Fatigue and Distraction: How to Assess the Invisible Threat

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Fatigue is the state of being tired, weary or sleepy and typically results from inadequate sleep, prolonged physical or mental work, or extended periods of stress and anxiety. Within mining operations, fatigue is a leading contributor in 60-70 percent of human error incidents[1] and surveys of shift workers across all industries demonstrates that nearly half of the population nods off while working.

Fatigue represents an invisible threat to business; capable of undermining productivity and performance targets, brutally impacting financial results and damaging business reputations. However, this invisible threat isn't all negative, as it provides an opportunity to better understand operator performance, positively impact risk mitigation, make efficiency gains, drive cost control and improve the overall health and wellness of our employees. Regardless, of the tireless efforts made by organisations to manage fatigue, or by science to understand it, fatigue remains inevitable. We are all human and we all get tired.

For businesses, who already manage operations down to the smallest unit, this provides an opportunity to mitigate the risk of another human variable – the naturally occurring fatigue levels of their employees. "Effectively controlling fatigue and distraction forms the biggest single opportunity to reduce serious incidents, injuries and fatalities in mobile fleets at our sites", said the VP of Safety for a large global mining organisation. But, how can we manage what we don't measure, and how can we measure something that we can't see?

One thing that I have learned over the years through multiple Change Management and Continuous Improvement systems is to first assess (define and measure) the

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[1] 2008, Caterpillar Inc., *Operator Fatigue, Detection Technology Review*

current state of any operation, before developing an improvement plan that helps reach the desired state.

For Caterpillar Inc., the ability to accurately assess fatigue represented a clear opportunity; build a technology-enabled solution that would equip any organisation with the vision, visibility and insight to quantify their issues regarding operator performance. Using their own Six Sigma practices, Caterpillar Inc. built a comprehensive safety product suite that includes a Fatigue & Distraction Risk Assessment - a holistic employee fatigue and distraction measurement tool that provides real-time visibility to an ongoing risk.

Over the last decade many technologies have emerged in the fatigue space ranging from in-cab camera systems and devices needing to be worn by an operator, to computer software scheduling systems. When used as stand-alone technologies, these tools can provide you with valuable improvement data however, when used together, these technologies can capture the entire picture. During the assessment period it's important to consider the use of a range of technologies in order to clearly define the volume of the problem. For example, an in-cab camera system detecting operator alertness will provide the number of fatigue and distraction events occurring, but it doesn't provide any data on that same operator's sleep quality. Similarly, telematics data provides ample information about how the equipment is operating, but provides very little information about the control module (the operator).

Caterpillar, Inc. has carefully reviewed the various technologies available and has selected what we consider to be the best combination of products to provide a holistic view of operator and fleet performance. The product suite includes:

- Cat Smartband – scientifically validated wrist worn technology that captures the quantity and quality of sleep for the wearer, which is then used to calculate an effectiveness score
- Fatigue Avoidance Scheduling Tool (FAST) – fatigue modelling software that identifies areas of fatigue risk in schedule and roster design utilising individual and group sleep data to generate minute-by-minute performance predictions

- Driver Safety System (DSS) – an in-cab camera system that detects fatigue and distraction events
- Equipment Telematics – "black box" type technology used to transmit vital equipment and operation data to improve usage and product life

A Fatigue & Distraction Risk Assessment analyses the combined data from each of these technologies to bring visibility to the current state of operations, employee effectiveness and risk.

Through the use of these technologies, a more adequate assessment can be made into the current realities within any operation. I recommend a minimum 25% sample population be selected for a sleep analysis using the Cat Smartband technology. Designed to be worn 24/7 for a period of approximately 4 weeks, the anonymous data provides insight into the current sleeping patterns of your operators. Each participating operator in the study receives a report detailing their personal sleeping habits. Additionally, the organisation utilises the anonymous data in a FAST analysis, which creates predictive 'heat maps' to indicate when fatigue levels will be at their highest during shifts. The FAST tool is also used to simulate alternate shift schedules that identify maximum performance shifts.

Utilising the Cat Smartband, I've conducted two of my own personal sleep assessments over the last 10 weeks. The data generated from the first 4-week analysis caused me to take a harder look into my sleeping habits, diet and exercise schedule. I made some modifications and conducted my second 4-week analysis. The results of the latter analysis showed a measurable improvement in my sleeping habits and fatigue levels. I can attest to my own improved performance, attention span and personal wellbeing.

Fatigue is a naturally occurring human response. Even with the best management systems and control measures in place, it remains inevitable. This is where the Driver Safety System adds significant benefits. A camera based detection system, it analyses eye-lid closure and minuet head movements to determine when an operator is experiencing a fatigue or a distraction event during equipment operation. The Driver Safety System provides real-time intervention for fatigue and distraction

events through the use of an instantaneous in-cab alarm and seat vibration system. The accompanying 24/7 monitoring system also supports a Fatigue Intervention Plan for each detected event and customised reports to be used for analysis and continuous improvement. This technology provides an accurate measuring system for determining the success of your overall fatigue risk management system. In addition, the availability of real-time data enables the changing out of any operators who are at risk of accidents and injuries due to their fatigued state.

Since its development the Driver Safety System has monitored more than 8M hours and driven more than 101M kilometres in mining vehicles. 2641 of those kilometres have been driven while operators were fatigued. The Driver Safety System has also detected more than 1.5M distraction events in these same mining vehicles.

During the assessment process we strongly encourage cross checking and referencing equipment telematics, tyre and incident data from your machines. Integrating these data sets with fatigue and distraction events provides even more tangible information to define the current reality.

Once a Fatigue & Distraction Risk Assessment is undertaken, you have specific and verifiable data from which to build an improvement plan. Combining real-time intervention technologies, operator performance related data and engaging in operator consultation creates an integrated and comprehensive improvement plan for the business. In working with employees to optimise policies, procedures, training and schedules / rosters, an ongoing Fatigue Risk Management System will facilitate a culture of continuous improvement driven by data analytics for a sustainable future.