

Vehicle Interaction

EMESRT - Working together to improve design one step at a time

Introduction

Vehicles and driving is the mining industry's current number one risk. From 2004-2009, 35% of fatalities at mine sites were due to vehicle interaction incidents and 53% of these involved pedestrians. In late 2013, when collision avoidance systems became a major focus of the industry, EMESRT took on the challenge to:

- Clearly define the problem
- Understand the scenarios
- Build a set of performance requirements to enable evaluation of Proximity Detection System (PDS) technologies on the market with vastly differing capabilities

This work has proved to be far more complex than previous topics EMESRT had undertaken. EMESRT reviewed their current suite of design philosophies and recognised that DP 5, 'Machine Operation and Control' clearly encompassed the extent of the vehicle interaction problems; however, it did not contain enough detail for designers to fully understand the issues.

The problem

When mining vehicles collide with other vehicles, people or infrastructure, the outcome can be a fatality, or multiple fatalities but often a less severe outcome occurs such as a lost time injury, or equipment damage.

EMESRT adopted a nine step hierarchical type model around design, operate and react which clearly identified the areas of focus for both the end user, mining companies Original Equipment Manufacturers (OEM), and for the first time allowed us to engage with the third party suppliers of Vehicle Interaction (VI) systems to provide a 'one voice' of the industry approach.

Design philosophy focus area for vehicle interaction

1. Site Requirements	Equipment specifications, standards, mine design/plans	years
2. Segregation Controls	Berms, access control, traffic segregation, time schedule	months
3. Operating Procedures	SOPs, maintenance, road rules, quality control, lockout	weeks
4. Authority to Operate	Training, licences, induction, access control	days
5. Fitness to Operate	Fatigue state, drug and alcohol, medicals	shift
6. Operating Compliance	Pre-start, safety tests, machine health, event recordings	hours
7. Operator Awareness	Cameras, live maps, mirrors, lights, visible delineators	minutes
8. Advisory Controls	Alerts: Proximity, fatigue, over-speed, vehicle stability	seconds
9. Intervention Controls	Interlocks: Prevent start, slow-stop, rollback, retarder	ms

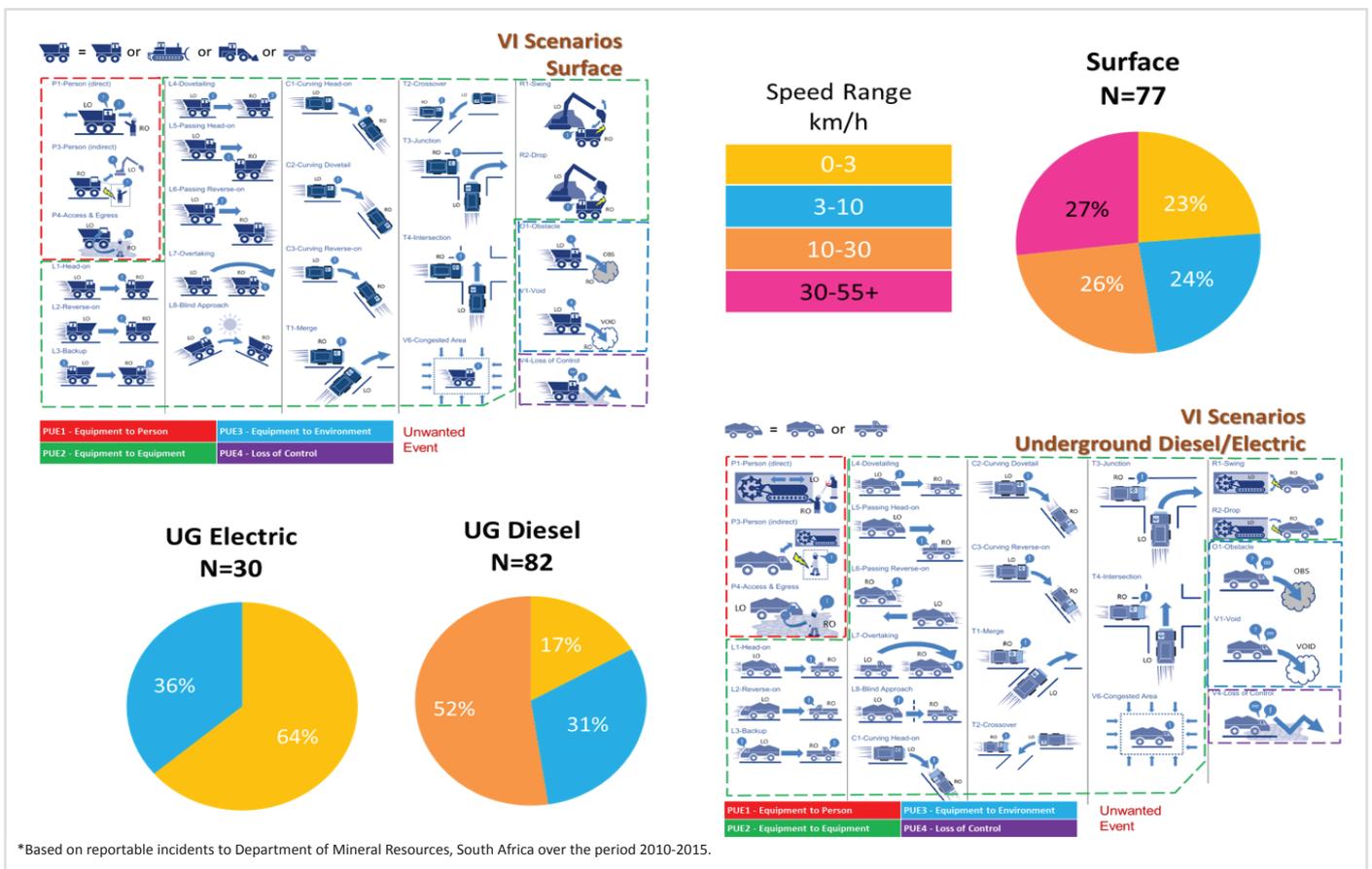
This work not only tried to clarify terminology but also the scenarios and speed ranges representing the most common interactions for mining equipment in both underground and surface operations. Being able to clearly articulate the complexity and magnitude of both human factors and design engineering requirements has proved invaluable in defining the problem.

This work has culminated in the development of the performance requirement document PR 5A to augment the existing DP 5 and provides for clear communication of system capabilities, requirements and performance between the parties.

The last piece of the puzzle was 'how to make these systems communicate seamlessly', in other words 'plug and play' over the vast array of mining equipment and allow for these new systems to take control of operating equipment where necessary.

EMESRT initiated and facilitated a collaborative industry working group with both the OEMs and third party system suppliers to develop a common electronic communication protocol to enable future slow down and stopping of mobile equipment. This protocol based on J1939 forms one part of a new ISO standard for Collision Awareness and Avoidance.

This project brings together OEMs, PDS suppliers and the end users with the "one voice".



A number of workshops have been held with OEMs and PDS suppliers over the last few years and progress has/is being made.

The objective is to prevent a person or equipment (machine or vehicle) causing a potential unwanted event in the following four categories resulting in injury or equipment damage:

1. Equipment to person
2. Equipment to equipment
3. Equipment to environment
4. Loss of control of equipment

"Join us on the journey to improve design one step at a time"

