REPORT

Vehicle collisions in the Western Australian mining industry

2015-16

Government of **Western Australia**
Department of **Mines, Industry Regulation and Safety**

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Contents

1 Introduction

This report examines the 172 collisions and near collisions involving 292 vehicles, as reported to the Department of Mines, Industry Regulation and Safety (the Department) from January 2015 to December 2016. It is an extension of the suite of publications by the Department that provide information and analysis of accident and incident data to identify causation factors.

1.1 Aims

The aim of this report is twofold:

- to develop a more detailed understanding of the factors that influence vehicle collisions
- used as an exemplar project to determine how the incident data can be used to develop a taxonomy for identifying hazards in Western Australian mining.

This vehicle collision study shows:

- vehicles involved in collisions
- collision causation factors
- areas where collisions occur
- activities in progress at the time of the collisions.

This information should assist stakeholders in identifying problem areas at their mining operations and to develop improved systems of traffic management.

1.2 Background

The West Australian mining industry employs over 100,000 people and has a highly complex hazard and risk profile. It is, therefore, essential to have an up-to-date understanding of hazards and risk exposures to achieve consistent safety improvements.

The Department has conducted reviews of information on fatalities and serious injuries captured in its databases to assist employers and employees to identify and reduce hazards in Western Australian mining in accordance with Section 3 of the *Mines Safety and Inspection Act 1994*.

Important hazards have been identified in the Department's fatality and serious injury reviews. These reviews demonstrated distinct areas where common causation factors contributed to repeat accident scenarios. In recent years, the Department has published two hazard registers and two reports on the analysis of fatality and injury data:

- Fatal accidents in the Western Australian mining industry 2000 – 2012: What lessons can we learn?
- Hazard register for all Western Australian mining fatalities from January 2000 to December 2017 (fatalities hazard register)
- Analysis of serious injury data in the Western Australian mining industry, July – December 2013: What lessons can we learn?
- Hazard register for serious injury or other serious incident investigations from January 2011 to December 2016 (serious injuries and incidents hazard register)

The findings from these reviews were incorporated into Safety Regulation Group's strategies such as the Mines Safety Roadshow and Registered Managers Forum to focus attention on important safety areas. This information should be used by employers and workers to assist in the development of safe work practices on mining operations.

1.3 Key findings from previous reviews

Fatality reviews

In 2014, the Department published a report on fatal accidents in the Western Australian mining industry from 2000 to 2012. The review was based on 52 detailed investigation reports prepared by inspectors of mines. The report identified the 10 most important repeat causation factors for the 52 fatality investigations considered and established both active failures and underlying conditions.

The fatalities hazard register was published on the Department website in January 2017, to identify ongoing causation factors leading to fatal accidents. The register lists all Western Australian mining fatalities from 2000 to 2017, and fits them into 20 hazard categories. The register also includes critical activities and critical controls identified to reduce the risk of a repeat event.

Serious injury reviews

The Department published a report on an analysis of serious injury data in the Western Australian mining industry in 2015. The report considered a sample of 837 injuries for the period July to December 2013. The sample set included 655 injuries that were classified as serious. Consistent statistical compliance was noted for six-monthly and annual samples going back to 2002, indicating repeating trends of common causation factors. The review showed limited improvement in injury statistics between 2002 and 2014 for high-level serious injuries such as amputations, fractures and crush injuries.

The serious injuries and incidents hazard register was published on the Department website in May 2018. The register presents the findings from 53 high level serious injury or serious incidents selected for investigation by the Investigations Services Branch over the period January 2011 to December 2016 in the Western Australian mining industry.

The incidents were assessed according to the same 20 categories as for the fatality hazard register with an additional two categories included.

1.4 Significance of vehicle collisions

According to the fatality hazard register, traffic management hazards contributed to four of the main causation factors (Table 1) in West Australian mining between 2000 and 2017. These vehicle-related hazards contributed to 16 of the 67 fatalities:

- Vehicle collisions (5)
- Vehicle over edge (4)
- Vehicle runaway (4)
- Vehicle rollovers (3)

Table 1 Hazard categories for mining fatalities from 2000 to 2017

Hazard category	Number of deaths
Fall from heights	11
Maintenance procedure deficiency	8
Underground rock fall	5
Vehicle collision	**5**
Machinery movement – crush	4
Vehicle runaway	**4**
Vehicle over edge	**4**
Vehicle rollover	**3**
Electrical contact	3
Inrush of fluids/material	3
Tyres – Pressure and gravity	3
Heat exhaustion	3
Falling equipment	2
Open pit wall failure or subsidence	2
Suspended load	2
Engineering design	1
Explosions and fires	1
Explosives	1
High pressure equipment	1
Natural event	1
Total	**67**

Vehicle collisions involving haul trucks or light vehicles resulted in four of the five fatal accident collisions recorded in the fatality hazard register. The fifth fatal vehicle collision was a head-on collision involving two road trains on a haul road.

The five fatal accident collisions are summarised below, and includes the fatality hazard register identity number for each incident.

