Improving Underground Mobile Mechanised Mining Productivity with Safety in Mind

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Keywords: proximity, underground, safety, data, productivity

# ABSTRACT

Historically, adverse vehicle interactions have disproportionately contributed to fatalities in mining, with underground operations being particularly affected. This correlation underscores the need to emphasise safety, as incidents resulting in injuries or fatalities often lead to substantial lost time and diminished operational efficiency. Surface mines have seen success by implementing various positioning and communication technologies to mitigate these issues. However, such solutions are not directly transferable to underground environments, where the lack of GNSS, numerous blind corners, and limited communication infrastructure prevail.

In these subterranean settings, early non-line-of-sight (NLOS) communication is crucial for giving vehicle operators advance visibility of potential unwanted events (PUE). The ISO 21815-3:2023(E) standard, which outlines the components and calculations for Collision Warning Systems (CWS) and Collision Avoidance Systems (CAS), provides a framework for defining appropriate NLOS stopping distances. Factors like operating speed, interaction scenarios, and necessary safety margins reveal that these distances can exceed casual expectations, sometimes requiring 75m+ NLOS when vehicles approach intersections at 20 km/h.

Achieving reliable communication between moving vehicles at such ranges is challenging, and finding interoperable solutions with market support can be even more difficult. Vehicle-to-everything (V2X) technology, originating from the automotive sector, has demonstrated through testing its capacity to provide consistent communication distances of over 100m in underground environments, enhancing situational awareness and reducing cycle times by increasing the safe travel speed.

Safety technologies can further boost productivity by minimising their reliance on complex components and sensors, thereby reducing downtime and operational disruptions. Collecting detailed interaction data supports continuous improvement, while leveraging industry standards fosters interoperability between systems, paving the way for seamless integration and enhanced operational efficiency.