenue. Accurate digital data promotes more informed decisions relating to the position of the mantle that ultimately controls the gap between it and the lining.

Sending consistent size material to the processing plant provides an opportunity to improve productivity.

Crusher design companies can evaluate the wear patterns and adjust the position of the mantle based on this accurate data. Industry R&D investment could also lead to further improvements in the overall crushing process.

Predicting crusher shutdown to replace parts and achieve optimum crusher life will deliver ongoing productivity gains.

The ideal scenario would be to continuously scan crusher components to measure wear and tear. If safety and access limitations make this impractical, scanning more regularly would still be a worthwhile investment.