

FORGING DEFENSES AGAINST FATIGUE RISK

How one mining company reduced incidents by 86%

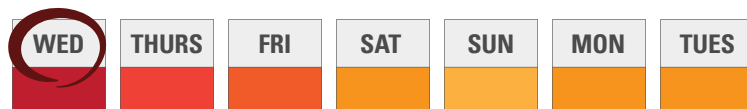


It's 6:00 a.m. on a Wednesday. A crew of miners is starting a shift of seven, 12-hour work days for a major Oil Sands mining project in Canada.

In two hours this group of fathers, mothers, spouses and friends will experience the highest level of fatigue risk during their work week.

That's not a hunch. It's a quantifiable fact proven through the power to "see" and measure fatigue risk across this operation.

7-DAY STRETCH OF 12-HOUR SHIFTS



Longitudinal data shows fatigue events spike on Wednesdays, when 7-day shifts are ending for some crews and beginning for others.

"It isn't a matter of *if* one of our operators will fall asleep at the wheel of a 400-ton haul truck, it's a matter of *when*," said the mine operations manager. "We won't eliminate that risk, but we're doing everything in our power to protect our people against it."

So today this crew is starting its shift with a discussion about fatigue. Routine educational sessions are part of the company's robust Fatigue Risk Management System. Operators are empowered with information to personally manage their sleep health, but they're also provided peace of mind that technology will protect them if the formidable force of fatigue bears down.

SEEING AN INVISIBLE RISK



That technology is the Cat® Driver Safety System (DSS), an in-cab fatigue and distraction monitoring and mitigation device. A camera that utilizes non-intrusive facial mapping technology watches for physical signs of weariness. If the operator nods off for a couple seconds – experiences what is called a ‘microsleep’ – the system activates a rumble in the seat and audible in-cab alarm.

In its initial pilot test of the technology, the DSS was installed in just five of the company’s haul trucks and a 90-day, three-phase approach to quantifying fatigue risk and mitigating incidents ensued. To see and measure the scope of the problem, for the first 30 days the in-cab cameras recorded microsleep events, but the alert systems didn’t activate to alert drivers. In one month 63 fatigue events were recorded. Operators traveled 1.6 kilometers while sleeping.

Statistic	Phase 1	Phase 2	Phase 3
Total Mobile Hours	2,966	1,981	2,005
Total Fatigue Events	63	31	9
Average Fatigue Events (per mobile hour)	0.020	0.020	0.004
Distance Traveled while Fatigued (meters)	1,611	922	369

A three-phase Fatigue Risk Assessment uncovered its scope of risk (Phase 1), started mitigating incidents (Phase 2) and initiated comprehensive fatigue risk management (Phase 3).

“Seeing those numbers made the threat and ability to reduce it so obvious that our senior leadership committed immediately to using the technology across our fleet,” said the mine’s technical services manager. “When I saw operators falling asleep at the wheel, I couldn’t in good conscience turn away from this system.”

The alarms in those first five trucks were activated and fatigue events diminished by 86% in the next 60 days.

BATTLING BIOLOGY

Of all the safety hazards on a mining site, fatigue is a unifier – because no one can escape it. At some point, every human gets so sleepy that decision making, reaction time and overall cognitive power is compromised. For miners, the potential for reaching that ultra-weary state is heightened because 24/7 operations require people to work when the human body is wired to be sleeping.



Still frames from a video captured by the Driver Safety System show the progression of a microsleep event over approximately two seconds.

Similar in concept to a safety harness, the DSS serves as personal protective equipment – ready to catch operators if they fall. The system also includes living, breathing protection in the way of safety advisors who work in a 24/7 Fatigue Monitoring Center. When a DSS unit activates because the operator’s eyes have closed for 1.5 seconds and the truck is moving at least 10 kph, a short video clip of the event is captured, sent to the monitoring center and reviewed by a safety advisor. If the analysis confirms a microsleep occurred, the safety advisor contacts a dispatch officer on site to communicate the incident. What happens next is dictated by a Fatigue Intervention Plan designed with guidance from a Caterpillar fatigue management expert. The protocol involves direct human contact with the operator, possibly a break from driving, but never punishment.

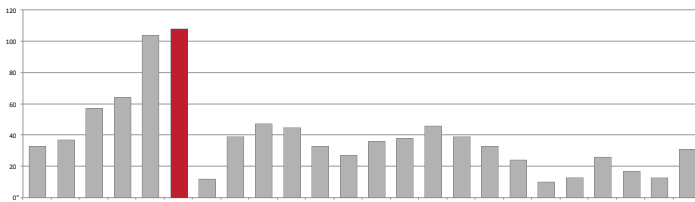
“I didn’t believe I had really fallen asleep – until I saw the video.”

