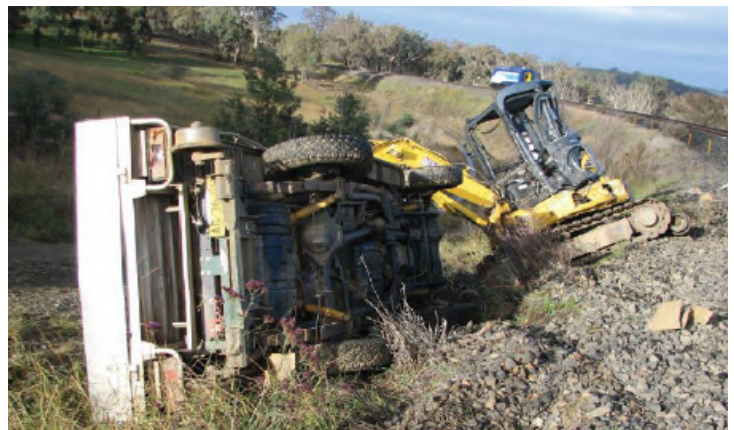




Australian Government
Australian Transport Safety Bureau

Safe work on track across Australia

Analysis of incident data, 2009 – 2014



Investigation

ATSB Transport Safety Report

Research Investigation

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Addendum

Page	Change	Date

Safety summary

The ATSB has investigated a number of accidents and incidents while maintenance work was being performed on or near railway tracks. The ATSB *SafetyWatch*, introduced in 2012 to emphasise broad transport safety concerns in Australia, also highlighted 'safe work on rail'.

The ATSB continues to receive notifications of safe working incidents involving worksite protection arrangements for work on track. These notifications suggest the existence of broader safety issues associated with work on track that continue to increase risk to worker safety. In 2017, safe work on track continues to be an ATSB *SafetyWatch* priority.

This safety issue investigation reviews available data from across Australia of incidents and accidents relating to work on track. It is designed to provide industry with insights into the protection arrangements that are failing, and the reasons why, across many occurrences so that safety action can be designed to reduce future safe work on track occurrences.

What the ATSB found

The ATSB analysis grouped the notifiable occurrence data into eleven categories. The analysis indicated the most common events exposing track workers to highest risk, were:

- the incorrect removal of the worksite protection
- the incorrect positioning of the worksite protection
- the type of protection being insufficient or incorrect, and
- the incorrect identification of the worksite location.

The results of this safety issue investigation were largely reflective of the safety factors identified from previous ATSB occurrence investigations. That is, incidents were predominately a result of errors during the implementation or dissolution stage of providing track protection. Protections were either removed incorrectly or prematurely, or key communication exchanges failed to establish the location of the worksite with respect to approaching rail traffic.

What's been done as a result

The outcome of this ATSB safety issue investigation suggests that the rail industry should consider the event types identified above in determining areas in which to target effort for maximising the effectiveness of safety arrangements for work on track.

Rail transport operators continue to enhance arrangements within their networks that facilitate safe work on track. Work to share learnings between operators and to deliver better safety outcomes across the industry is also ongoing through industry initiatives such as the National Track Worker Safety Forum.

This forum has identified priority areas and is exploring improvements in worker competencies, technologies for worksite protection systems, compliance with critical communications protocols and addressing interface arrangements where differing rules and procedures exist between adjoining networks – particularly in sidings and yards.

Safety message

To minimise risk, rail transport operators must ensure systems for safe work on track encourage workers accessing the rail corridor to communicate sufficient information to validate their worksite location, the adequacy of the protections in place, and their positioning in relation to any approaching train movements.

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Context

Conducting work on or near a railway track can be dangerous, especially if safe working rules and procedures have not been correctly implemented to protect the worksite. Trains cannot stop quickly and any breakdown in the communication or management of a worksite can leave workers extremely vulnerable to dangerous situations.

The Australian Transport Safety Bureau (ATSB) has investigated a number of accidents and incidents while maintenance work was being performed on or near railway tracks (Appendix A). As a result, the ATSB [SafetyWatch](#), introduced in 2012 to emphasise broad transport safety concerns in Australia, highlighted 'safe work on rail'.

The ATSB continues to receive notifications of safe working incidents involving worksite protection arrangements for work on track. These notifications suggest the existence of broader safety issues associated with work on track that continue to increase risk to worker safety. In 2017, safe work on track continues to be an ATSB *SafetyWatch* priority.

This safety issue investigation reviews available data from across Australia of incidents and accidents relating to safe work on track. It is designed to provide industry with insights into the protection arrangements that are failing, and the reasons why, across many occurrences so that safety action can be designed to reduce future safe work on track occurrences.

Safe work on track background

The provision of a safe workplace for workers to undertake construction, maintenance or inspection tasks is a fundamental objective of a rail transport operator (RTO)¹ in managing their railway network. It is also a legislated requirement under both the *Rail Safety National Law* as well as the *harmonised Work Health and Safety (WHS) legislation*.

It is impractical for a RTO to exclude rail traffic on every occasion that work on track is required. The railway manager must therefore implement risk controls to ensure the safe separation of workers and rail traffic. The risk controls are generally hierarchical and form an integral part of the operational rules, procedures and instructions within the RTO's safety management system.

There are many RTO's within Australia, each with management systems typically tailored to address the risks, and the operational/infrastructure requirements of their network. This environment of multiple RTO's and multiple safety management systems can result in a variation in risk controls (rules and procedures). Although there may be variances in the methodologies, the overall objective and approach to ensuring safe separation of workers and rail traffic is generally consistent between RTO's.

RISSB Australian Network Rules and Procedures (ANRP)

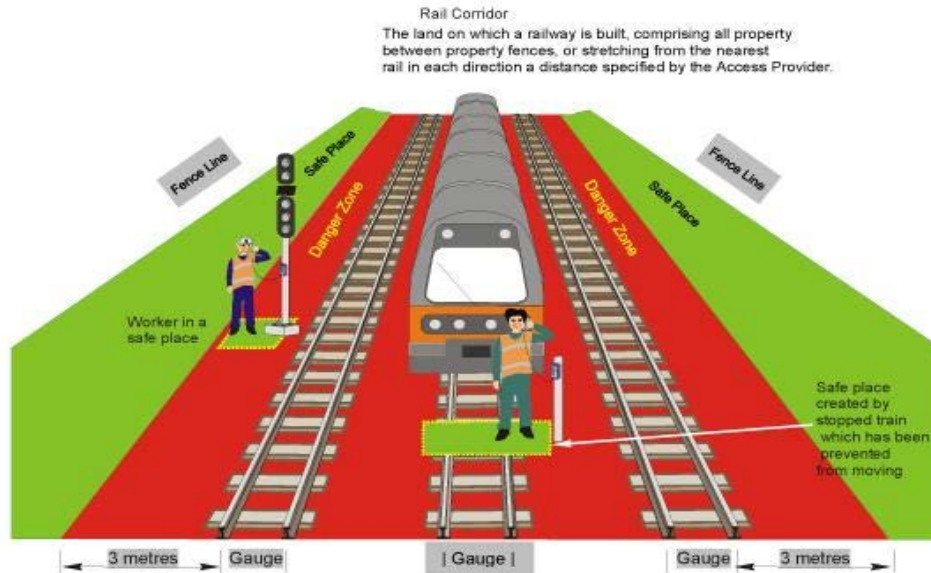
The hierarchical safety measures adopted by all RTO's are generally consistent with the published suite of Australian Network Rules and Procedures (ANRP) developed by the Rail Industry Safety Standards Board (RISSB). Track workers planning work in a rail corridor must assess the implications to safety and the potential for their work to intrude into the *danger zone* (Figure 1). Usually, any work in the danger zone must not:

- be carried out unless there is a safe place that can be easily reached
- begin until the required safety measures are in place.

¹ Rail transport operator. A rail infrastructure manager or a rolling stock operator or a person who is both a rail infrastructure manager and a rolling stock operator.

Work in the danger zone must be carried out using the safety measures detailed within the RTO's selected arrangements for providing an authority or a means of protection. The safety measures selected are heavily dependent on the intended type of work activity and machinery used.

Figure 1: The danger zone



Source: RISSB ANRP 2001 Walking in the Danger Zone, V12, 10 June 2014

The RISSB have published five sets of work on track rules and procedures. These range from *authorities*, which provide for exclusive occupancy for workers and rail service traffic is excluded from the worksite, to *methods of protection*, where systems are implemented to ensure workers are provided sufficient warning before the arrival of a train.

Local possession authority (LPA)

A LPA authorises the closure of a defined portion of track for a specified period, giving exclusive occupancy to a possession protection officer (PPO).² Work or the movement of rail vehicles within the portion of track must only be done with the agreement of the possession protection officer.

Track occupancy authority (TOA)

A TOA authorises a protection officer (PO)³ to occupy a track section *for an agreed time period*. A TOA gives exclusive occupancy, though joint occupancy is permitted under defined conditions. Only rail traffic authorised and associated with the TOA may enter the specified limits of the TOA.

Track work authority (TWA)

A TWA authorises a protection officer the occupation of a defined portion of track *between rail traffic movements*. A TWA does not give exclusive occupancy of the defined portion of track. Rail traffic crews must follow instructions given by hand signallers or the protection officer.

Absolute signal blocking (ASB)

An ASB excludes rail traffic from a portion of track by placing and holding a controlled signal⁴ at stop. It is used for work in the danger zone where a risk assessment shows a work on track authority is not necessary.

² Qualified worker to whom train control transferred control of a section of track and who is responsible for coordinating protection of worksites under a local possession authority (LPA).
³ Qualified worker responsible for safety and protection of personnel at a track worksite and ensuring that the site is safe for the operation of trains.
⁴ A signal that is controlled or operated by a network control officer or competent worker. The signal must not be passed at stop without authority.

Lookout working

In lookout working, the protection officer assigns workers whose sole task is to look for approaching rail traffic and provide an immediate warning to any workers in the danger zone. The warning must be provided in sufficient time to allow workers to clear the danger zone at least 10 seconds before the arrival of the oncoming rail traffic.

RISRB note that lookout working is the least preferred protection method and ASB should be used if practical.

Work on track investigations and identified safety factors

Between September 2006 and October 2015, the ATSB investigated 12 work on track occurrences. A summary of each ATSB investigation, and the associated safety factors, are detailed in *Appendix A – ATSB work on track occurrence investigations*.

Of the 12 investigations, about half involved a collision at the worksite location of rolling stock with a person. Two resulted in the death of a track worker.

The safety factors identified from the ATSB investigations related predominately to errors that occurred during the implementation or dissolution stage of providing track protection. However, there were occasions where a worker intentionally acted in violation of the prescribed rules or procedures.

A significant portion of the errors occurred during the key communication exchanges between the protection officer and the network controller when establishing the location of the worksite with respect to approaching rail traffic. Errors also occurred during communication between these parties resulting in incorrect or premature removal of protections.

A number of safety factors were associated with limitations within rules or procedures to prevent/detect mistakes or omissions. Although rail transport operators have implemented improvements to arrangements for safe work on track, the ATSB has continued to receive notifications of safe working incidents involving worksite protection arrangements.

Comparable research

In August 2015 the United Kingdom Rail Accident Investigation Branch (RAIB) published a report entitled [*Class investigation into irregularities with protection arrangements during infrastructure engineering work*](#). The investigation analysed occurrences involving engineering work carried out, or planned to be carried out, in a two year period between April 2011 and April 2013. A total of 714 events involving operating irregularities during infrastructure engineering work were identified for this time period. Of these events, 86 per cent were able to be grouped according to the type of operating irregularity. Of these, 71 per cent were categorised into one of nine significant event categories. Although the event categories used in the RAIB report differed from those used in this report (discussed below), there were similarities and some overlap of the categories chosen for both reports. For example the most common event category identified in the RAIB report (33%) was 'protection equipment incorrectly placed'. This was followed by 'work carried out without protection' (13%), and 'working outside a protected area' (12%).

More recently, in April 2017, RAIB released its report into the [*Class investigation into accidents and near misses involving trains and track workers outside possessions*](#). This report followed-on from the work published in 2015 and expanded the research to include events involving a near miss as well as events involving workers working outside possessions of the line.

Analysis of notifiable occurrences

Data and analysis methods

Under the occurrence classification guideline,⁵ a safe working rule or procedure breach is defined as any breach of an operational safe working system or procedure that endangers or has the potential to endanger the safety of railway operations and/or persons. It includes:

- human failures (intentional and unintentional acts) in the application of safe working procedures
- failure to communicate or act on vital information to protect trains and personnel
- failure to comply with a hand signal
- irregularities in the management of train separation (for example, a near miss)
- any breach of a network rule
- any breach of the work scheduling practices and procedures set out in the rail transport operator's fatigue risk management program.

Since occurrences coded under this category include such a broad range of event types, the ATSB provided regulators with a list of keywords relating to safe work on track to search for in their occurrence databases. In total, 12,146 occurrence records were obtained from all state and territory rail safety regulators for the 5 year period between July 2009 and June 2014. The ATSB further filtered these records, and about 15 per cent (1,779) were found to involve a safe working authority or a means of protection for a work on track related activity. The remaining records were not associated with work on track, but related to the operation of train movements.

In order to extract as much meaningful information as possible, the description field for each record was examined and the events/conditions (where described) grouped into eleven categories (Table 1). In order to best describe what happened during the occurrence, the events/conditions were further grouped into subcategories. The complete table of categories and subcategories is shown in *Appendix B – Safe work on track event/condition type taxonomy*.

Of the 1,779 occurrence records related to a work on track activity, 100 per cent were able to be categorised into one of the eleven event/condition categories. In addition, 80 per cent could also be categorised into one of the respective subcategories. The remaining 20 per cent were grouped into subcategories labelled 'Other' within each category. These included occurrences where insufficient information was provided to identify likely antecedents to the unsafe act, and those where the likely antecedents were not addressed within the taxonomy.

To preserve data integrity and assist with the analysis (and any potential future rail occurrence analysis), all data for this project was imported into a relational database.⁶ Data was then extracted from this database for analysis. A database diagram showing the seven tables in the database, and how they relate to each other, is shown in *Appendix C - SQL relational database structure*.

