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Acceleration and GPS data monitor truck-haulage jolts

Accelerometers and pressure transducers, mounted in suspension components, can be used to monitor the ride of haulage trucks. Presently, it is difficult to tell what caused a jolt to the truck using either pressure or acceleration data alone.

When information from a global positioning system (GPS) is recorded at the same time as shock pressures or acceleration data, the exact location of an event can be determined. Mine management can then determine what caused the jolt to the truck.

This research is part of a National Institute for Occupational Safety and Health (NIOSH) project called "Engineering controls for reduction of jolting/jarring injuries in surface mines." NIOSH is investigating how the work environment of haulage truck drivers can be improved.

The US Mine Safety and Health Administration (MSHA) notes that, between 1986 and 1995, 60% of the back injuries were to haulage truck drivers in metal/non-metal surface mining. Personnel from Phelps Dodge suggested that combining acceleration data with information obtained from a GPS could generate results with a variety of uses.

Therefore, researchers at the Spokane Research Laboratory (SRL) began investigating how to tie acceleration and GPS data together. It was originally thought that this tool would be used primarily for road and truck maintenance. However, as research progressed, it became apparent that it would also be useful in providing

feedback about equipment operations and identifying unusual causes of jolting.

Experimental approach

Available components that function well by themselves were linked for the purpose of proof of concept. Using a Modular Mining Systems (MMS) product called Vital Signs, SRL researchers took an Aero-Marine Products (AMP) acceleration recorder and hardwired it to MMS Dispatch equipment already installed on a truck. AMP is one of several manufacturers of acceleration recorders frequently used to monitor freight during shipping. MMS Dispatch is used for production accounting and truck dispatching and uses GPS tracking.

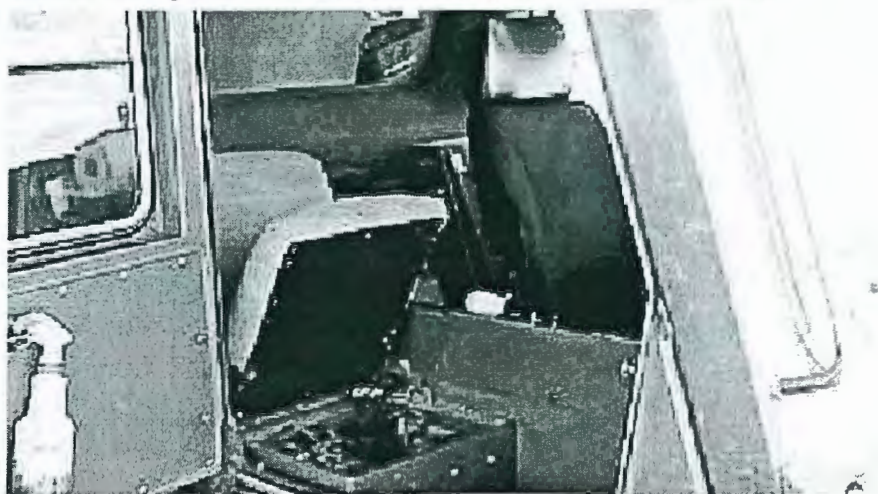
Through Vital Signs, an analog or digital alarm signal can be recorded. Steve Rhoades, of MMS, wrote unique code that links the Vitals Signs data and GPS location and stores this data in an ASCII log file. SRL researchers installed the equipment in a Caterpillar 793 haul truck. The result was a working prototype. Figures 1 and 2 show the instrument installation in the truck.

Discussion

From 8:30 pm on Sept. 14, 1998 until 6:50 am on Sept. 15 1998, 899 jolts above a threshold of 2 g (1 g is the acceleration of gravity. It is either 9.81 m/s² or 32.17 ft/s².) were measured on the test truck. Some sections of the haulage road produced most of the events, while

FIG. 1.

View of "buddy seat" where an acceleration recorder was installed.



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