



## Significant Incident Report No. 226

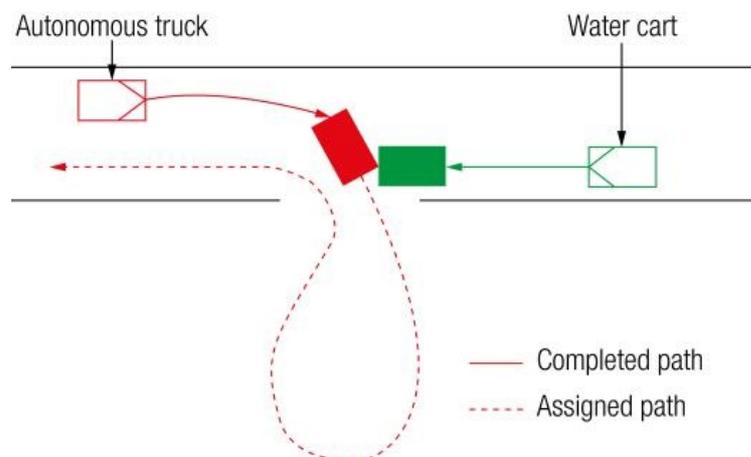
**Subject:** Collision between an autonomous haul truck and manned water cart

**Date:** 11 August 2015

### Summary of incident

Autonomous trucks were hauling mine waste on night shift at an open pit mine. The control room operator directed an autonomous haul truck to turn right at an intersection and perform a loop so it could be positioned under an excavator bucket on the pit floor. The intersection and turnaround loop existed in the control system but the intersection was not physically signposted or marked on the ground to alert manually operated vehicles.

A manned water cart was travelling in the opposite direction when the autonomous truck was about to turn to right. The water cart driver was not aware of the autonomous truck's assigned path and, on recognising it, tried to take evasive action. The two vehicles collided, resulting in significant damage to the autonomous truck. The water cart driver received minor injuries.



### Direct causes

- The travel paths of the autonomous truck and water cart intersected.
- The turnaround loop for the autonomous truck was released for use in the control system but the corresponding intersection was not delineated on the ground, nor its intended use communicated.
- On detecting the water cart in its assigned path of travel, the autonomous truck's speed (about 40 km/hr) and response time meant it could not prevent the collision.

### Contributory causes

- The change management processes for planning and assigning roads in the control system were inadequate.

- An awareness system was set up in the water cart to allow the driver to monitor the autonomous truck's path. However, at the time of the collision, the water cart driver was not fully aware of the intended path of the autonomous truck.

## **Actions required**

Principal employers and responsible persons at mine sites using autonomous mobile equipment are reminded of the importance of identifying, monitoring and reviewing hazards associated with the interaction of manned and autonomous mobile equipment.

So far as reasonably practicable, the potential for interactions should be minimised by using the hierarchy of control as a guide. The following actions are recommended.

### ***Elimination***

- Where possible, eliminate manned activities within the autonomous mining area.

### ***Substitution***

- Where manned activities are unavoidable within the autonomous mining area, identify opportunities to mitigate potential interactions between manned and autonomous equipment.

### ***Engineering controls***

- The collision awareness system used by autonomous mobile equipment should detect and react to mobile equipment outside its assigned path of travel in a sufficient time to prevent a collision.
- Ensure awareness systems within manned mobile equipment effectively monitor and alert drivers of potential collisions with autonomous mobile equipment.
- When calculating appropriate speed limits for the autonomous mobile equipment, consider the time required for object detection and response.

### ***Administrative controls***

- Implement robust traffic management procedures to manage the risks associated with manned and autonomous interactions.
- Implement comprehensive change management processes to ensure traffic management controls are appropriate and verified on the ground before changes are made in the control system.
- Ensure control room operators and pit supervisors are competent in the operating processes and change management procedures for the control system.
- Ensure personnel working in the autonomous haulage area receive suitable training in traffic management standards and are deemed competent to operate within the autonomous haulage area.

## **Further information**

Mines Safety Bulletin No. 110 *Seeking safe mobile autonomous equipment systems*

This Significant Incident Report was approved for release by the State Mining Engineer on 11 August 2015