- A road train driver was killed when two road trains collided head-on on a haul road. [25]
- A worker was killed while spotting a haul truck into close proximity of a stationary haul truck to connect jumper leads between the two vehicles. [26]
- A drill operator was killed when his light service truck collided with a parked-up drill service truck in a park-up area and drill rods protruding from the drill service truck struck the drill operator. [30]
- A haul truck driver, engaged in waste tipping, was driving down a ramp at an open pit when he lost control of his vehicle and was killed when his haul truck collided with a parked-up dozer. [36]
- A heavy duty fitter in a light vehicle was killed in a collision with a haul truck entering an intersection on a haul road. The light vehicle was shielded behind another turning haul truck and was not visible to the haul truck driver involved in the accident. [39]

All mines use a fleet of vehicles to conduct mining operations and the hazard of a vehicle collision is a feature of operations on the mines. There are common hazard exposures at many mines, but each site may have different characteristics and operating profiles. Strategies to reduce the risk of injury to workers can be developed once the causation factors are understood.

1.5 Approach

There is sufficient raw data in the Department's Safety Regulation System (SRS) to enable ongoing quantitative analysis of key performance areas. Previous studies have shown that grouped data containing 100 or more like events can be used to identify key problem areas.

The approach used in this report builds on the serious injury study where data was grouped into specific areas for analysis.

In analysing the data, the focus has been on identifying which factors (e.g. vehicle types) accounted for high numbers of collision incidents.

1.6 Structure of the report

There are legislative requirements that determine the incident information notified to the Department. Notifications are managed and stored in SRS. Chapter 2 outlines the reporting requirements and how the data is processed.

Chapter 3 outlines the methodology used in the data collection and analysis.

Chapters 4 to 7 describe how the data was analysed and present the results and key findings.

Chapter 8 presents strategies for industry to reduce the incidence of vehicle collisions.

Links to charts depicting the data are spread throughout the report. Click on the link and hover the cursor over the bars of the charts for detailed information.

2 The Safety Regulation System (SRS)

2.1 Legislative requirements

The *Mines Safety and Inspection Act 1994* (the Act) and Mines Safety and Inspection Regulations 1995 (the Regulations) require mining operations to report certain types of injuries and occurrences to the district inspector.

The reportable incidents are defined in sections 76, 78 and 79 of the Act.

- Section 76: any accident, which results in an injury to an employee that prevents the employee from performing their normal duties.
- Section 78: occurrences are a defined list of incidents that must be reported, whether or not an injury occurs. The term 'occurrence' has a specific legal meaning in the Act.
- Section 79: potentially serious occurrences which, in the mine manager's opinion, could have caused serious injury or harm, even though no injury occurred.

Injuries and occurrences are submitted as notifiable incident reports via SRS.

2.2 Quality assurance of data held in SRS

When mining operators submit incident reports via SRS, a quality assurance process is undertaken during which coding standards are applied to each report against a set of defined categories.

The 15 categories in SRS (SRS incident type descriptions are derived from legislative requirements) have been in use and unchanged since 1994, and are limited to the groupings defined in ss. 76, 78 and 79 of the Act (Table 2).

Table 2 SRS incident description categories

Legislation	SRS incident type description
s. 76 (2)(a)	1. Serious or appears to be serious injury (including fatality)
s. 78 (3)(a)	2. Extensive subsidence, settlement or fall of ground or any major collapse
s. 78 (3)(a)	3. Earth movement caused by seismic event
s. 78 (3)(b)	4. Outbreak of fire above or below ground
s. 78 (3)(c)	5. Breakage of a rope, cable, chain or other gear by which persons are raised or lowered
s. 78 (3)(d)	6. Inrush of water
s. 78 (3)(e)	7. Dust ignition below ground
s. 78 (3)(e)	8. Presence or outburst of potentially harmful or asphyxiant gas
s. 78 (3)(f)	9. Accidental, delayed or fast ignition or detonation of explosives
s. 78 (3)(g)	10. Explosion or bursting of compressed air receivers, boilers or pressure vessels
s. 78 (3)(h)	11. Electric shock or burn or dangerous occurrence involving electricity
s. 78 (3)(i)	12. Poisoning or exposure to toxic gas or fumes where persons are affected
s. 78 (3)(j)	13. Loss of control, failure of braking or steering of heavy earth moving equipment
s. 79	14. Potentially serious occurrence
r. 6.36	15. Incidents affecting registered plant

Note: the groupings used for the sample came from the s. 79 notifications internal quality assurance coding process. The events recorded under s. 79 are coded in subgroups and these were used to extract the sample of collisions used for the study.

3 Methodology

3.1 Data collection

This review analysed incidents involving vehicles for the two-year period from January 2015 to December 2016. The following pre-set filter categories in SRS (under SRS incident type description *14. Potentially serious occurrences*) were used to obtain a total vehicle sample:

- light vehicle incident
- truck or mobile equipment collision
- truck or mobile equipment NOC (not otherwise classified).

These incidents were then manually assessed to extract those which involved a collision (or near-collision) of a vehicle with another vehicle or object.