⁵ Classifying Notifiable Occurrences, Occurrence Classification Guideline (OC-G1), Office of the National Rail Safety Regulator (ONRSR) or its forerunner, the Occurrence Classification Guideline 1 (OC-G1, July 2008 Rail Safety Regulators' Panel).

⁶ A relational database is one in which the data is arranged so it can be accessed at several points or by combining a number of different criteria for searching, thus allowing for greater flexibility in retrieving and manipulating the data. The safe work on track relational database was created using SQL server 2012.

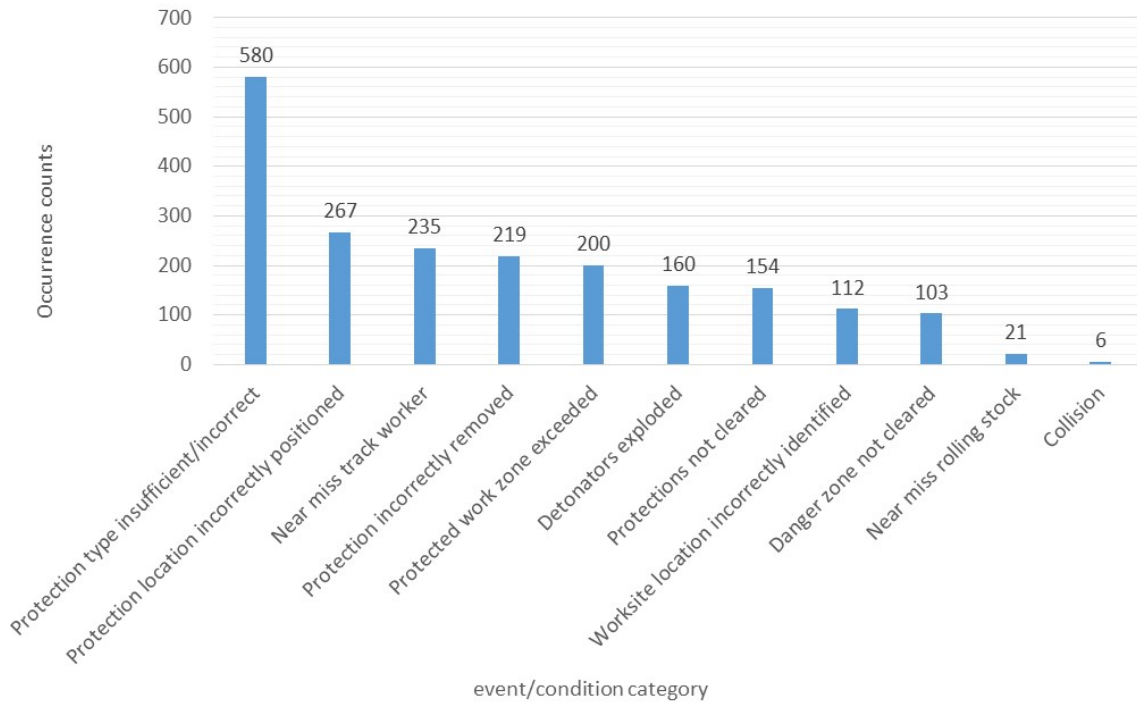
Table 1: Event/condition category definitions

Category	Definition
Collision	Any reports of a train colliding with something.
Danger zone not cleared	Workers or equipment left in danger zone after work zone cleared for rail movement.
Detonators exploded	Includes occurrences where detonators were encountered by rail movement and movement stopped.
Near miss rolling stock	Reports of rolling stock nearly colliding with other rolling stock.
Near miss track worker	Reports of rolling stock nearly colliding with track workers.
Protected work zone exceeded	Workers or equipment/plant in danger zone outside of area protected by current track authority.
Protection incorrectly removed	Includes occurrences where the protections were removed inadvertently by protection officer or network control officer while workers or plant were operating in the danger zone.
Protection location incorrectly positioned	Includes occurrences where protection officer or network control officer erred in locating either 'in field' or 'control system' protections.
Protection type insufficient/incorrect	Includes occurrences where no protection was implemented or the protection method implemented was incorrect for the type of work undertaken in the danger zone.
Protections not cleared	Flags, detonators or signs left in situ after work on track authority cleared.
Worksite location incorrectly identified	Includes occurrences where protection officer or network control officer incorrectly located the worksite.

Overall analysis results

The distribution of the 1,779 safe work on track occurrences between the 11 categories is shown in Figure 2. It can be seen that occurrences where the protection applied was either insufficient or incorrect were the most commonly featured event category between July 2009 and July 2014. This occurrence category (580 occurrences) was nearly twice as common as the next most frequent, where protection systems were incorrectly positioned (267 occurrences).

Figure 2: Counts of work on track occurrences by event/condition categories category, June 2009–June 2014



Closer examination of occurrences associated with insufficient or incorrect protection found that the occurrence reports were largely a result of drivers observing workers in or adjacent to the rail corridor. Although reported as having none or insufficient protections in place, it was not clear whether the workers were infringing in the danger zone or what, if any, work on track protections were actually required by these workers.

The next most frequent category involved occurrences where protection systems were incorrectly positioned. A large proportion related to errors associated with administering the protection arrangements at the worksite location itself or errors between the protection officer trackside and the network controller in the control centre. Also of note was the number of instances where the protections provided by a flagman/lookout broke down.

In reviewing the notifications associated with each category it was evident that the magnitude of the category was not indicative of the potential increase in risk exposure to track workers. That is, in some categories there was a high proportion of events where the risk exposure to track workers was nil or minimal. In other categories, there were a high proportion of events with increased risk exposure, evident since the controls in place to protect a worksite were significantly compromised.

Consequently, further analysis was required to ensure the safety risk was considered within each category.

Higher risk event/condition types

To establish the likelihood of an increased risk to track workers, the description provided for each of the 1,779 reported work on track occurrences were reviewed further to evaluate the effectiveness of the risk controls in capturing the unsafe condition or event. The assessed risk was coded into four risk categories:

- *Risk neutral* - where the train crew observed workers or equipment within the rail corridor unexpectedly and reported the occurrence, or where protections were not cleared correctly after works were completed.
- *Low risk* - where the processes used in work on track started to break down, but still relatively low risk to workers or train crew.

- *Risk exposure increased* - similar to low, but where a number of processes (defences) had broken down resulting in an increased likelihood that an adverse consequence could occur.
- *High risk exposure* - significant failure in process (defences). The detection of the breakdown or lack of protection occurred late in the sequence of events, resulting in a heightened risk to workers or rail crew of adverse consequences.

Figure 3 shows the number of occurrences per risk level for each of the 11 event/condition categories. Figure 4 shows the risk ratings as a proportion of the total number of occurrences within that category.

Figure 3: Occurrence counts as a function of event/condition category and risk rating

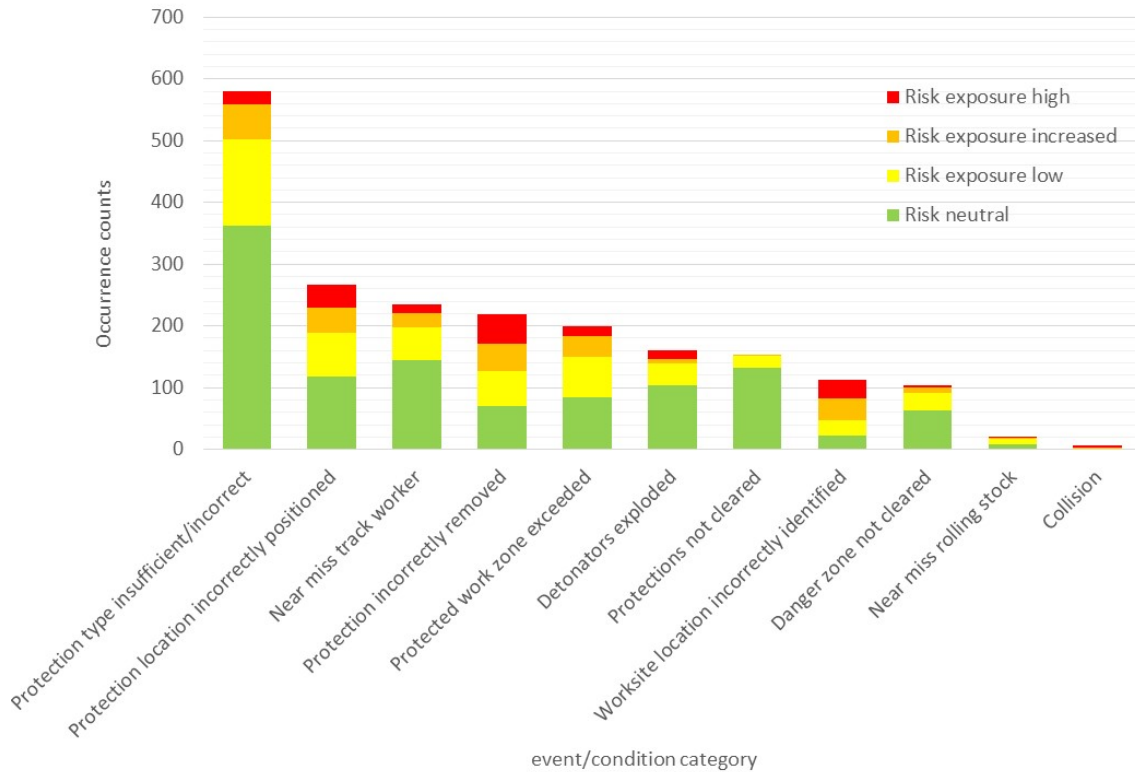
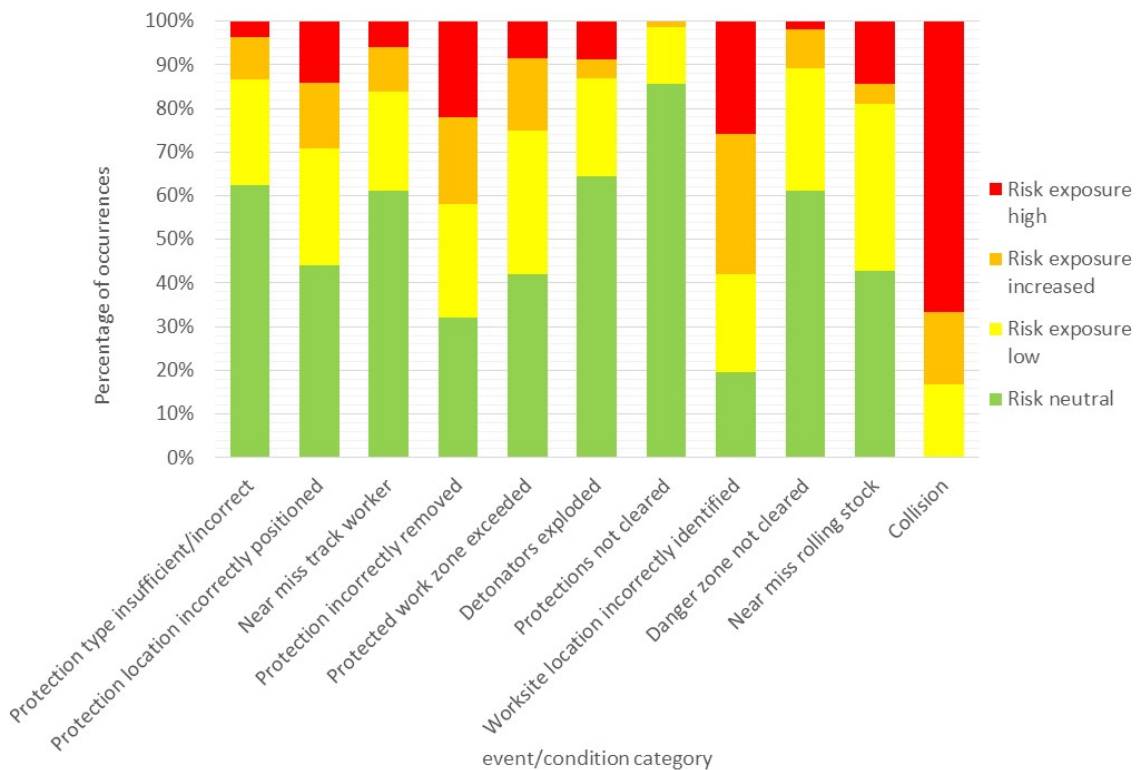


Figure 4: Risk rating as a proportion of occurrences in each event/condition category



Although events where protection was considered insufficient or incorrect was by far the most commonly reported safe work on track occurrence category, nearly two thirds (62%) were classified as risk neutral occurrences. Similarly, many of the events where protections had not been cleared were also classified as neutral risk (about 86%).

While most of the event/condition categories had a high proportion of risk neutral classified occurrences, of particular concern were the occurrences where the defences that were in place failed to maintain track worker safety. These higher risk occurrences, (red in Figure 3 and Figure 4), give an indication of the event/condition categories more likely to result in injury to track workers.

Notable was where events resulted in a collision. Since the highest consequence had occurred, most were categorised as high risk events (four of six occurrences). However, this category only accounted for six events out of a total of 1,779 examined (about 3%).

Again, further analysis was required to ensure both safety risk and event frequency was considered when comparing event categories.

