The Titan 3300 payload monitoring system in use.

Manage what you measure

As miners strive for efficiency and improvement, payload monitoring takes on greater importance. By **Lisa Shearon**

With mining companies across the board struggling to increase productivity, greater emphasis is being placed on measuring payloads and structural fatigue on excavators.

As LC Engineering senior engineer Derek Mulder succinctly puts it: "You can't manage what you don't measure.

"Payload monitoring is receiving increased interest due to the widespread drive for efficiency improvement.

"This concept is well understood with respect to truck and shovel fleets.

"It is the reason for the success of and focus on fleet management systems, which track truck payloads from the dig point to the dump point as well as haul times. That data relies heavily on the truck payload measurement systems, which use strut pressures to calculate payload."

Truck payload measurement systems typically provide three measures of payload: at-shovel weight; leave weight; and final weight.

"The purpose of the at-shovel-weight indicator is to provide feedback to the excavator operator on how much more dirt is required to fill the truck to its rated capacity," Mulder said.

"The values are usually displayed via a 'fill-board' on the truck or other technology that transmits the value to a display in the excavator cabin.

"The accuracy of this payload measure varies greatly because the strut pressures are influenced by uneven ground, off centre payloads, and varying friction in the struts themselves.

"The leave-weight payload measure is more accurate because the ground conditions tend to improve as the truck moves out of the dig face.

"This payload measure is used by the truck control system to determine if the truck is overloaded and, if necessary, de-rate the machine to limit the potential damage.

"Final-weight measure is the most accurate truck payload and is most often the value reported by fleet management systems. It is generally calculated when the truck is traveling on level ground and acceleration or deceleration is minimal."

According to Mulder, accuracy is poorest when the operator has the ability to change the desired result – that is, when the truck is being loaded.

"This has been the drive behind new payload monitoring systems that are installed on the excavator," he said.

"This approach allows the payload to be calculated accurately on a bucket basis and gives the operator a great deal more influence on the final truck payload accuracy.

"The result is a reduction in the variation of truck payloads, dramatically reducing the number of trucks with loads over 110% of the target and almost eliminating truckloads more than 120% of the target."

Accurate excavator-based payload measurement systems in the mining environment are a relatively recent innovation.

The Titan 3330 hydraulic excavator and shovel production monitoring system was developed by LC Engineering specifically for hydraulic machines operating in a dynamic mining environment.

"It's designed to increase productivity, decrease overloading and monitor fatigue, and is now deployed at a number of sites on equipment ranging from a 360t backhoe to a 980t faces shovel," Mulder said.

LC's Titan 3330 uses highly sophisticated instruments and algorithms to calculate and display the excavator payload of each bucket accurately, in real time and during motion, before it is dumped in the truck.

This real-time measurement is completely stable, carefully filtered and fully compensated for the high-vibration digging environment. While dumping, the screen informs the operator of continuous summaries of the total truckload to date and how much remains to be filled.

Trials have showed that most operations generate a statistical spread of truckloads with a standard deviation of 10% of the average load. Use of the Titan 3330 monitor tightens this distribution to achieve a standard deviation of only 5% of the average truckload, resulting in increased truck fleet productivity by around 6% and decreased overloads of more than 110%.

"Studies of the first mine-site deployments revealed the significant reduction in the variation of truck payloads," Mulder said.

"They also highlighted the importance of knowing if the bucket was dumped in a truck or if the operator was just preparing the face. AMM