By reading each description and extracting those which identified a vehicle collision, a data set of 172 collisions was obtained. There were 120 vehicle-on-vehicle collisions (including nine near-collisions) and 52 vehicle-on-other collisions.

Although only nine near-collisions had been reported, they were included in the data set. The hazards associated with these incidents remain relevant to collisions. Refer to Appendix 1 for summaries of these incidents.

3.2 Grouping data

Seven categories of factors that formed part of the collision incidents were derived from the industry description for each of the 172 incidents. These categories provide the basis for the analysis:

- primary vehicle type
- secondary contact types:
  - vehicle
  - non-vehicle
- causation factor
- location (surface or underground)
- area of mine
- activity of the primary vehicle at the time of the collision.

In this report, the primary vehicle is the vehicle that impacted a secondary contact, either another vehicle (secondary vehicle), object or person. 'Other secondary contact' refers to any non-vehicle object or pedestrian struck by the primary vehicle.

In addition to identifying the main contributors in each group, the data was also analysed to identify trends of repeat collision types.

3.3 Limitations

Although there is a wealth of data on occurrences available in SRS, samples of data cannot be extracted in sufficient detail by automatic means due to the limited coding process for occurrences. Any review involves human analysis rather than an automated search methodology.

For this review, a sample of incidents was extracted from SRS. The incident description provided by the mines was then manually analysed and tagged according to an assessment of the factors involved in the collision.

4 Vehicle type

4.1 Types of vehicles involved in collisions

A total of 292 vehicles were involved in 172 collisions, either by driving into a vehicle or object, or by being struck by another vehicle.

See *Ch 4 - Vehicles in collisions* tab in the *Vehicle collisions report graphs* for more details.

Of the 172 collisions:

- 120 collisions involved a secondary vehicle
- 52 collisions involved a non-vehicle secondary contact

Table 3 Totals for all vehicles involved in vehicle collisions reported

Vehicle type	Primary vehicles	Secondary vehicles	Total vehicles
Haul trucks – surface	51	31	82
Light vehicles [1]	35	36	71
Haul trucks – underground	16	5	21
Loaders – surface	15	5	20
Load-haul-dump trucks (LHD)	15	4	19
Dozers [2]	13	5	18
Water carts	2	8	10
Diggers [3]	3	5	8
Graders	2	5	7
Road trains	4	2	6
Elevating work platforms (EWP) [4]	3	2	5
Service trucks	3	1	4
Cranes [5]	2	2	4
Autonomous haul trucks (AHT) – surface	1	3	4
Bowl scrapers	1	2	3
Vacuum trucks	2	0	2
Buses	1	1	2
Integrated tool carriers (ITC)	1	1	2
Stemming trucks	1	1	2
Charge-up trucks – underground	1	0	1
Skip trucks	0	1	1
Total vehicles involved in collisions	**172**	**120**	**292**

Notes:

1. *Includes maintenance vehicles*
2. *Includes wheel dozers and track dozers*
3. *Includes excavators and shovels*
4. *Includes forklifts and scissor lifts*
5. *Includes pick-and-carry cranes, slew cranes and telehandlers*

The main six vehicle types involved in 172 collisions are:

- Surface haul trucks (30%)
- Light vehicles (20%)
- Underground haul trucks (9%)
- Surface loaders (9%)
- LHDs (9%)
- Dozers (6%)

These vehicle types are used on most mines and represent major hazards with regard to the potential for a collision.

Five of the six main vehicle types involved in collisions are large machines and have the potential to do significant damage or cause serious injury during a collision. From a priority risk prevention strategy, a focus on these vehicle types offers the greatest opportunity to reduce the risk of a collision.

Surface haul trucks (82) and light vehicles (71) represent more than half of the total number of vehicles involved in collisions. Together with underground haul trucks (21), surface loaders (20), LHDs (19) and dozers (18), these six vehicle types account for 231 of the 292; that is, 79% of vehicles involved in collisions.

Haul trucks (35%)

Surface haul trucks (82) and underground haul trucks (21) account for 103 of the 292 vehicles involved in collisions.

A surface haul truck is the most common vehicle involved in collisions, with 51 incidents as the primary vehicle and 31 as the secondary vehicle.

Underground haul trucks account for 21 collisions, with 16 incidents as the primary vehicle and five as the secondary vehicle.

Light vehicles (24%)

Light vehicles account for 71 of the 292 vehicles involved in collisions, with 35 incidents as the primary vehicle and 36 as the secondary vehicle. A light vehicle was the primary vehicle in all three of the collisions where pedestrians were contacted (Table 4).

Loaders (13%)

Surface loaders (20) and LHDs (19) account for 39 of the 292 vehicles involved in collisions.

Surface loaders were involved in 20 collisions, with 15 incidents as the primary vehicle and five as the secondary vehicle.

LHDs were involved in 19 collisions, with 15 incidents as the primary vehicle and four as the secondary vehicle.

Dozers (6%)

Dozers account for 18 of the 292 vehicles involved in collisions, with 13 incidents as the primary vehicle and five as the secondary vehicle.