Frequency and risk analysis

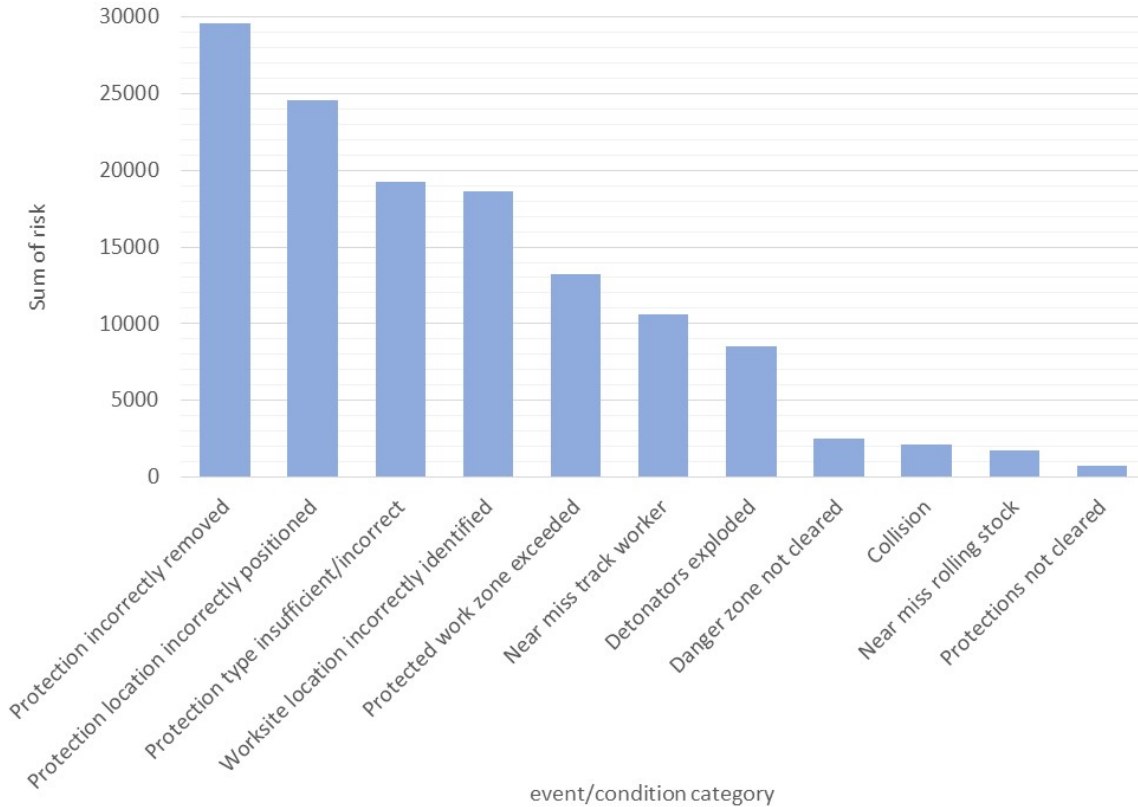
The classification of a risk category for each occurrence allows the sum of risk for each of the occurrence categories to be considered. The sum of risk takes into account both the frequency of occurrences shown in Figure 2 as well as risk rating, shown in Figure 3.

Since 2012, the ATSB has utilised an Event Risk Classification (ERC) process to risk assess aviation occurrences. The ERC is based on the Aviation Risk Management Solutions Event Risk Classification ERC framework.⁷

⁷ The methodology is from the report *The ARMS Methodology for Operational Risk Assessment in Aviation Organisations* (version 4.1, March 2010).

Using a similar methodology, the four risk categories discussed above were assigned a risk value and multiplied by the number of occurrences to obtain the sum of risk. In this way the sum of risk integrates both the frequency and severity of potential outcomes for each of the occurrence categories. Figure 5 illustrates the occurrence categories in order of sum of risk.

Figure 5: Sum of risk for each event/condition category



The four categories assessed as having the highest sum of risk were:

- protection incorrectly removed
- protection location incorrectly positioned
- protection type insufficient/incorrect
- worksite location incorrectly identified.

Detailed analysis of categories

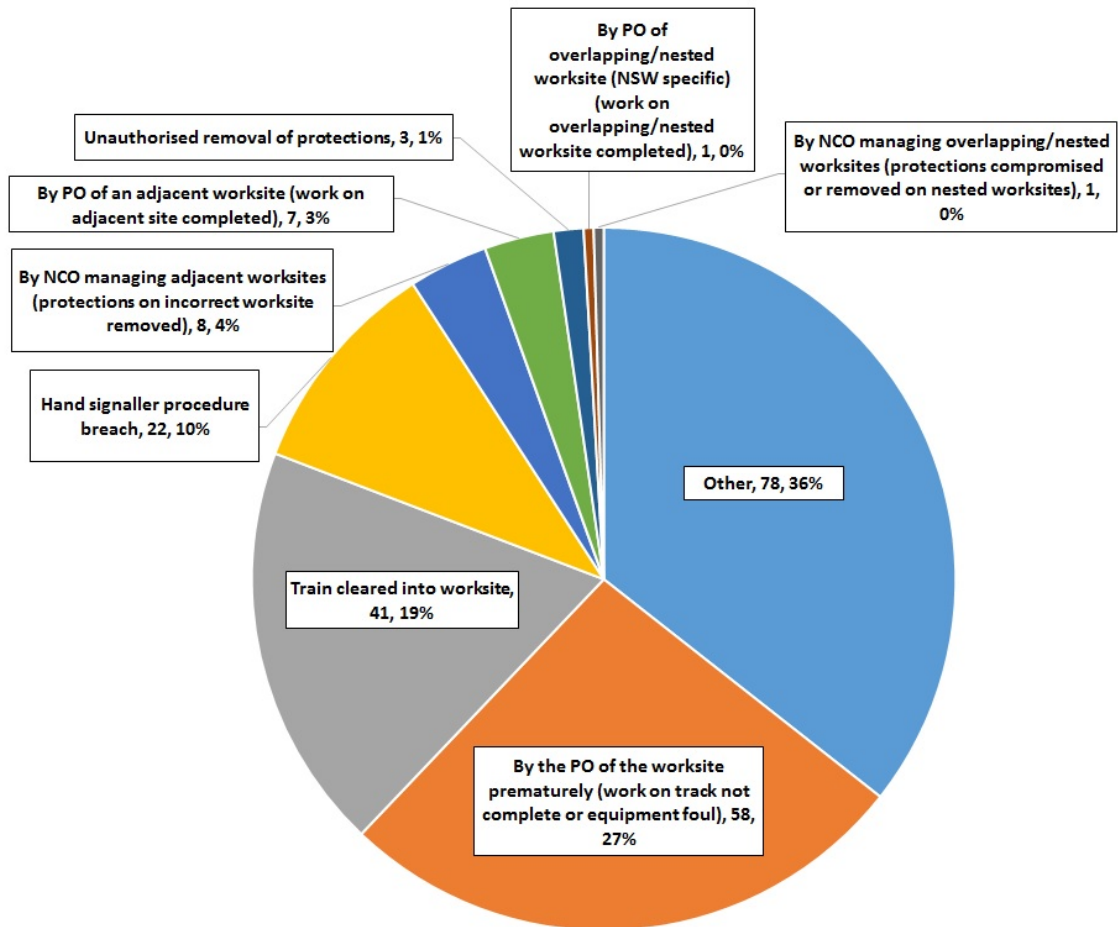
The following illustrates the data analysis in further detail. Complete tables of the data analysis are documented in Appendix D, along with some examples of de-identified occurrence reports for each category.

Protections incorrectly removed

This category included a range of events where the protection officer (PO) or network control officer (NCO) removed safeguards inadvertently while the plant or workers were operating in the danger zone. The consequence of the removal of safeguards, without an appropriate warning, understandably resulted in the highest assessed risk exposure to track workers.

There were 219 occurrences where the protections were incorrectly removed. About 22 per cent of these occurrences exposed workers to a high risk. Figure 6 illustrates the most common (subcategory) events that contributed to protections being incorrectly removed.

Figure 6: Protections incorrectly removed and subcategories



About a quarter (26%) of occurrences where protection was incorrectly removed were attributable to the protection officer prematurely removing site protections before the work on track was complete or before work equipment was removed from the danger zone. Another 41 (19%) were as a result of trains inadvertently being cleared into active worksites. Twenty-two occurrences (10%) were a result of incorrect procedures used by hand signallers.

Twenty occurrences involving protections incorrectly removed also featured in three other occurrence categories. Eleven of these occurrences led to a near collision, four of which were within 100 m or 10 seconds of a collision with track workers and/or equipment.

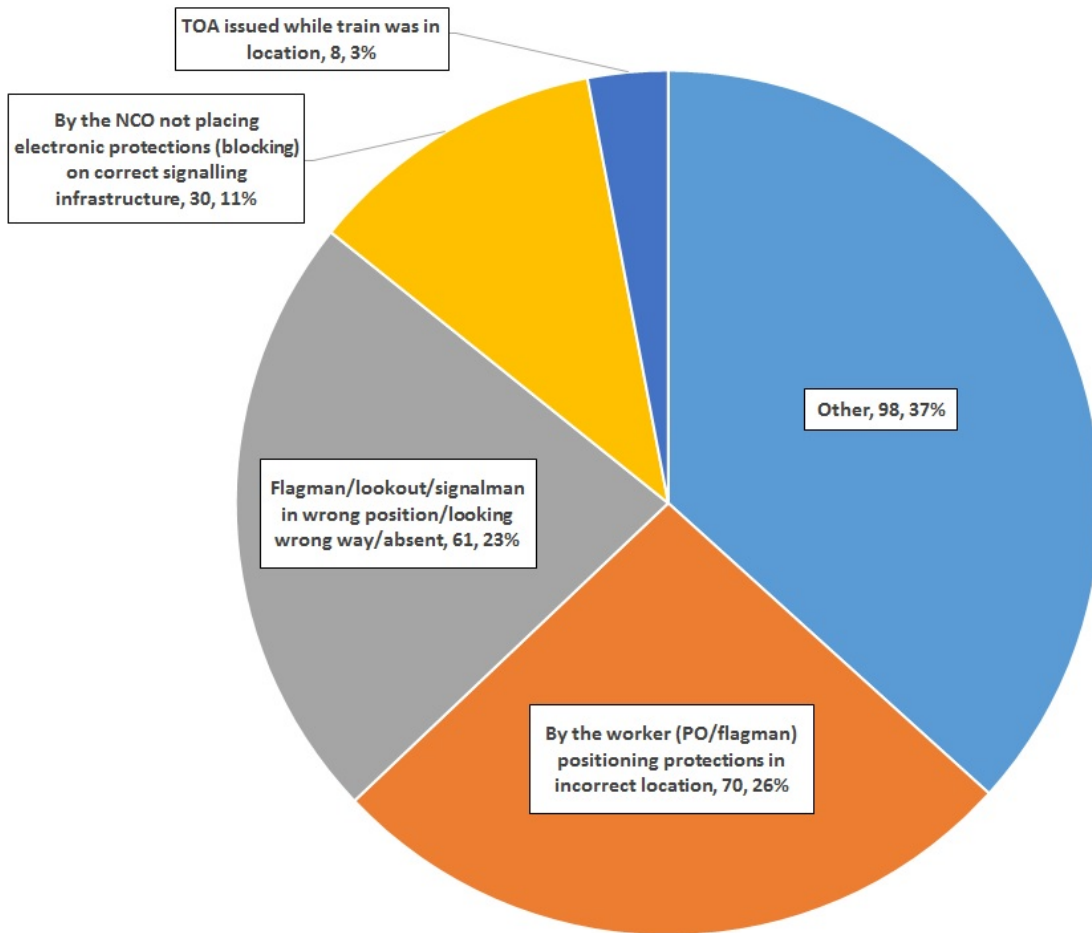
A high percentage occurrences in this category (36%) were assessed as ‘Other’. These were occurrences where insufficient information was provided to identify likely antecedents that led to the incorrect removal of the protections, or where the likely antecedents were not addressed within the taxonomy.

Protection location being incorrectly positioned

This category included events where the protection officer or network control officer incorrectly placed signage at the worksite or electronic blocks preventing signals from clearing. The consequence of incorrectly applying safeguards resulted in increasing risk exposure, particularly in situations where protections were positioned with a train still operating between the protection and the worksite.

There were 267 occurrences where the protections were incorrectly located. About 14 per cent of these exposed workers to a high risk. Figure 7 illustrates the most common (subcategory) events that contributed to the protections being incorrectly located.

Figure 7: Protections incorrectly positioned and subcategories



About a quarter (26%) of occurrences where the protections were incorrectly located were due to either the protection officer or flagman putting the protections in the wrong location. There were 61 instances (23%) where the flagman was facing the wrong way, absent, or in the wrong position, (these also include accounts of flagmen in their vehicles, and/or having lunch, and/or on telephones, and/or asleep while on duty). There were 30 accounts (11%) where network control officers did not implement electronic (blocking) protections in the correct location. The remaining eight were due to the issuing of TOA's while trains were still in the section.

Forty-two recorded occurrences where protections were incorrectly positioned also featured in six other occurrence categories. Detonators exploded in 28 of these occurrences and of these, 22 were at active worksite.

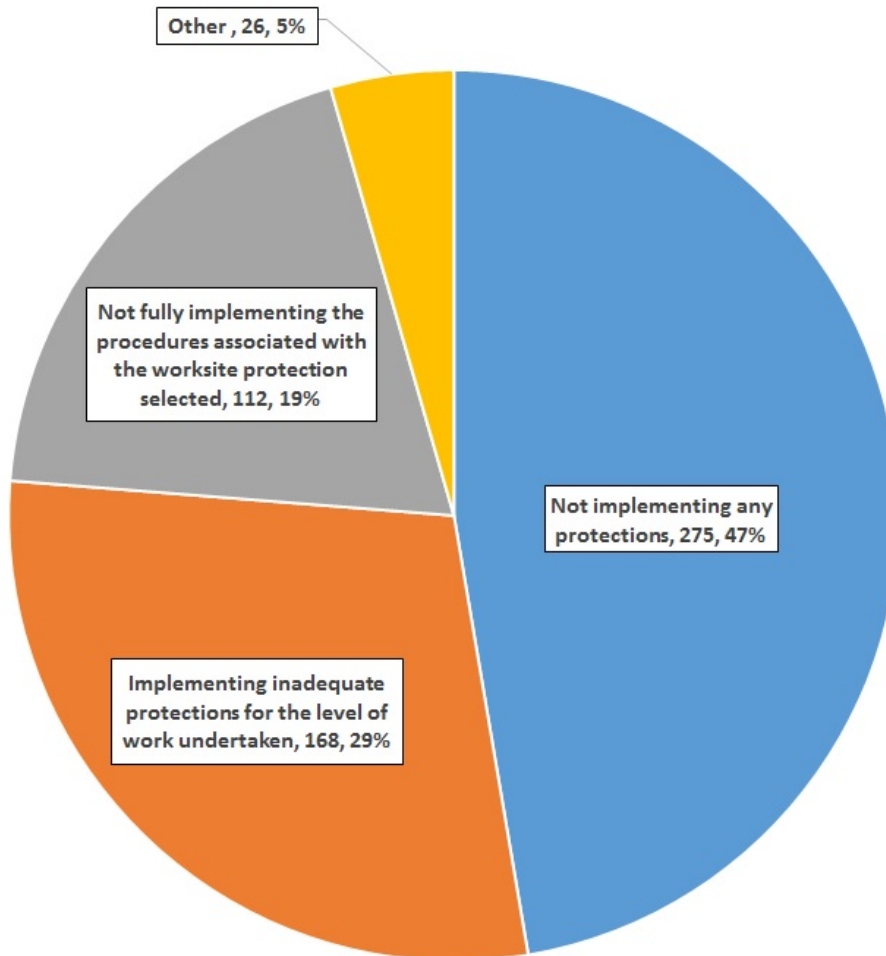
A high percentage of incorrectly positioned protection occurrences (37%) were assessed as 'Other'. These were occurrences where insufficient information was provided to identify likely antecedents that led to the incorrect positioning of protections, or where the likely antecedents were not addressed within the taxonomy.