“When the DSS alerted me, I didn’t believe I had really fallen asleep – until I saw the video ,” said one operator. “Often we don’t realize how fatigued we are, and likely don’t even know we’re falling asleep.”

THE CULTURAL IMPERATIVE

Analytics from the Driver Safety System (DSS) have revealed previously hidden trends that are shaping the organization's incident prevention strategy. For example, data from this site shows the first day of a seven-day shift is the most likely time for an operator to succumb to fatigue. Longitudinal reporting shows precisely which hours of the day and night are high-risk for each crew, and which hours operators are most alert.

FATIGUE EVENTS BY HOUR



Across a 24-hour period data shows incidents peak at 5:00 a.m., one hour before shift change.

The company tracks every data point possible and continually refines its management system. It's become a passion, because many here bear emotional scars from a time before fatigue was taken so seriously.

"Three years ago we had a fatality, we lost someone we loved, and we believe it was due to distraction," one crew member shared. Distraction is a common symptom of fatigue because operators often move around to avoid nodding off, so the DSS watches for both distraction and fatigue.

"If we had the DSS at that time, there's a strong possibility our co-worker would still be with us today. This initiative is very personal," the crew member added.

That loss catalyzed a culture change in this organization, which like many in the industry once perceived fatigue as a sign of weakness, something shameful. The way management has responded to each DSS alert has shaped a new attitude about fatigue and forged trust between leaders and operators.

"No one has ever been, nor will ever be, punished for having a fatigue event," said the technical services manager. "The technology will only protect people if they trust the purpose, and you have to earn trust – you can't buy it."





2000 WAKE-UP CALLS

Within two years after the first DSS units were installed, more than 2,000 fatigue events were recorded on this site. That doesn't surprise management, nor discourage them. In fact, DSS alerts have prevented about 500km of fatigued driving in that time.

"Imagine, two, three years ago we were driving hundreds of kilometers a year while asleep," said the coordinator of mine operations.

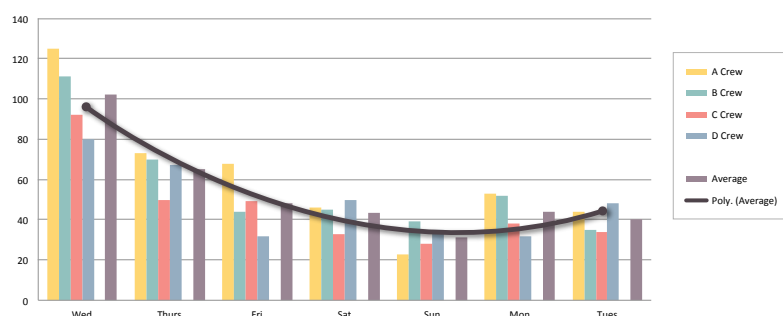
DSS alerts have prevented 500km of fatigued driving.

An effective Fatigue Risk Management System delivers benefits beyond its primary objective to protect operators. Reduced berm contact and prolonged tire health are typical outcomes of increased operator alertness. Over two years this company reduced equipment maintenance spending by \$500,000, savings management attributes to increased operator alertness.

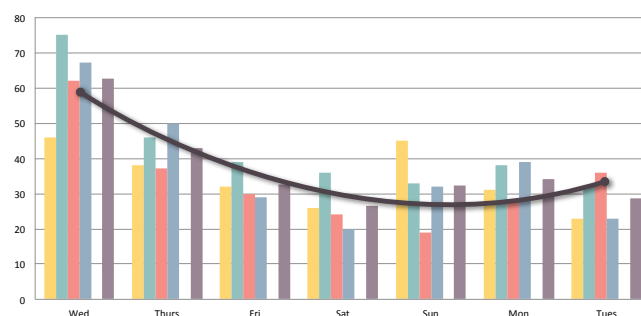
The organization is growing, and with each acquisition or expansion comes new assets. Every one of the haul trucks is upgraded with a DSS, an expense management doesn't hesitate to make. The power to see, mitigate and manage fatigue risk is saving this company much more than money. ❖

VISIBILITY TO VULNERABILITY

FATIGUE EVENTS ON **DAY SHIFT** (YEAR TO DATE)



FATIGUE EVENTS ON **NIGHT SHIFT** (YEAR TO DATE)



Tracking fatigue events by day and crew provides insight into how the schedule impacts risk, data that is driving an increasingly effective Fatigue Risk Management System.