4.2 Main secondary vehicle types in vehicle-on-vehicle collisions

The main three secondary vehicle types involved in 120 vehicle-on-vehicle collisions are:

- light vehicles (30%)
- surface haul trucks (26%)
- water carts (6%)

See *Ch 4 - Primary secondary type* tab in the *Vehicle collisions report graphs* for more details.

The most frequently contacted secondary vehicle type is a light vehicle. A light vehicle was contacted by a much larger vehicle in 33 of 36 collisions, and was parked-up or stationary in 13 of those incidents.

This is a major hazard area as the primary vehicle is invariably much larger in the majority of vehicle-on-vehicle collisions.

4.3 Main non-vehicle secondary contact types in vehicle-on-other collisions

The main non-vehicle secondary contact types are:

- bunds (44%)
- tunnel walls (17%)

It is a concern that the objects designed to contain vehicles are the objects most frequently involved in collisions.

All three incidents involving pedestrians were with light vehicles. However, all areas where vehicles operate are high-risk areas for pedestrians and it is imperative that vehicle and pedestrians are separated as much as possible. It is particularly important that large vehicles alert others in the area before they start moving.

Table 4 Non-vehicle contacts involved in vehicle-on-other collisions

Secondary contact (non-vehicle)	Number of collisions
Bunds [1]	23
Tunnel walls [2]	9
Pedestrians	3
Warehouses [3]	2
Power poles	2
Safety railings	2
Conveyor structures	1
Embankments	1
Gatehouses	1
Hoppers	1
Lighting plant	1
Pillars	1
Storage cabinets	1
Fixed beams	1
Stockpile walls	1
Stockpile water cannons	1
Trees	1
Total	**52**

Notes:

1. *Includes windrows and traffic islands*
2. *Includes decline walls and haulage drive walls*
3. *Includes sea containers*

4.4 Repeat incidents

In 46 of 120 (38%) vehicle-on-vehicle collisions, the **same** primary vehicle type impacted the **same** secondary vehicle type more than five times each (Table 5). The main vehicle types involved were:

- haul trucks – surface (32)
- light vehicles (22)
- dozers (9)
- haul trucks – underground (5)

Table 5 Repeat collisions where the same primary vehicle type impacted the same secondary vehicle type more than five times each

Primary vehicle	Secondary vehicle	Number of collisions
Haul truck – surface	Haul truck – surface	15
LHD	Light vehicle	9
Dozer	Haul truck – surface	9
Haul truck – surface	Light vehicle	8
Haul truck – underground	Light vehicle	5
Total		**46**

5 Causation factors

5.1 Causation factors associated with vehicle collisions

Causation factors are any behaviours, omissions or deficiencies that, if corrected, eliminated or avoided would have prevented the incident. Allocation to groups of causation factors was based on an assessment of the factors that formed part of the collision incidents provided in the incident descriptions from the industry submissions.

Table 6 Causation factors associated with the vehicle collisions

Causation factor	Number of vehicle-on-vehicle collisions	Number of vehicle-on-other collisions	Total number of collisions
Parked-up or stationary secondary vehicle	25	1	26
Communication breakdown [1]	18	0	18
Failure to stop or give way or slow down	15	2	17
Visibility obscured [2]	15	2	17
Fell asleep or micro sleep or medical	2	14	16
Loss of concentration	2	14	16
Rear view unchecked	9	2	11
Distance misjudged	9	1	10
Deviated [3]	3	4	7
Oncoming vehicle [4]	6	0	6
Traction loss [5]	3	2	5
Loss of control on bend	0	4	4
Brake failure [6]	3	0	3
Crossing AHT permission line	3	0	3
Crossing in front of vehicle	2	1	3
Driving under the influence	1	1	2
Loss of control on descent	1	1	2
Loss of control (mechanical fault)	0	1	1
Parked vehicle runaway	1	1	2
Rock obstruction	1	0	1
Single lane not identified	1	0	1
Protruding structure	0	1	1
Total	**120**	**52**	**172**

Notes:

1. *Includes radio break-down and miscommunication*
2. *Includes vehicle blind spot*
3. *Includes drifted or veered to avoid obstacle*
4. *Head-on contact collisions with no additional information provided in the incident report*
5. *On wet or greasy surface*
6. *Includes a brake pedal obstruction*

5.2 Main causation factors for vehicle-on-vehicle collisions

The main causation factors for 120 vehicle-on-vehicle collisions were:

- associated with a parked-up or stationary secondary vehicle (19%). Over half (13 of 25) were reversed into
- due to communication breakdowns (15%)
- failures to stop, give way or slow down (12%)
- due to obscured visibility (12%).

Surface haul trucks, dozers, light vehicles and LHD were the main vehicle types involved.

See *Ch 5 - Collision cause* tab in the *Vehicle collisions report graphs* for more details.

All these factors should be incorporated in the traffic management plan (TMP). Mine sites should ensure that the TMPs include parked-up or stationary vehicles and obscured visibility.