Protection type insufficient/incorrect

Protection type insufficient or incorrect was the most commonly featured (Figure 2) of all the work on track occurrences. Although there were a large number of occurrences (581), the assessed risk exposure for majority were either neutral or low. However, the number of occurrences when multiplied with the assigned risk value resulted in the relatively high ranking (Figure 5) of this event category.

Figure 8 illustrates the most common (subcategory) events that contributed to reports of incorrect or insufficient protection.

Figure 8: Protection type insufficient / incorrect and subcategories



Occurrences relating to the protection type being insufficient or incorrect contained a broad spectrum of reported events and conditions. Almost half (47%) related to train drivers observing persons or vehicles within the rail corridor, without any advice to the train crew or discernible trackside protection arrangements in place. Many reports by the drivers arose from the unauthorised entry by rail maintenance crews, utility providers or contractors into the rail corridor, but not necessarily within the danger zone itself.

Seventy-three recorded occurrences relating to insufficient or incorrect protection also featured in eight other occurrence categories. The most common was a near collision with a track worker (31 events), but only five were reported as being within 100 meters or 10 seconds of a collision with track workers or machinery. Occurrence where workers or machinery moved beyond the work zone limits was the next most commonly co-occurring (30 events), most (20 events) involved unauthorised machinery entering into a protected work zone.

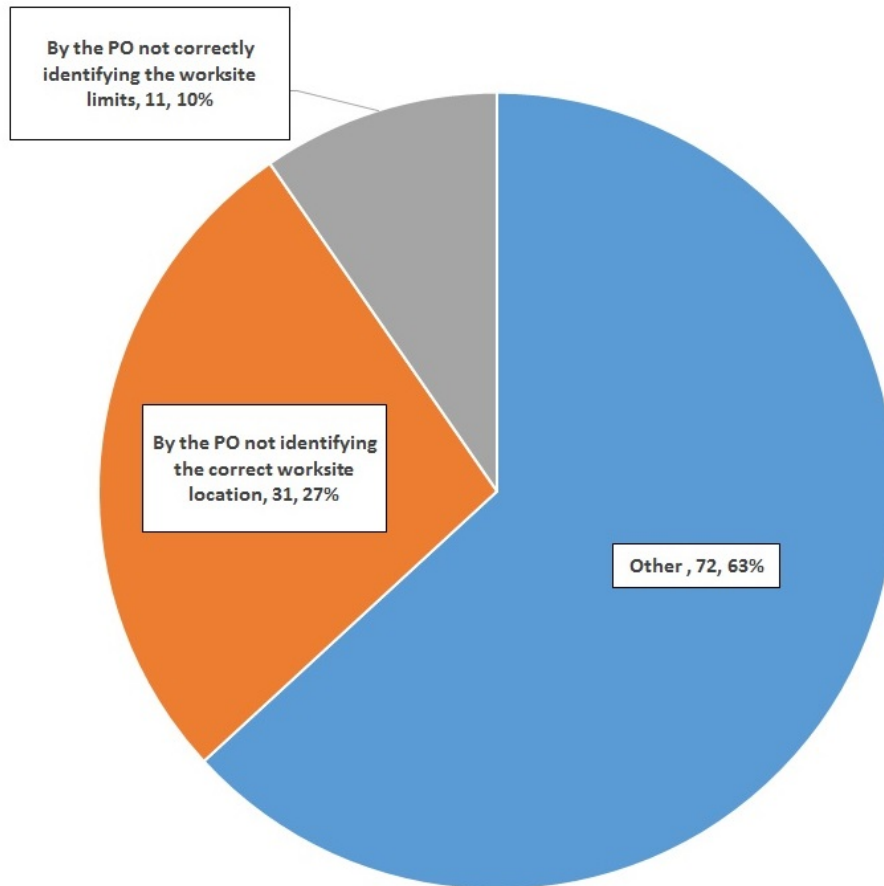
Worksite location incorrectly identified

Accurately determining and communicating the geographic location of the worksite is essential in interfacing with other worksite locations, qualified workers providing onsite protections, control centre staff at locations remote to the worksite, and train drivers.

There were 114 occurrences where the worksite location had been incorrectly identified. Figure 9 illustrates the most common (subcategory) events that led to the incorrect identification of worksite locations.

Almost two-thirds of records in this category (63%) were assessed as ‘Other’, due to insufficient information or the likely antecedents not being addressed within the taxonomy. However, there was sufficient information to determine that almost 60% of these occurrences exposed track workers to increased risk, with about 26% of these considered to have exposed workers to a high risk.

Figure 9: Worksite location incorrectly identified and subcategories



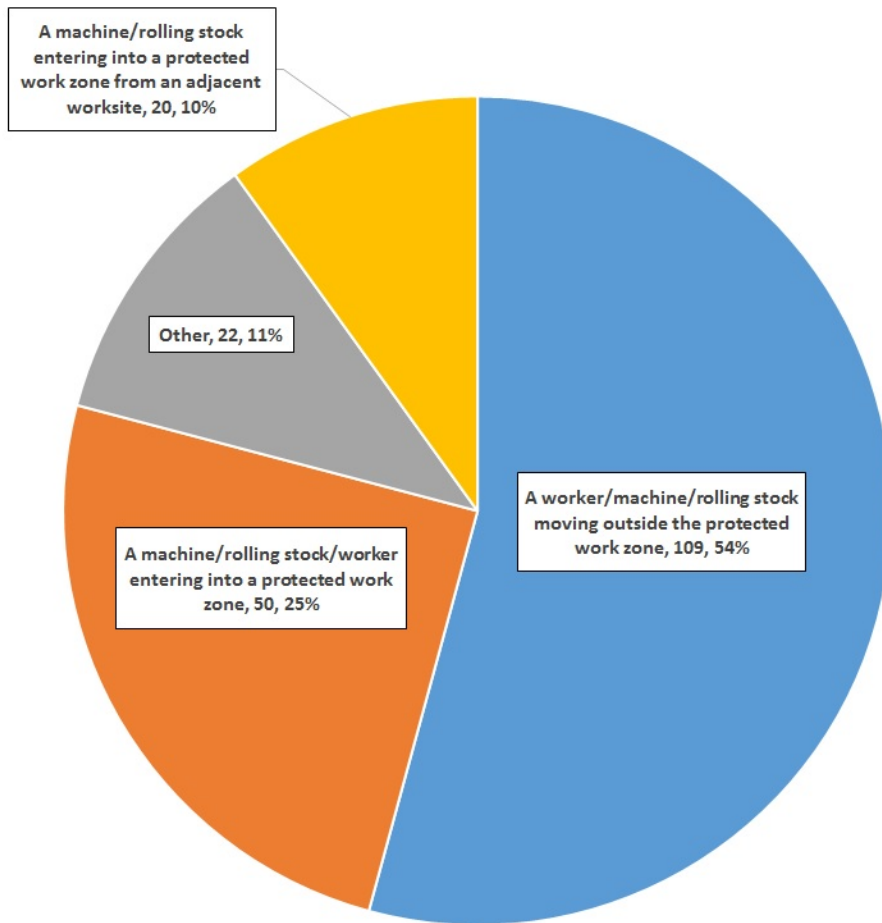
Thirty-one occurrences (27%) reported that the protection officer did not identify the correct worksite location. In another 11 occurrences (10%), the protection officer did not correctly identify the worksite limits.

Twenty-six recorded occurrences where the worksite location had been incorrectly identified also featured in five other occurrence categories. The most common was where workers or machinery moved outside the protected work zone, with 10 reported.

Protected work zone exceeded

Occurrences where the protected work zone was exceeded included where workers, machines or equipment were in the danger zone but outside of the protected area. The category also picked up occurrences where other workers or machines had entered a worksite without the knowledge of the protection officer.

Figure 10: Protected work zone exceeded and subcategories



Of the 201 occurrences, just over half (54%) were as a result of a workers or machines moving outside the protected work zone. Fifty (25%) were due to workers or machines entering into a protected work zone and another 20 (10%) due to workers or machines entering from an adjacent worksite.

Fifty-four occurrences also featured in seven other occurrence categories. The most common was related to insufficient or incorrect protection with 23 of those a result of protections not being implementing at all.

Near collision with track worker ('near miss')

This category included 236 reports where rolling stock nearly collided with track workers. The majority of occurrences (82%) were unspecified reports of a 'near miss'. Only about 13 per cent of reports specifically mentioned that the track workers were within 100 metres or 10 seconds of a collision.

Eighty-four occurrences were also associated with other occurrence categories. The most frequent (31) involved insufficient or incorrect protection, although occurrences where workers had not cleared the danger zone also featured prominently (29).

Detonators exploded

This category included 163 occurrences where detonators were encountered by a rail movement and the movement stopped as a result.

In 94 (58%) of these, the detonators were left on site by the protection officer at the completion of work. Consequently, a large proportion of these occurrences also feature in the category of *protections not cleared*.

However in 54 occurrences (33%), the detonators were correctly placed and protecting an active worksite. A significant proportion of these were the result of protections having been incorrectly positioned.

Danger zone not cleared

This category includes 103 occurrences where workers or equipment were in the danger zone after the work zone was cleared for a rail movement.

These occurrences were most commonly attributed to the protection officer not clearing workers from the danger zone before a train was authorised to pass through the worksite (37%). This was followed by workers being slow to respond when instructed to clear a work zone (19%). A small proportion were due to a flagman remaining within the danger zone (7%) or workers re-entering the danger zone after having cleared (6%).

Notably, about 28 per cent of occurrences were also reported as a near collision with a track worker. Of these, 11 per cent were reported to be within 10 seconds or 100 meters of a collision.

About a third of the occurrence reports for this category were assessed as 'other', due to insufficient information or the likely antecedents not being addressed within the taxonomy.

Collision

Of the six recorded collisions, three involved vehicles, two involved people and one involved equipment.

Of the three involving vehicles, one was a collision between a freight train and an (unoccupied) excavator (ATSB investigation [RO-2011-018](#)). The second occurrence involved a low speed collision between a ballast regulator and road rail vehicle, and the third involved a collision between a train and a road rail vehicle.

Of the two collisions with track workers, one involved a collision between a passenger train and an occupied hi-rail excavator. This occurrence is the only fatality identified in the data set and was investigated by the ATSB (investigation [RO-2010-004](#)). The other occurrence involved a train striking a lookout.

The sixth collision involved a train striking a rail drill with no injuries or damage to track.

Near collision ('near miss') with rolling stock

There were 21 near collisions with rolling stock. About half of the reports were assessed as 'other'. Of the remainder, nine occurred while the rolling stock (road rail vehicles, tampers, ballast regulators) were operating within a worksite, with only one occurrence involving a near collision due to rolling stock entering into an occupied worksite.

Protections not cleared

Protections not cleared refers to occurrences where flags, detonators or signs were left in situ after the work on track authority was cleared.

Just over 90 per cent of the 155 occurrences where protections were not cleared were as a result of the protection officer not removing them at the completion of work. Eight occurrences were as result of the protection officer omitting to cancel work site protections with the network control officer. In over half of the occurrences, it was also reported that detonators were exploded, all of which were left on site by the protection officer.

Summary of analysis

The ATSB analysis grouped the notifiable occurrence data into eleven categories. Each category was further grouped into subcategories in order to better describe the events/conditions that led to the occurrence. Further analysis took into consideration both safety risk and event frequency, allowing the data to be presented in order of risk exposure to track workers.

The four categories assessed as exposing track workers to highest risk were:

- protection incorrectly removed
- protection location incorrectly positioned
- protection type insufficient or incorrect
- worksite location incorrectly identified.

It was noted that the category of protection type insufficient/incorrect resulted in a relatively high ranking due to its high number of occurrences, even though the assessed risk exposure for majority of individual occurrences were either neutral or low. Almost half (47%) related to train drivers observing persons or vehicles within the rail corridor, but not necessarily within the danger zone itself.

The results of the study were largely reflective of the safety factors identified from previous ATSB investigations. That is, incidents were predominately a result of errors during the implementation or dissolution stage of providing track protection. Protections were either removed incorrectly or prematurely, or key communication exchanges failed to establish the location of the worksite with respect to approaching rail traffic.

The outcome of this ATSB safety issue investigation suggests that the rail industry should consider the event types identified above in determining areas in which to target effort for maximising the effectiveness of safety arrangements for work on track.

In addition, the rail industry should continue to monitor occurrence data to develop long-term trends, which would likely aid in the identification of other areas for improvement and in gauging the effectiveness of industry initiatives to reduce certain factors (events/conditions) from occurring.

While all of the occurrence records related to a work on track activity could be categorised into one of the eleven event/condition categories, about 20 per cent could not be subcategorised to better describe what happened during the occurrence. A proportion of these were a result of insufficient description of the conditions present at the time. The absence of this information limited the detailed analysis to identify likely antecedents to the unsafe act.

To facilitate future analysis, the current limitations in the descriptor information provided with each occurrence needs to be addressed. With the availability of more detailed narrative within the descriptor field, the ability to categorise an event will improve the accuracy of any future trend analysis.

Data limitations

The initial data collection for this report yielded 12,146 occurrence records from all states and territories. Due to variations in the state and territory occurrence coding practices, usage of the data as provided was significantly limited.

In order to undertake any of the analysis shown in this report, a new three-tiered occurrence event/condition type taxonomy was created (see *Appendix B – Safe work on track event/condition type taxonomy*). A significant proportion of the effort involved in this investigation went into the manual coding of data into these occurrence categories and subcategories. Additionally, a SQL database was created for this investigation (see *Appendix C - SQL relational database structure*) and the reclassified data was input into this. Once this was achieved, the actual analysis process was comparatively straight-forward.

