Safety Berm Design: Moving Beyond Rules of Thumb

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# ABSTRACT

Safety berms, also known as safety bunds or windrows, play a critical role in preventing vehicles from falling over edges in surface mines and quarries. Despite their importance, the design of these structures often relies on rules of thumb that primarily focus on the berm's height relative to the vehicle’s tyre diameter. This oversimplified approach overlooks the complex dynamics of vehicle-berm collisions, potentially undermining safety in high-risk environments.

To address this issue, a more rigorous and scientific approach to safety berm design is essential. Effective designs must consider not only the berm’s height but also its overall geometry, including the top and base width and batter angle. Incorporating these geometric parameters into a comprehensive analysis allows for a better understanding of the berm’s capacity to safely redirect or arrest vehicles during impact.

Advanced numerical modelling, combined with full-scale experimental testing, provides a robust framework for improving safety berm designs. This integrated approach enables the simulation of diverse collision scenarios, capturing critical variables such as vehicle type, load, approach angle, velocity, berm geometry, and material properties. By analysing the interplay of these factors, it is possible to identify and optimise berm configurations that offer superior performance under real-world conditions.

This paper marks a significant step forward in transitioning from rudimentary design guidelines to simulation-based solutions. By leveraging state-of-the-art numerical modelling and experimental techniques, safety berm designs can be tailored to site-specific conditions. This approach enhances the safety and effectiveness of berm designs, ensuring they meet the demands of modern mining and quarrying operations. Ultimately, this work contributes to safer working environments by advancing the understanding of vehicle-berm interactions and providing a robust foundation for future design standards.