5.3 Main causation factors for vehicle-on-other collisions

The main causation factors for vehicle-on-other collisions were:

- fell asleep or micro-sleep or medical (27%)
- loss of concentration (27%)
- deviated to avoid obstacle, drifted or veered (7%)
- loss of control on bend (7%).

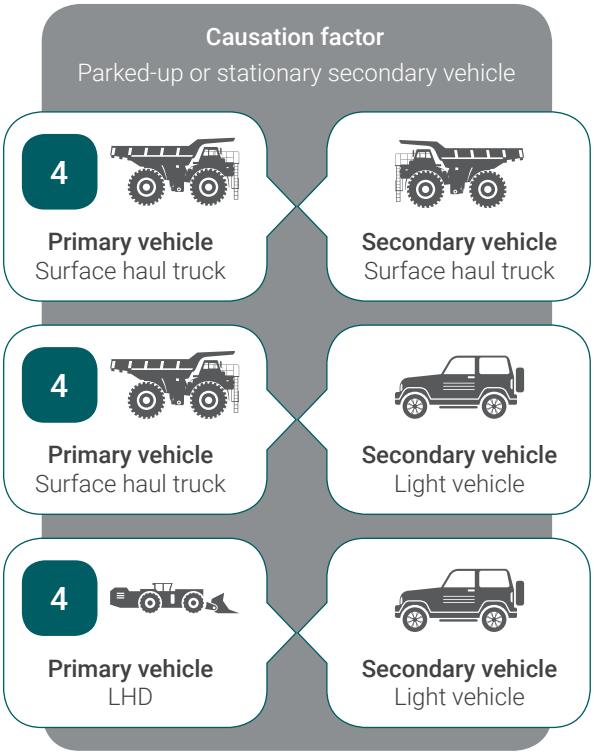
Surface haul trucks, underground haul trucks and light vehicles were the main primary vehicles involved in these collisions. The main secondary non-vehicle contacts involved in collisions were bunds, windrows, traffic islands and tunnel walls.

See *Ch 5 - Vehicle other cause* tab in the *Vehicle collisions report graphs* for more details.

5.4 Repeat incidents

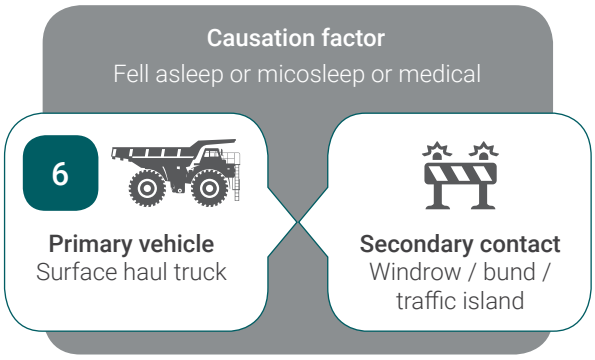
Repeat incidents are represented in the infographic below for each causation factor. The primary vehicle is on the left and the secondary on the right.

The highest repeat vehicle-on-vehicle collisions where the **same** primary vehicle collided with the **same** secondary vehicle associated with the **same** causation factor were:



There were equal number of repeats for each of these primary vehicle x secondary vehicle combinations.

Main repeat vehicle-on-other collision events where the **same** primary vehicle collided with the **same** secondary non-vehicle contact type associated with the **same** causation factor were:



6 Location and area of mine

For all vehicle collisions:

80% occurred on the **surface**

20% occurred **underground**

This trend is consistent for both vehicle-on-vehicle and vehicle-on-other collisions.

Tables 7A and 7B show where vehicle collisions occur on mine sites.

Table 7A Area of mine for vehicle-on-vehicle collisions – surface

Area of mine – surface	Number of vehicle-on-vehicle collisions	Number of vehicle-on-other collisions	Total number of collisions
Roads	8	15	23
Waste dumps	15	4	19
Intersections [1]	12	6	18
Pit floors and benches	17	0	17
Stockpiles, yards and sheds	13	3	16
ROM pads	12	3	15
Ramps [2]	11	3	14
Park-up areas [3]	4	1	5
Buildings (surface) [4]	1	4	5
Workshops	3	1	4
Tailings dams	1	0	1
Unloading areas	0	1	1
Total	**97**	**41**	**138**

Notes:

1. *Includes junctions and level crossings*
2. *Includes switchbacks*
3. *Includes go-lines*
4. *Includes processing plants*

Table 7B Area of mine for vehicle-on-vehicle collisions – underground

Area of mine – surface	Number of vehicle-on-vehicle collisions	Number of vehicle-on-other collisions	Total number of collisions
Declines	12	8	20
Drives [1]	4	2	6
Levels [2]	4	1	5
Passes [3]	2	0	2
Pass and load points	1	0	1
Total	**23**	**11**	**34**

Notes:

1. *Includes access and ore drives*
2. *Includes crosscuts*
3. *Includes tipples*

The areas of mines where the majority of the 172 vehicle collisions occurred are:

- Roads (13%)
- Declines (12%)
- Waste dumps (11%)
- Intersections (10%)
- Pit floors and benches (10%)
- Stockpiles, yards and sheds (9%)
- ROM pads (9%)
- Ramps (8%)

On the surface, while most collisions occur on roads (eight vehicle-on-vehicle and 15 vehicle-on-other collisions), pit floors and benches are the main area of mine for vehicle-on-vehicle collisions (17).