Industry work on track initiatives

In November 2013, RISSB instigated the National Track Worker Safety Forum (NTWSF). The NTWSF is ongoing and includes a cross-section of representatives from rail infrastructure managers. Representation also may include rail regulators, contractors, the ATSB, unions or equipment suppliers as required.

The objective of the forum is to:

- share learning
- create a community of practice
- develop a voice for this segment of industry
- develop benchmarking opportunities
- build relationships
- work as an industry to deliver better safety outcomes.

The NTWSF members identified the following three priority issues that should be addressed to achieve improvement in the effectiveness of track worker safety arrangements:

- competencies and consistency of training, local knowledge and currency of practice
- engineering controls/sharing technology
- possession management and complexity.

The NTWSF work is progressing with members exploring technologies for worksite protection systems and addressing interface arrangements where differing rules and procedures exist between adjoining networks – particularly in sidings and yards and developing nationally consistent track site safety inductions.

Findings

From the analysis of notifiable occurrence records for the 5 year period between July 2009 and June 2014 that were classified as a safe working (network) rule or procedure breach, the following findings are made with respect to the occurrence notifications related to safe work on track. These findings should not be read as apportioning blame or liability to any particular organisation or individual.

- Analysis of occurrence data indicated the most common events exposing track workers to highest risk, were:
 - the incorrect removal of the worksite protection
 - the incorrect positioning of the worksite protection
 - the type of protection being insufficient or incorrect, and
 - the incorrect identification of the worksite location.
- If an occurrence taxonomy with sufficient fidelity was employed consistently to occurrences reported by all states and territories, future analysis, such as that presented in this report, could be available to industry in a more timely manner. With such a system in place, this analysis could also include occurrence-type trend analysis to monitor high risk occurrences, and inform stakeholders of any new developing trends.

Sources and submissions

Sources of information

The sources of information during the investigation included the:

- Department of Transport and Main Roads (Rail Unit), Queensland
- Independent Transport Safety Regulator, New South Wales
- Office of the National Rail Safety Regulator
- Office of Rail Safety Department of Transport, Western Australia
- Rail Industry Safety and Standards Board
- Transport Safety Victoria, State Government of Victoria.

References

Classifying Notifiable Occurrences, Occurrence Classification Guideline (OC-G1), Office of the National Rail Safety Regulator, Version 1.1 Submissions.

Submissions

Under Part 4, Division 2 (Investigation Reports), Section 26 of the *Transport Safety Investigation Act 2003* (the Act), the Australian Transport Safety Bureau (ATSB) may provide a draft report, on a confidential basis, to any person whom the ATSB considers appropriate. Section 26 (1) (a) of the Act allows a person receiving a draft report to make submissions to the ATSB about the draft report.

A draft of this report was provided on the ATSB website for public review before a final report is issued.

Submissions were received from the Office of the National Rail Safety Regulator. The submission was reviewed and where considered appropriate, the text of the report was amended accordingly.

Appendices

Appendix A – ATSB work on track occurrence investigations

RO-2015-002⁸ - Collision between track worker and passenger train at Guildford, WA

On 10 February 2015, a Public Transport Authority (PTA) maintenance crew commenced work at Meadow Street, Guildford, Western Australia. The crew's assigned tasks included maintaining the pedestrian gates adjacent to the level crossing. At about 1035, one of the track workers was struck by a Perth bound suburban passenger train. The track worker sustained fatal injuries.

RO-2015-019 - Track worker struck by a passenger train near Laverton station, Vic.

On 2 October 2015, track workers planned to undertake dog-spike removal works in preparation for sleeper replacement works. At around 0910, the supervisor commenced marking the track to identify those dog-spikes to be removed. A lookout had been stationed for his protection. At about 0916, a suburban commuter train approached the worksite. The lookout observed the train, warned workers of its approach and signalled to the driver that the track was clear. However, as the train took the crossover, the supervisor was foul of the track, and was struck by the train that was travelling at about 59 km/h. The supervisor suffered serious injuries.

RO-2013-025 - Transport Safety Safe working irregularity at Glenrowan, Vic.

On 29 October 2013, ballast redemption and drainage maintenance works was undertaken on the bidirectional west track between Benalla and Wangaratta in Victoria. Flagmen and audible track warning signals (ATW) were placed on the east track at either end of the worksite to protect workers from any rail traffic travelling on the adjacent east track.

At about 0730, a passenger train approached the worksite on the east track. The track force coordinator⁹ instructed the flagmen on the east track to remove the ATWs and allow the train to pass the work site unrestricted. No notice was provided to the work site supervisor or any of the track workers that protections were removed or that rail traffic was approaching.

On this occasion, the work site supervisor saw the approaching rail traffic and alerted the track workers who took action to ensure that they and their machines were clear of the track. The driver of the train was not aware of the near-miss incident and passed the worksite without incident.

RO-2013-018 - Safe working Breaches at Blackheath, Newcastle and Wollstonecraft, NSW

During June and July 2013, three separate safe working breaches occurred on the Sydney Trains network in NSW involving the application of Network Rule NWT 308 absolute signal blocking and Network Procedure NPR 703 Using Absolute Signal Blocking. The incidents occurred at Blackheath on 13 June 2013, Newcastle on 13 July 2013 and Wollstonecraft on 17 July 2013. In each case, trains were to be excluded from worksites, as part of worksite protection arrangements, using the absolute signal blocking (ASB) rule and procedure.

⁸ ATSB investigations RO-2015-002 and RO-2015-019 relate to incidents that occurred outside of the occurrence dataset range (June 2006 to June 2014) used in the analysis in the following chapter. In both incidents a collision between train and track worker occurred. The safety factors identified in each investigation are therefore relevant and included within this report.

⁹ Qualified worker undertaking similar role to that of a protection officer

The rule and procedure were not adhered to by the signaller or protection officer during the authorisation of the ASB resulting in trains entering or passing through the worksites from which they should have been excluded.

RO-2013-017 - Safe working breach involving a Local Possession Authority, Revesby, NSW

On 10 July 2013, a pre-planned and advertised local possession authority (LPA) was implemented on the Up Main line between Revesby and Turrella, NSW. Approximately 30 minutes after the LPA was implemented, a passenger train entered the limits of the possession area and immediately ran over railway track signals (detonators) and was brought to a stand.

RO-2011-018 - Collision between an empty coal train and a track mounted excavator near Maitland, NSW

On 20 December 2011, an empty coal train collided with an excavator that was being used for scheduled maintenance of rail lines near the High Street Station at Maitland, NSW. The excavator was extensively damaged. Neither the train drivers nor the track workers were injured in the collision. The lead locomotive incurred only minor damage and was able to continue on its journey after a crew change.

RO-2011-011 - Collision between freight train and road-rail vehicle near Menindee, NSW

On 13 July 2011, a freight train collided with a road-rail vehicle in the Kaleentha to Menindee section of track, western NSW. The road-rail vehicle, a station wagon, was extensively damaged. The lead locomotive of the train incurred only minor damage.

RO-2011-006 - Collision between freight train and a track mounted excavator near Jaurdi, WA

On 28 March 2011, a collision involving a freight train and a track mounted excavator occurred between Jaurdi and Darrine, WA. The train driver sustained a minor injury. There was significant damage to the lead locomotive and the excavator, and minor damage to the track as a result of the accident.

RO-2010-007 - Safe working incident - Junee, NSW

On 4 August 2010, a safe working incident occurred within the Junee station yard limits when a locomotive was moved from one road to another without authority, while a track occupancy authority (TOA) was in force. The drivers were aware that the southern end of the Junee yard was closed to rail traffic but were unaware that a TOA was also applicable at the northern end of the yard.

RO-2010-004 - Collision between passenger train and a track-mounted excavator near Newbridge, NSW on 5 May 2010

On 5 May 2010, a collision occurred between a passenger train and a track-mounted excavator near Newbridge, NSW. The operator of the track-mounted excavator was fatally injured. During the course of the investigation, a similar incident occurred near Wards River, NSW (17 March 2011), where two work groups had to hurriedly vacate their on-track worksite due to an approaching train. There were no injuries. Both incidents occurred despite the fact that the work groups had been authorised, under a TOA, to occupy and work on the track.

20060011 - Collision between freight train and an elevated platform vehicle at North Geelong, Vic

On 26 October 2006, an Adelaide to Melbourne bound freight train collided with an elevated platform vehicle at the Separation Street overpass at North Geelong, Vic. At the time of the collision, an employee was undertaking maintenance on the support beams of the overpass. He was working from within the basket of the elevated platform vehicle underneath the overpass and directly above the standard gauge track when struck by the train. The maintenance worker received serious injuries as a result of the collision.

2006008 - Collision between freight train and a track mounted excavator, Vic

On 25 September 2006, a Melbourne bound freight train travelling from Perth, collided with a track mounted excavator conducting track-work near Inverleigh, Vic. There were no injuries and only minor damage to both the train and the excavator as a result of the collision.

Common safety factors identified across ATSB investigations

The investigations above identified a variety of safety factors associated with each occurrence. The processes for planning to safely access the danger zone were routinely called upon by work crews. It was apparent that in implementing selected method of authority or means of protection applicable, common errors were repeated.

The identification of antecedents to these common errors is essential to improve the effectiveness of safe working procedures for work on track.

To highlight the likely origin of the safety factors identified with the breakdown, the relevant work on track method were grouped based on the factor being a characteristic of the organisation or system (organisational influence), a characteristic of an individual (human influence) or the operational environment at the time (environmental influence).

Local Possession Authority rules

Organisational influence:

- Validation processes were not effective in detecting errors in safe work documents prior to the implementation by key stakeholders ([RO-2013-017](#)).
- Conflicting information in safe work documents used during the planning of worksite possessions was not detected ([RO-2013-017](#)).
- Control centre handover procedures were inadequate in ensuring the identification of correct possession authority limits ([RO-2013-017](#)).
- Site pre-work briefings did not include dissemination of train running information or site protection arrangements ([RO-2011-006](#)).

Human influence:

- Rules and procedures were not followed during the implementation by key stakeholders ([RO-2013-017](#), [RO-2011-006](#)).
- Non-compliances to the repeat back provisions when implementing a worksite possession ([RO-2013-017](#)). Similar factor was present in occurrence associated with CSB ([RO-2011-018](#)).

Environmental influence:

- On site communications equipment was inadequate to effectively communicate with the key stakeholders ([RO-2011-006](#)).

Track Occupation Authority rules

Organisational influence:

- Procedure did not require protection officer to inform all persons or workgroups within the possession boundary of its existence ([RO-2010-007](#)).
- Procedure did not accurately identify boundary of possession or type of work being undertaken ([RO-2010-004](#)).
- Track workers provided with insufficient training in relation to the hazards and required protections ([RO-2010-004](#)).
- At times throughout the network controller roster, fatigue levels were conducive to performance degradation ([RO-2010-004](#)).

Human Influence:

- Track workers were using unauthorised reproductions (uncontrolled copies) of forms ([RO-2010-004](#)).
- Protection officer and network controller incorrectly concluded that the train had passed beyond the limits of the worksite ([RO-2010-004](#)). Similar factor was present in occurrence associated with CSB (RO-2011-008).
- Train driver had not adequately prepared the train to stop prior to the worksite given the prior knowledge of the track work location, route experience and knowledge of the trains handling characteristics ([2006008](#)).

Environmental Influence:

- Consideration of track local conditions (grade, line of sight) when determining the location of inner or outer lookouts ([RO-2014-004](#), [2006008](#)).

Controlled Signal locking/Absolute Signal Blocking

Organisational influence:

- Rule and procedure did not provide any guidance on acceptable methods for determining the location of rail traffic in the section or confirming the clearance of rail traffic past a proposed work location ([RO-2013-018](#)).
- There were no forms or checklists to provide practical guidance for completing the steps required to implement Absolute Signal Blocking or to provide an auditable record of the process ([RO-2013-018](#)).
- Procedures did not require the coordination between network control officers when the CSB affected more than one controller's area of responsibility ([RO-2011-018](#)).

Human Influence:

- The protection officers and signallers did not effectively communicate all information that was critical to the implementation of Absolute Signal Blocking ([RO-2013-018](#)).
- Differences exist in the way signallers and protection officers identify trains to each other ([RO-2013-018](#)).
- Network controller misunderstood the location of the worksite and information provided by the Protection Officer related to the locomotive that has passed the worksite ([RO-2011-018](#)). Similar factor was present in occurrence associated with TOA ([RO-2010-004](#)).
- Non-compliances to the repeat back provisions when implementing a worksite possession ([RO-2011-018](#)). Similar factor was present in occurrence associated with LPA ([RO-2013-017](#)).

- Procedures were misconstrued by key stakeholders when implementing worksite protection ([20060011](#)).
- Variations in safe working arrangements to the pre-determined plan were not formally communicated to key stakeholders ([20060011](#)).

Track Work Authority rules

Human Influence:

- Track force coordinator allowed the removal of protections for the passage of a train without informing key stakeholders at the worksite ([RO-2013-025](#)).

Lookout working

Organisational Influence:

- The organisation did not have any documented work instructions to ensure a consistent and safe approach to maintaining automatic pedestrian crossing equipment ([RO-2015-002](#)).

Human Influence:

- Worksite protection had not been adequately implemented to ensure workers were protected against inadvertently stepping into the path of a train while undertaking maintenance work ([RO-2015-002](#)).
- It was common practice for maintenance personnel to adopt a process that was inherently less safe than an alternative when maintaining automatic pedestrian crossing equipment ([RO-2015-002](#)).
- The track was accessed by the work crew without an assessment of the risks and without the establishment of appropriate risk controls ([RO-2015-019](#)).
- The lookout gave an 'All-Right' hand signal to the train driver before the supervisor had moved to a position of safety clear of all tracks ([RO-2015-019](#)).
- The supervisor did not move to a position of safety as the train approached. He probably expected the train to proceed directly along the adjacent line and not take the crossover to his location ([RO-2015-019](#)).