Underground, most collisions occur on the decline (12 vehicle-on-vehicle and eight vehicle-on-other collisions).

Vehicle types associated with repeat vehicle-on-vehicle collisions in the decline are haul trucks, light vehicles and LHDs. The limited vision around LHDs is a significant factor in activities in these areas.

6.1 Main areas of mine and activities for vehicle-on-vehicle collisions

See *Ch 6 - Area vehicle collisions* tab in the *Vehicle collisions report graphs* for more details.

The main areas of the mine where 120 vehicle-on-vehicle collisions occurred are:

- **Combined waste dumps, ROM pads, and stockpile, yards and sheds (33%)**

  The main activity in these areas is tipping dirt from haul trucks. The main secondary vehicles involved in these events were wheel dozers, loaders and light vehicles. In six of the 40 incidents, the secondary vehicle was parked-up or stationary.

- **Combined intersections, ramps, roads and go-lines (29%)**

  The activities in these areas can be regarded as normal driving activities. In six of the 35 incidents, the secondary vehicle was parked-up or stationary, with two on a bend. In three of the 35 incidents, the collision was head-on.

- **Pit floor or bench (14%)**

  Activities associated with haul trucks being loaded by shovels or diggers predominate. Dozers also feature in the events and are associated with clean-up and levelling work. The secondary vehicle was parked-up or stationary in four of the 17 incidents.

- **Decline (10%)**

  In three of the 12 incidents the secondary vehicle was parked-up or stationary. In two of the 12 incidents the collision was head-on. Other causation factors include communication breakdown, brake failure, visibility obscured and distance misjudged.

Together these areas contribute 104 incidents and 87% of the total.

See *Ch 6 - Area vehicle cause* tab in the *Vehicle collisions report graphs* for more details.

Vehicle congestion on pit floors and in tipping activities is a significant causation factor. This clearly highlights areas for further assessment on individual mines. Segregation of vehicles during this type of work is a precaution to reduce the risk of vehicle contact.

6.2 Main areas of mine for vehicle-on-other collisions

See *Ch 6 - Area other collision* tab in the *Vehicle collisions report graphs* for more details.

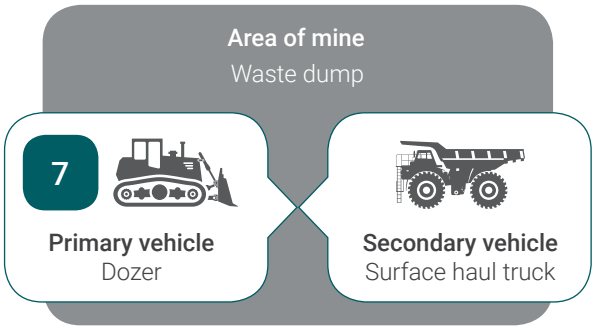
The areas of the mine where 52 vehicle-on-other collisions occurred are:

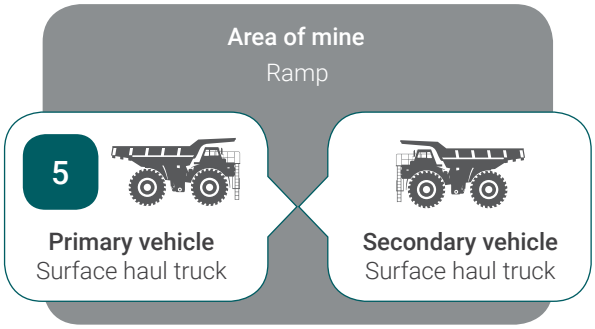
- Roads (28%)
- Declines (15%)
- Intersections (11%)
- Waste dumps (7%)
- Surface buildings (7%)

See *Ch 6 - Area other cause* tab in the *Vehicle collisions report graphs* for more details.

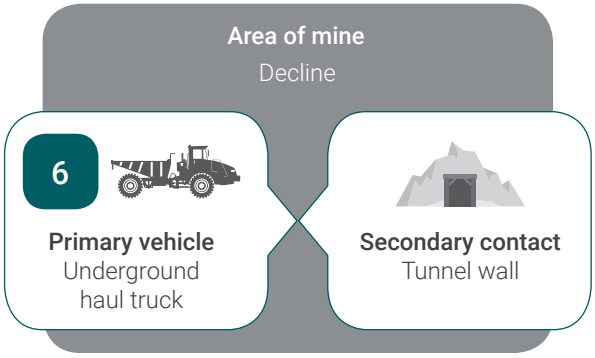
6.3 Repeat incidents

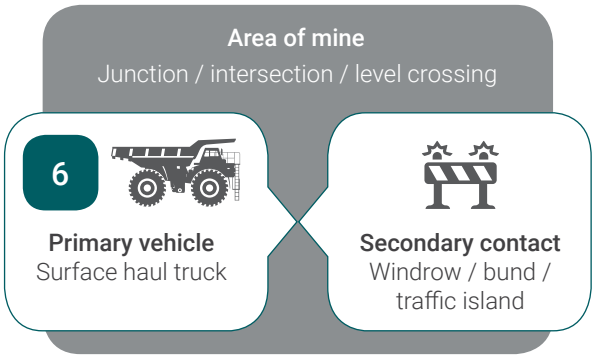
The highest number of repeat vehicle-on-vehicle collisions where the **same** primary vehicle type impacted the **same** secondary vehicle type in the **same** area of mine were:





The highest number of repeat vehicle-on-other collisions where the **same** primary vehicle type impacted the **same** secondary non-vehicle type in the **same** area of mine were:





7 Activity of primary vehicle

7.1 Main primary vehicle activity for vehicle-on-vehicle collisions

This chapter describes the activity of the primary vehicle at the time of the collision event.

See *Ch 7 - Activity vehicle* tab in the *Vehicle collisions report graphs* for more details.

Reversing (42 collisions) is the primary vehicle activity that accounts for the largest number of collisions, with 38 of the 120 vehicle-on-vehicle collisions and four of the 52 vehicle-on-other collisions. Approximately a third (31%) of the vehicle-on-vehicle collisions that occurred while reversing were with a parked-up or stationary secondary vehicle.

Surface loaders and dozers were the main primary vehicles involved in the 42 reversing incidents, and the main areas of mine were on stockpiles and waste dumps.

Visibility and communication issues account for two thirds (67%) of these 42 collisions:

- communication breakdown (10)
- rear view unchecked (10)
- visibility obscured (8)

Segregation of vehicles during this type of activity is a precaution to reduce the risk of vehicle contact.

The next main category of vehicle-on-vehicle collisions occurred while travelling on the road (14%), with just under a third of those due to a failure to stop, slow down or give way.

Table 8 Activity of primary vehicle at the time of collision

Activity of primary vehicle	Number of vehicle-on-vehicle collisions	Number of vehicle-on-other collisions	Total number of collisions
Reversing	38	4	42
Travelling on road	17	18	35
Entering or exiting intersection	11	4	15
Travelling on decline	9	6	15
Travelling on ramp	10	5	15
Pulling in or out of a work area	10	3	13
Negotiating bend or turn	4	6	10
Loading	5	0	5
Travelling on drive	2	2	4
Dumping	3	0	3
Tipping	2	1	3
Overtaking	2	0	2
Parking	1	1	2
Spotting	2	0	2
Delivering	0	1	1
Filling	1	0	1
Grading	1	0	1
Moving EWP	1	0	1
Scraping	1	0	1
Spraying	0	1	1
Total	**120**	**52**	**172**

See *Ch 7 - Activity vehicle cause* tab in the *Vehicle collisions report graphs* for more details.

7.2 Main primary vehicle activities for vehicle-on-other collisions

The main activities of the primary vehicles in 52 vehicle-on-other collisions are:

- travelling on road (34%)
- negotiating a bend or turn (11%)
- travelling on decline (11%)
- travelling on ramp (10%)

Light vehicles and surface haul trucks were the main primary vehicles involved in these incidents.

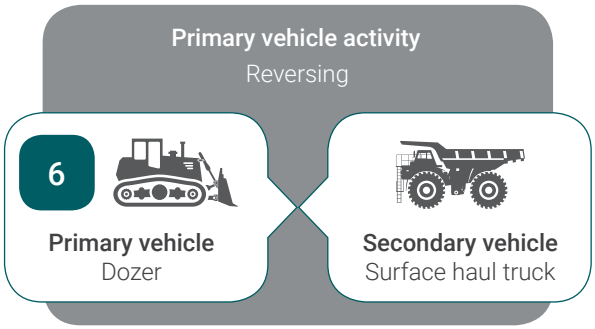
See *Ch 7 - Activity other* tab in the *Vehicle collisions report graphs* for more details.

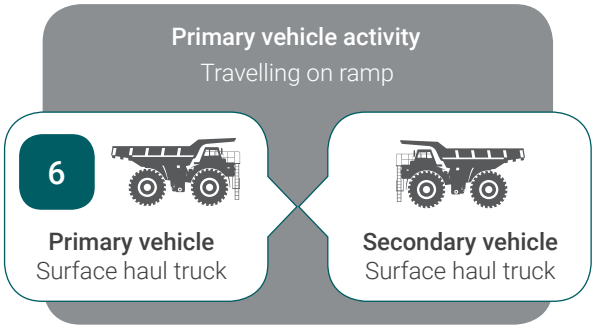
Causation factors of fell asleep or micro-sleep or medical (44%) and loss of concentration (33%) accounted for three quarters of collisions that occurred while driving on a road.

See *Ch 7 - Activity other cause* tab in the *Vehicle collisions report graphs* for more details.