Appendix B – Safe work on track event/condition type taxonomy

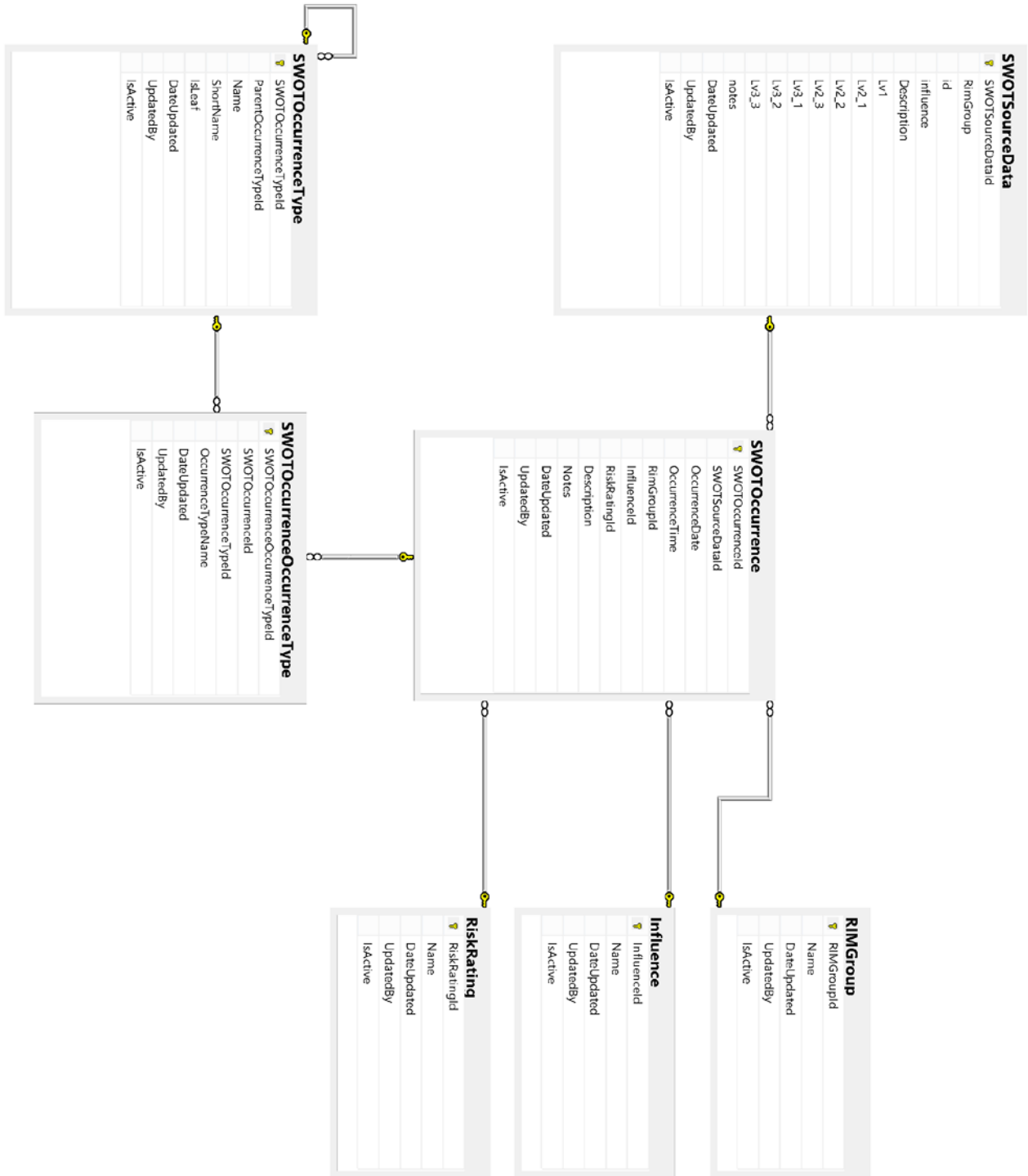
Table 2: Event/condition categories and their corresponding subcategories

Category	Definition	Subcategories
Collision	Any reports of a train colliding with something	<ul style="list-style-type: none"> • Infrastructure • Person • Rolling stock • Other
Danger zone not cleared	Workers or equipment left in danger zone after work zone cleared for rail movement.	<ul style="list-style-type: none"> • Protection officer not clearing workers from danger zone for controlled train movement through work zone • Protection officer /flagman within danger zone during passage of controlled train movement • Worker re-entering danger zone after initially being cleared • Workers slow in responding to clearing work zone instruction • Other
Detonators exploded	Includes occurrences where detonators were encountered by rail movement and movement stopped.	<ul style="list-style-type: none"> • Protection officer omitted to remove following completion of worksite protection • protection officer placed as worksite protection zone active • Other
Near miss rolling stock	Reports of rolling stock nearly colliding with other rolling stock	<ul style="list-style-type: none"> • Entering into a worksite occupied by a rail vehicle • Operating within a worksite • Other
Near miss track worker	Reports of rolling stock nearly colliding with track workers	<ul style="list-style-type: none"> • A report by a driver of a near miss (word near miss used in occurrence description) • Workers or plant reported in danger zone within 100 m or 10 seconds of approaching rail movement. • Other
Protected work zone exceeded	Workers or equipment/plant in danger zone outside of area protected by current track authority	<ul style="list-style-type: none"> • A machine/rolling stock entering into a protected work zone from an adjacent worksite • A machine/rolling stock/worker entering into a protected work zone • A worker/machine/rolling stock moving outside the protected work zone • Other
Protection incorrectly removed	Includes occurrences where the protections were removed inadvertently by protection officer or network control officer while workers or plant were operating in the danger zone.	<ul style="list-style-type: none"> • By network control officer managing adjacent worksites (protections on incorrect worksite removed) • By network control officer managing overlapping/nested worksites (protections compromised or removed on nested worksites) • By protection officer of an adjacent worksite (work on adjacent site completed) • By protection officer of overlapping/nested worksite (work on overlapping/nested worksite completed) • By the protection officer of the worksite prematurely (work on track not complete or equipment foul) • Hand signaller procedure breach

Category	Definition	Subcategories
		<ul style="list-style-type: none"> • Train cleared into worksite • Unauthorised removal of protections • Other
Protection location incorrectly positioned	Includes occurrences where protection officer or network control officer erred in locating either 'in field' or 'control system' protections.	<ul style="list-style-type: none"> • By the network control officer not placing electronic protections (blocking) on correct signalling infrastructure • By the worker (protection officer /flagman) positioning protections in incorrect location • Flagman/lookout/signalman in wrong position/looking wrong way/absent • TOA issued while train was in location • Other
Protection type insufficient/incorrect	Includes occurrences where no protection was implemented or the protection method implemented was incorrect for the type of work undertaken in the danger zone.	<ul style="list-style-type: none"> • Implementing inadequate protections for the level of work undertaken • Not fully implementing the procedures associated with the worksite protection selected • Not implementing any protections • Other
Protections not cleared	Flags, detonators or signs left in situ after work on track authority cleared.	<ul style="list-style-type: none"> • The protection officer omitting to cancel work site protection arrangements with network control officer following completion of work • The protection officer omitting to remove signs/ATW after completion of works • Other
Worksite location incorrectly identified	Includes occurrences where protection officer or network control officer incorrectly located the worksite	<ul style="list-style-type: none"> • By the protection officer not correctly identifying the worksite limits • By the protection officer not identifying the correct worksite location • Other

Appendix C - SQL relational database structure

Figure 11: Safe work on track SQL relational database structure



Appendix D – ATSB analysis of incident data, 2009 – 2014

Appendices D1 to D11 illustrate the assessed data in both diagram and tabular form for each of the 11 occurrence categories and their corresponding subcategories. Also illustrated are the occurrences assessed as featuring in other occurrence categories. In this way, factors contributing to, or associated with, certain occurrence outcomes can be observed.

D1 - Protections incorrectly removed

Figure 12 illustrates the types of events (likely antecedents) which resulted in occurrences reports (219) where the protections were incorrectly removed. The diagram also illustrates the 20 recorded occurrences which featured in three other occurrence categories.

Detailed distribution is shown in Table 3.

Figure 12: Protections incorrectly removed

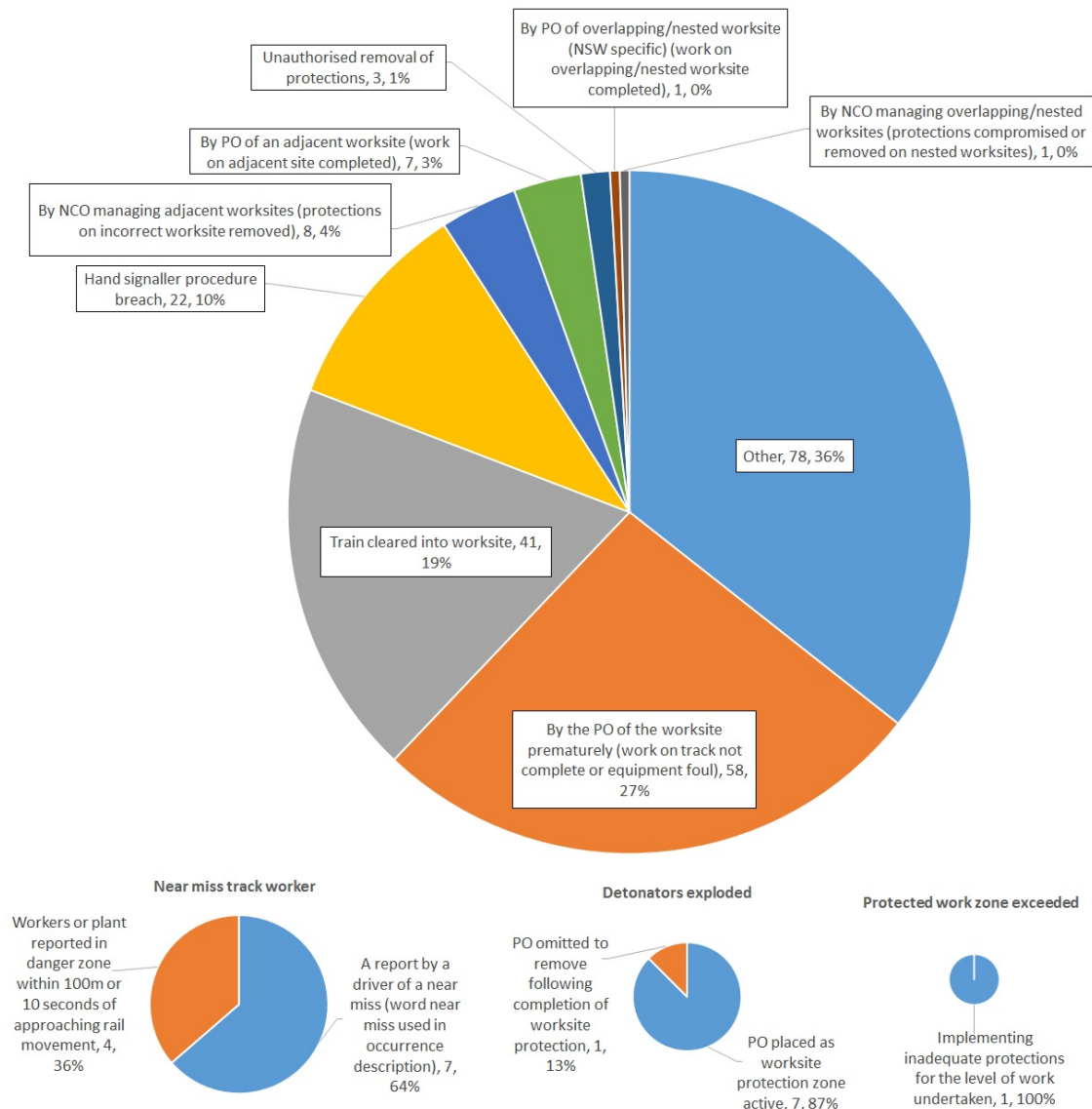


Table 3: Protections incorrectly removed

The 219 recorded occurrences where the danger zone had not been cleared and the subcategories describing the likely antecedents.

Occurrence category		Subcategories	
Protection incorrectly removed	219	Other	78
		By the PO of the worksite prematurely (work on track not complete or equipment foul)	58
		Train cleared into worksite	41
		Hand signaller procedure breach	22
		By NCO managing adjacent worksites (protections on incorrect worksite removed)	8
		By PO of an adjacent worksite (work on adjacent site completed)	7
		Unauthorised removal of protections	3
		By PO of overlapping/nested worksite (work on overlapping/nested worksite completed)	1
		By NCO managing overlapping/nested worksites (protections compromised or removed on nested worksites)	1

The 20 recorded occurrences which featured in three other occurrence categories, and their respective subcategories.

Occurrence categories associated with protection incorrectly removed			
Near miss track worker	11	A report by a driver of a near miss (word near miss used in occurrence description)	7
		Workers or plant reported in danger zone within 100m or 10 seconds of approaching rail movement	4
Detonators exploded	8	PO placed as worksite protection zone active	7
		PO omitted to remove following completion of worksite protection	1
Protection type insufficient/incorrect	1	Implementing inadequate protections for the level of work undertaken	1

Examples - Protections incorrectly removed

Examples of de-identified occurrence reports are provided below grouped relative to the condition that was present at that time:

Removed protections

- At 1856, the network controller identified that when contacted to fulfil a TOA that they had in fact removed the blocking facilities for this TOA at 1710.
- A passenger train had authority from train control to depart the station. The train driver later observed rail safety workers on the track ahead and applied emergency brakes. Work on track protections were in place under a TWA. It was reported that the passenger

train was brought to a 'stop' in the work site 20 m short of track welding activities on the West track. On observing the approaching train, the rail safety workers scattered to a place of safety. Train control confirmed the incident and reported that the TWA on the East track had finished earlier in the day, however, the 'blocks' were removed on the West track in error.

- Track protection lifted without notification to the work group supervisor and a train proceeded through the down track without advice to workers.

Multiple (or nested) possessions

- The controller advised the PO of requirement to suspend the TOA to which the PO acknowledged and requested time to clear the track of workers. The TOA was suspended to allow two track machines to depart another closure area. The PO later advised network controller that they had failed to liaise with another work group inside the TOA, which were still on track and proceeding with their work. The network controller advised track machines to stop immediately and do not proceed in either direction until advised. Network controller contacted the work group still on track and advised them to move off the track immediately due to the suspension of the TOA. The work group advised that they were half way through a weld and if the weld was not completed the track would be unserviceable.
- The PO was advised that when his protections were removed from his worksite, a second nested worksite was left exposed.
- A qualified employee working in rail corridor between A and B advised he was clear of area at 1413. A TOA, which was issued to another qualified employee working in the same section, was incorrectly fulfilled at the same time.

Trains through worksites

- Protection lifted without authority of the project worksite coordinator when six track machines entered worksite without authority. An adjoining PO failed to contact the worksite coordinator before lifting the protection.
- Train crew advised that they had come to an emergency stop due to maintenance personnel on the track. Driver advised that he had been given the all clear by lookout 100 m prior. Driver applied emergency brakes at 72 km/h, stopping train 250 to 300 m past work site.

D2 - Protection location incorrectly positioned

Figure 13 illustrates the types of events (likely antecedents) which resulted in occurrences reports (267) where the protections were incorrectly positioned. The diagram also illustrates the 41 recorded occurrences which featured in five other occurrence categories.

Detailed distribution is shown in Table 4.

Figure 13: Protection location incorrectly positioned

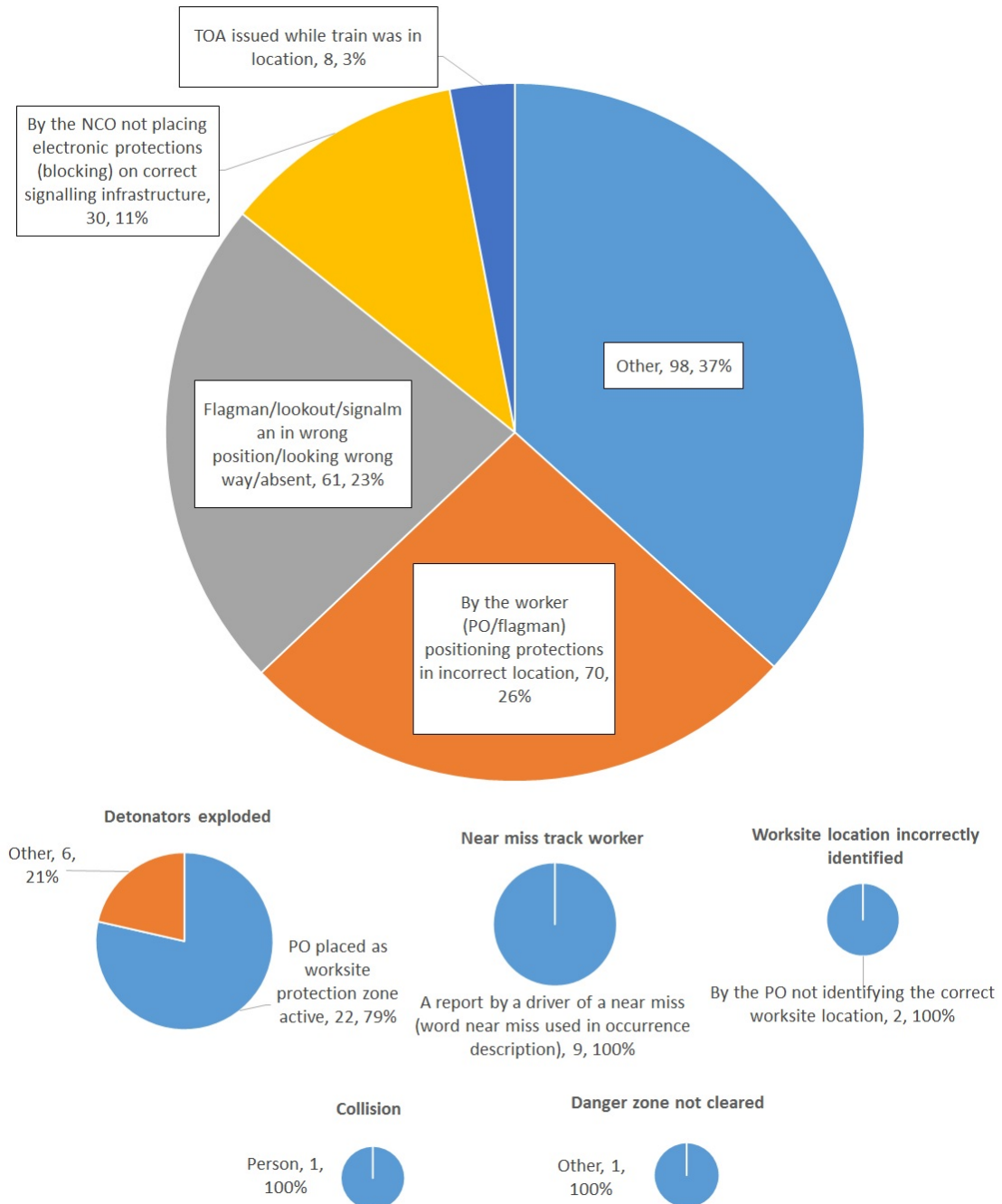


Table 4: Protections incorrectly positioned

The 267 recorded occurrences where the danger zone had not been cleared and the subcategories describing the likely antecedents.

Occurrence category		Subcategories	
Protection location incorrectly positioned	267	Other	98
		By the worker (PO/flagman) positioning protections in incorrect location	70
		Flagman/lookout/signalman in wrong position/looking wrong way/absent	61
		By the NCO not placing electronic protections (blocking) on correct signalling infrastructure	30
		TOA issued while train was in location	8

The 42 recorded occurrences which featured in six other occurrence categories, and their respective subcategories.

Occurrence categories associated with protection location incorrectly positioned			
Detonators exploded	28	PO placed as worksite protection zone active	22
		Other	6
Near miss track worker	9	A report by a driver of a near miss (word near miss used in occurrence description)	9
Worksite location incorrectly identified	2	By the PO not identifying the correct worksite location	2
		Other	1
Danger zone not cleared	1	Person	1
Collision	1		

Examples - Protections incorrectly positioned

Examples of de-identified occurrence reports are provided below grouped relative to the condition that was present at that time:

Train approaching worksite

- Gang requiring to do work on the points in a yard requested a train running information (TRI) from train control. Train driver reported through the yard at 1330 and gang was the given a TRI to work up to 1400 for the yard. Gang working in the yard reported that the train had not cleared the yard and were surprised when the train then approached the points where their work location was a couple of minutes later.
- Network controller had given the gang TRI permission to work on the track between the XX km and YY km. The network controller had endorsed the TRI in the C to D section on the train control graph where the actual kilo-meterage was in the A to B section. This resulted in the gang being given permission to work on track in front of the train. The gang sighted the train and cleared the track when the headlight was sighted.
- Network controller issued the track inspector a TOA to work one track machine between 99.500 km and 100 km. A train crew was issued with a train authority (TA) to proceed from 0.000 km to 108.100 km. The track inspector observed approaching train and made contact with the train crew. Movement stopped and network controller contacted.

Position of trackside signage/flagmen trackside

- Report of worksite approximately 82.618 km had lookout incorrectly positioned with his back to the approaching train. The protection officer failed to address a number of key areas with the protection for the worksite.
- The driver of a train that travelled through a work site reported he was not notified of the work site and was travelling at a speed of 55 km/h where his speed should have been 20 km/h. There was no outer flagman, no audible warning devices in place and the inner flagman was located 50 m from the work site.
- Train driver reported that the hand signaller was located at the incorrect location. Hand signaller located at 81.100 km and should have been located at 81.000 km as per worksite protection form.

Application of electronic/mechanical isolation at the control centre or signal box

- Train control had not placed all required signals at stop for CSB.¹⁰ No protection was applied to bi-directional signals in the down direction.
- At 1515 it was identified that blocking facilities had not been placed in conjunction with TOA.
- Incorrect placement of blocking protection by network controller caused a near miss with gang personnel working on points crossovers. The network controller did not place blocking protection in the correct location and or confirm or repeat the information or request a repeating of the information by the PO.
- PO requested a TOA. PO called and reported a train approaching his work site. Control advised that a train was approaching his protecting signal and the train should be coming to a halt. The PO then stated that he had used the wrong signal that being the down distant automatic signal as his limit. The PO advised to fulfil TOA and off-track. The PO stated that train was roughly 1 km from the work site when he cleared the track.

¹⁰ Controlled signal blocking. Similar function to ASB.

D3 - Protection type insufficient/incorrect

Figure 14 illustrates the types of events (likely antecedents) which resulted in occurrences (581) reported as having insufficient or incorrect protection. The diagram also illustrates the 70 recorded occurrences which featured in seven other occurrence categories.

Detailed distribution is shown in Table 5.

Figure 14: Protection type insufficient / incorrect

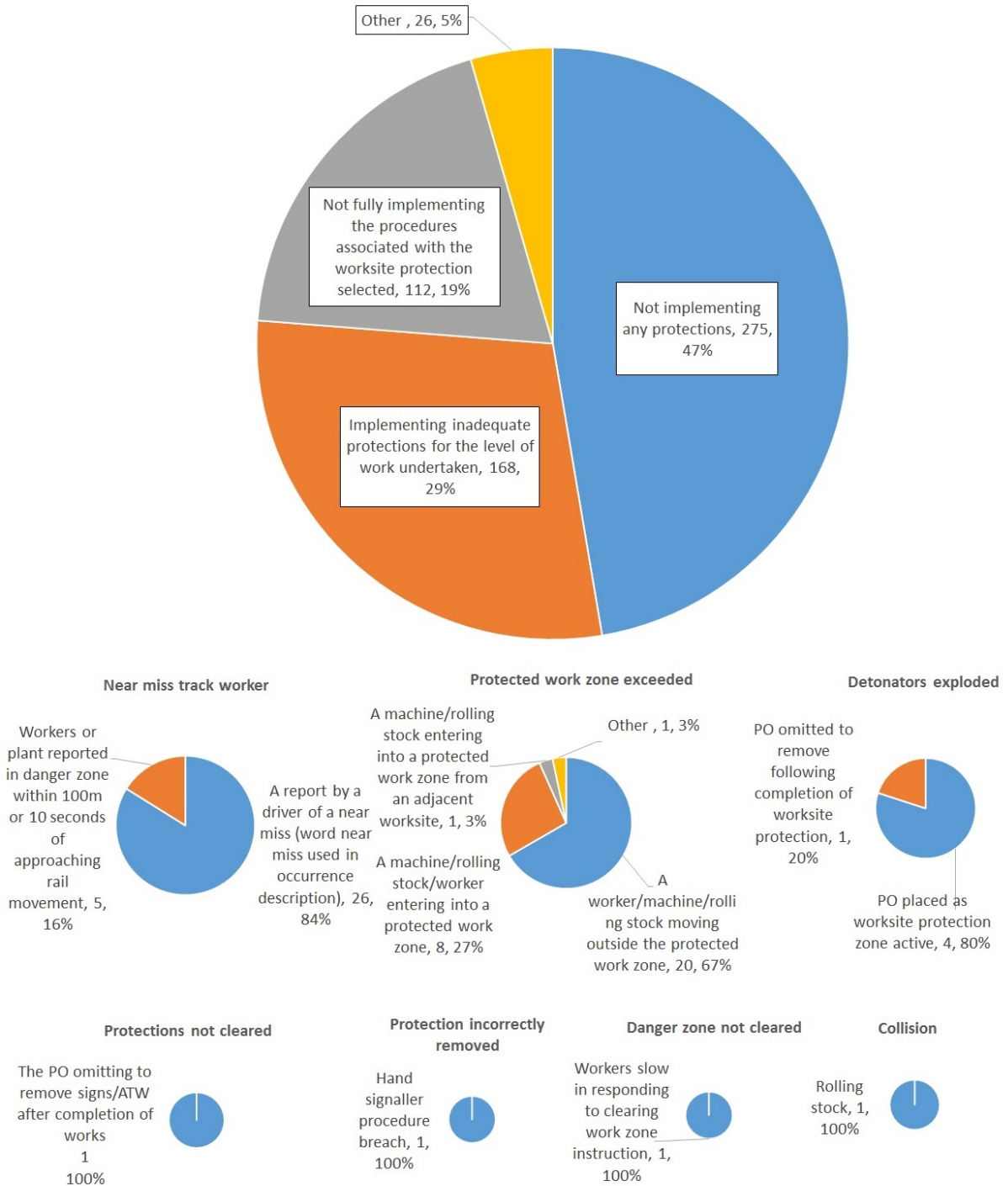


Table 5: Protection type insufficient / incorrect

The 581 recorded occurrences where the danger zone had not been cleared and the subcategories describing the likely antecedents.

Occurrence category		Subcategories	
Protection type insufficient/incorrect	581	Not implementing any protections	275
		Implementing inadequate protections for the level of work undertaken	168
		Not fully implementing the procedures associated with the worksite protection selected	112
		Other	26

The 73 recorded occurrences which featured in eight other occurrence categories, and their respective subcategories.

Occurrence categories associated with protection type insufficient/incorrect			
Near miss track worker	31	A report by a driver of a near miss (word near miss used in occurrence description)	26
		Workers or plant reported in danger zone within 100m or 10 seconds of approaching rail movement	5
Protected work zone exceeded	30	A worker/machine/rolling stock moving outside the protected work zone	20
		A machine/rolling stock/worker entering into a protected work zone	8
		A machine/rolling stock entering into a protected work zone from an adjacent worksite	1
		Other	1
Detonators exploded	5	PO placed as worksite protection zone active	4
		PO omitted to remove following completion of worksite protection	1
Protections not cleared	1	The PO omitting to remove signs/ATW after completion of works	1
Protection incorrectly removed	1	Hand signaller procedure breach	1
Danger zone not cleared	1	Workers slow in responding to clearing work zone instruction	1
Collision	1	Rolling stock	1

Examples - Protection type insufficient / incorrect

These occurrences include a broad spectrum of occurrences from grass cutting within corridor with no authority to the wrong worksite protection being selected. Examples of de-identified occurrence reports are provided below.

- The driver reported he came very close to striking two maintenance personnel working the points on the up road approaching a station. The driver advised the train was closer than 100 m from the workers and travelling at 90 km/h when they cleared the track. The driver

advised he was shaken by the incident. The controller had no knowledge of workers in in that area and the matter referred to the network manager. The driver advised he could not see any lookouts in the area for the workers. The driver was too distressed to drive the train back.