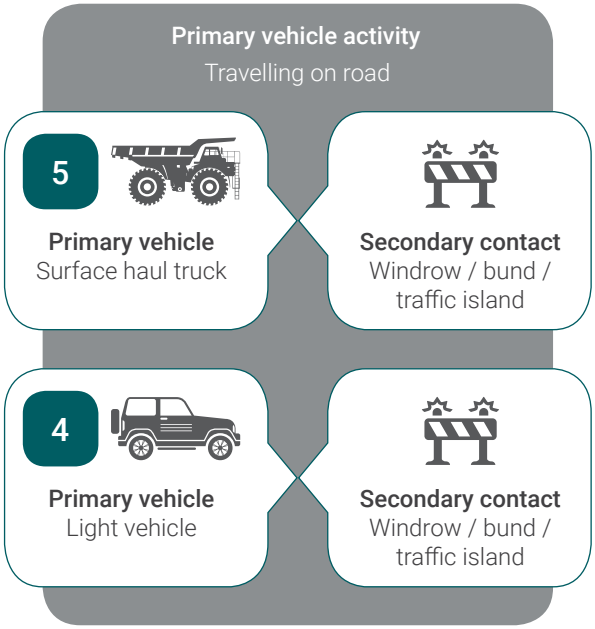
7.3 Repeat incidents

The highest number of repeat incidents involving the **same** primary vehicle type impacting the **same** secondary vehicle type, where primary vehicle is conducting the **same** activity were:





The highest number of repeat incidents involving the **same** primary vehicle type conducting the **same** activity when striking the **same** secondary non-vehicle contact type were:



8 Recommendations

A clear understanding of critical problem areas is essential to direct resources towards the development of effective solutions.

8.1 General risk assessment

Each vehicle type has the potential to cause a collision in a particular set of circumstances. Because each site is different, for a total risk management strategy, all vehicle types should be considered to identify all possible accident scenarios. The following general risk management actions are recommended.

- Mines should develop risk assessments for all vehicle types to include potential contacts and interaction with workplace and equipment in the workplace.
- Mines should incorporate the concept of critical tasks and activities within their safety system methodology. This method can be enhanced within a framework of principal hazard management plans and high impact function auditing.
- Planned inspections should be developed for each work area and task observations conducted for critical tasks based on an individual mine risk assessment.
- Inspection processes should carefully examine physical aspects of workplaces such as stockpiles, waste dumps, benches, go lines and ramps to understand vehicle interactions and physical conditions.
- Task observations should be applied to critical activities such as working around the digger, tipping on stockpiles, entering intersections and waste dump activities to focus on key problem areas.

8.2 Specific focus areas

The following specific risk reduction measures to reduce the risk of vehicle collisions are recommended.

- Ensure awareness of separate work activities in a common area. People should be aware of other work activities in their area. It is often not only their own actions which put them at risk, but the actions of others, or their actions that put others at risk:
  - identify all tasks or activities happening in each area
  - clearly communicate tasks or activities happening in the same area to all relevant workers (e.g. at pre-starts).
- Separate or isolate light vehicles from interaction in areas such as ROM pads and stockpiles, where large vehicles such as loaders and dozers work continuously.
- Segregate areas for pedestrians and vehicles, where possible. Where pedestrians have to move around in areas where there are large vehicles (especially in confined spaces such as workshops), ensure procedures are in place to alert others before large vehicles start moving (both forwards and backwards).
- Highlight the hazard of parking close to corners and bends and prohibit parking in those locations.
- Implement adequate fatigue management measures (e.g. sufficient breaks during shifts).
- Reduce the risk of vehicles contacting windrows, bunds, traffic islands and structures by:
  - making a careful assessment of where windrows, bunds and traffic islands are needed and how they are constructed and delineated
  - limiting access and minimising speed where any obstruction is close to vehicle routes
  - considering roadway routes and minimising the number of junctions and intersections when developing traffic management plans.
- Provide clear delineation of roadways, intersections, bends and declines.
- Improve underground visibility by clear demarcation on tunnel walls at regular intervals, with structured passing bays and level breakaways.
- Identify blind spots around vehicles in work areas and ensure training and procedures are in place to provide “no go” areas and vehicle spacing.

Appendix 1 Summaries of near-collision incidents

- A surface haul truck was driving along a wet waste dump ramp when the truck lost traction and spun out of control. The truck slid about 70 metres before coming to a stop.
- A light vehicle failed to stop at an intersection on a haul road and narrowly missed colliding with a haul truck.
- A light vehicle failed to stop at an intersection on a haul road and almost collided with a haul truck.
- A water cart had to slow down to avoid a collision with a light vehicle that failed to give way at an intersection on a haul road.
- A haul truck slowed down as it approached an intersection on a haul road to avoid a collision with a light vehicle crossing in front of it.
- A haul truck driver had to brake to avoid a collision when a light vehicle failed to give way on a haul road.
- A light vehicle had to brake hard to avoid a collision when a road train failed to stop at an intersection of a haul road.
- A crane had to take evasive action to avoid a collision with a loader at an intersection on a haul road when the loader failed to give way.
- A light vehicle had to slow down and stop to avoid colliding with a vacuum truck at an intersection on a haul road when the vacuum truck failed to stop.

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