- The manager at the network control centre received a phone call from the track PO to advice of a possible near miss that morning. The contractors had started work before the PO had arrived on site.

D4 - Worksite location incorrectly identified

Figure 15 illustrates the types of events (likely antecedents) which resulted in occurrences (114) where the worksite location was incorrectly identified. The diagram also illustrates the 26 recorded occurrences which featured in five other occurrence categories.

Detailed distribution is shown in Table 6.

Figure 15: Worksite location incorrectly identified

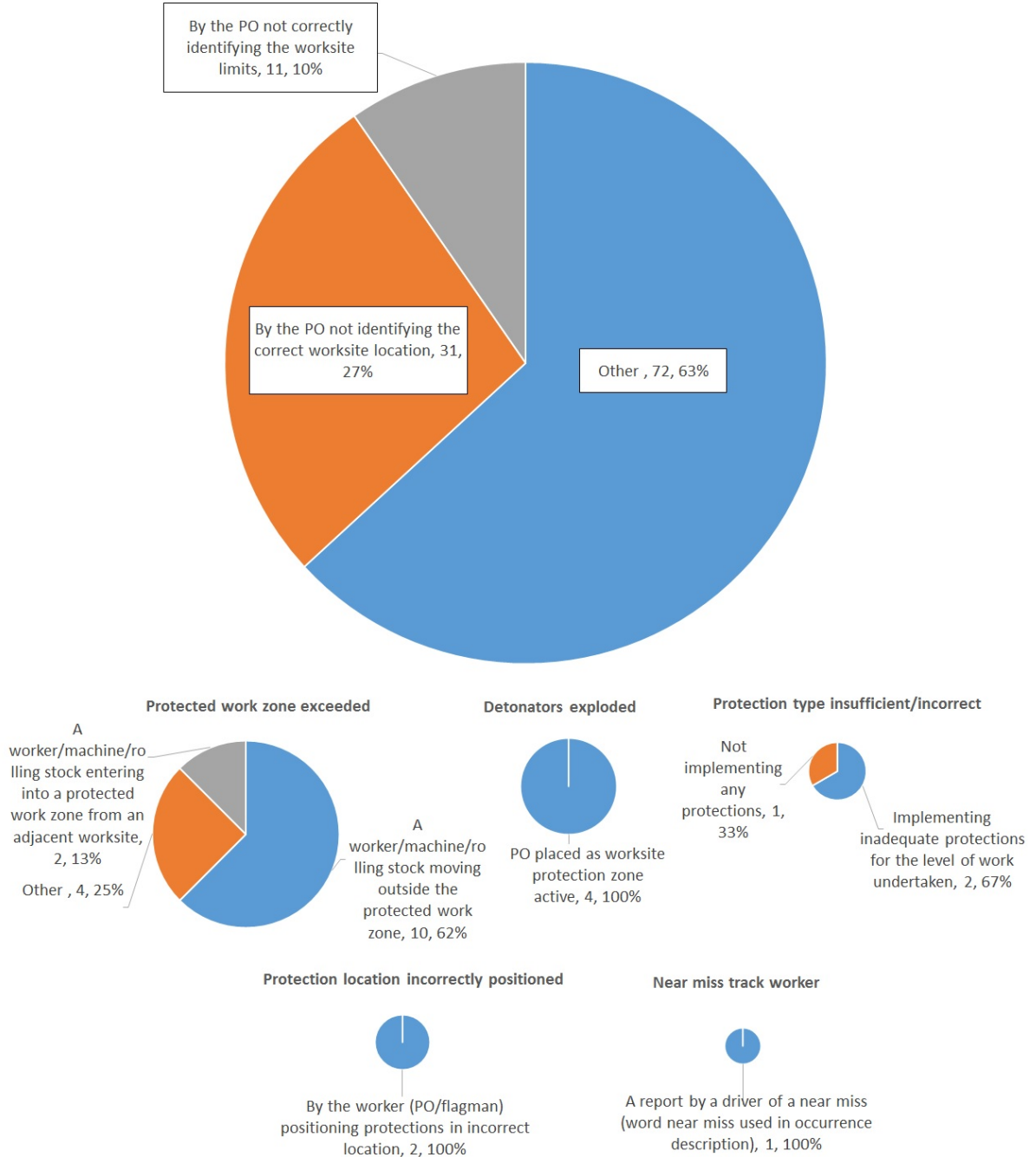


Table 6: Worksite location incorrectly identified

The 114 recorded occurrences where the danger zone had not been cleared and the subcategories describing the likely antecedents.

Occurrence category		Subcategories	
Worksite location incorrectly identified	114	Other	72
		By the PO not identifying the correct worksite location	31
		By the PO not correctly identifying the worksite limits	11

The 26 recorded occurrences which featured in five other occurrence categories, and their respective subcategories.

Occurrence categories associated with worksite location incorrectly identified			
Protected work zone exceeded	16	A worker/machine/rolling stock moving outside the protected work zone	10
		Other	4
		A worker/machine/rolling stock entering into a protected work zone from an adjacent worksite	2
Detonators exploded	4	PO placed as worksite protection zone active	4
Protection type insufficient/incorrect	3	Implementing inadequate protections for the level of work undertaken	2
		Not implementing any protections	1
Protection location incorrectly positioned	2	By the worker (PO/flagman) positioning protections in incorrect location	2
Near miss track worker	1	A report by a driver of a near miss (word near miss used in occurrence description)	1

Examples - Worksite location incorrectly identified

Examples of de-identified occurrence reports are provided below.

- At 1002, the PO fulfilled a CSB. At 1005, a train driver advised there were three detonators and red flag on the up main on the up side of the signal. Investigations revealed that protection was placed on the wrong track for TOA on the down main (protection placed on up main).
- Welding gang was enroute to location 'B' to repair a rail defect in the main line. They were advised that there was spare rail at the site to facilitate the repair. The gang drove to location 'C' instead of location 'B' (which was 36 km away). Gang entered the corridor and contacted network control to obtain a TWA in preparation for work identifying their location as 'B' main line. Network control required that trains be able to use the loop road to travel through 'B' and therefore permanent way protection was placed within the main line allowing trains to safely traverse the points into the loop. However as network control thought the gang was at 'B', the route for the loop was set at that station and not at location 'C'. The route at 'C' was actually still set (and clipped) for the main line where the gang was working. The supervisor identified a section of rail and a rail defect in the main line at 'C'. As work progressed, the supervisor of the gang received a phone call from another employee enquiring as to the gang's location so that he could undertake a spot safety audit. The supervisor advised they were at 'B' and the auditor

proceeded to 'B'. On arrival at 'B' the auditor could not find the gang and again rang the supervisor to enquire as their whereabouts. The supervisor again advised he was at 'B' at which time the auditor stated that he was standing at 'B' and nobody was in attendance. It was at this point that the supervisor realised that the gang was mistaken as to their location and with the weld already completed; the supervisor removed the personnel from the track and advised network control of their actual location. There was no defect found at 'B' and the defect reported to the gang was actually the one at 'C'.

- Driver reported track workers possibly working in wrong location. Driver advised gang working at 'A' which was not known to train control. After investigation, it was established the track supervisor had indicated via his work on track request he was in the 'B' area. The track supervisor had made the same error the day before which went undetected. The worksite was taken over by a senior qualified worker, and closed down.
- Train struck three detonators and stopped short of a red flag in the four foot. The PPO advised that the protection placed at wrong line.
- At 0100 mid-week night possession (LPA), a train struck detonators on the down local line (which was not part of the LPA). The driver reported this to network control. It was discovered that the flagman put out the LPA protection (detonators) at 11.672 km on the down local instead of the down main.
- Gang not advised of train movement. The gang was working on 'A' Line. On the control graph the line was plotted incorrectly (showing gang to be on 'B' line) passage.
- Workers entered the wrong tunnel unprotected (tunnel A) instead of the (tunnel 'B') which was under occupation.

D5 - Protected work zone exceeded

Figure 16 illustrates the types of events (likely antecedents) which resulted in occurrences (201) where workers, machines or equipment were in the danger zone but outside of the protected area. The category also picked up occurrences where other workers or machines had entered a worksite without the knowledge of the PO. The diagram also illustrates the 54 recorded occurrences which featured in seven other occurrence categories.

Detailed distribution is shown in Table 7.

Figure 16: Protected work zone exceeded

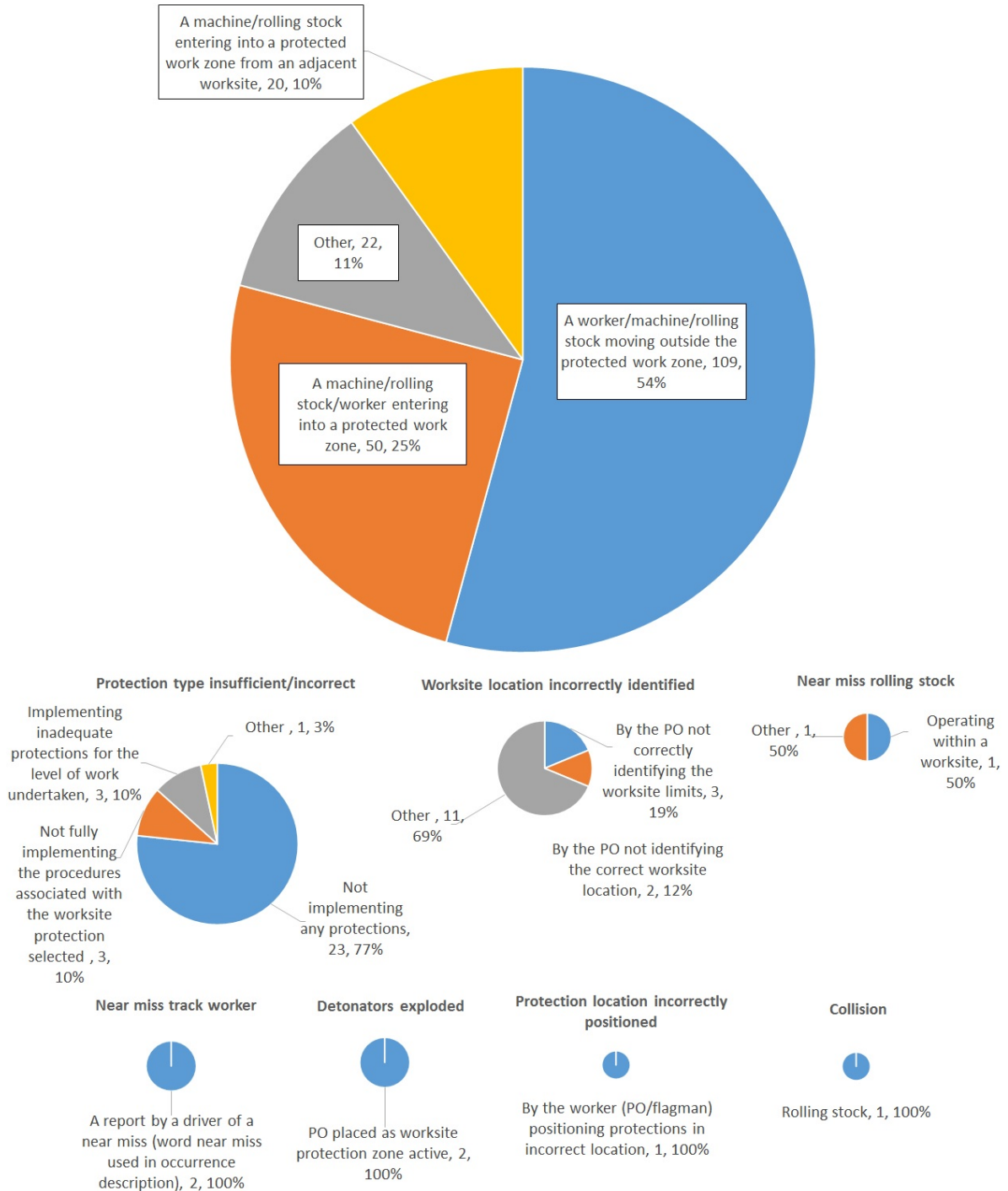


Table 7: Protected work zone exceeded

The 201 recorded occurrences where the danger zone had not been cleared and the subcategories describing the likely antecedents.

Occurrence category		Subcategories	
Protected work zone exceeded	201	A worker/machine/rolling stock moving outside the protected work zone	109
		A machine/rolling stock/worker entering into a protected work zone	50
		Other	22
		A machine/rolling stock entering into a protected work zone from an adjacent worksite	20

The 54 recorded occurrences which featured in seven other occurrence categories, and their respective subcategories.

Occurrence categories associated with protected work zone exceeded			
Protection type insufficient/incorrect	30	Not implementing any protections	23
		Not fully implementing the procedures associated with the worksite protection selected	3
		Implementing inadequate protections for the level of work undertaken	3
		Other	1
Worksite location incorrectly identified	16	By the PO not correctly identifying the worksite limits	3
		By the PO not identifying the correct worksite location	2
		Other	11
Near miss rolling stock	2	Operating within a worksite	1
Near miss track worker	2	Other	1
		A report by a driver of a near miss (word near miss used in occurrence description)	2
Detonators exploded	2	PO placed as worksite protection zone active	2
Protection location incorrectly positioned	1	By the worker (PO/flagman) positioning protections in incorrect location	1
Collision	1	Rolling stock	1

Examples - Protected work zone exceeded

Examples of de-identified occurrence reports are provided below.

- A signal passed at danger (SPAD) alarm was activated for a signal. Upon investigation it was found that a track worker was working outside of the TOA limits and had placed a spirit level onto the tracks setting off the SPAD alarm. TOA limits were from the signal, begin train order sign, to the next yard limit board. The gang was cleared from the track.

- A site audit and compliance check noticed a work group was crossing tracks to access the worksite outside protection limits. This had been occurring from the start of the possession. The work party was stopped and placed in a position a safety. Existing protection was assessed and was extended to cover access area.

D6 - Near collision ('near miss') with a track worker

Figure 17 illustrates the types of events (likely antecedents) which resulted in occurrences (236) where rolling stock nearly collided with track workers. The diagram also illustrates the 82 recorded occurrences which featured in seven other occurrence categories.

Detailed distribution is shown in Table 8.

Figure 17: Near miss track worker

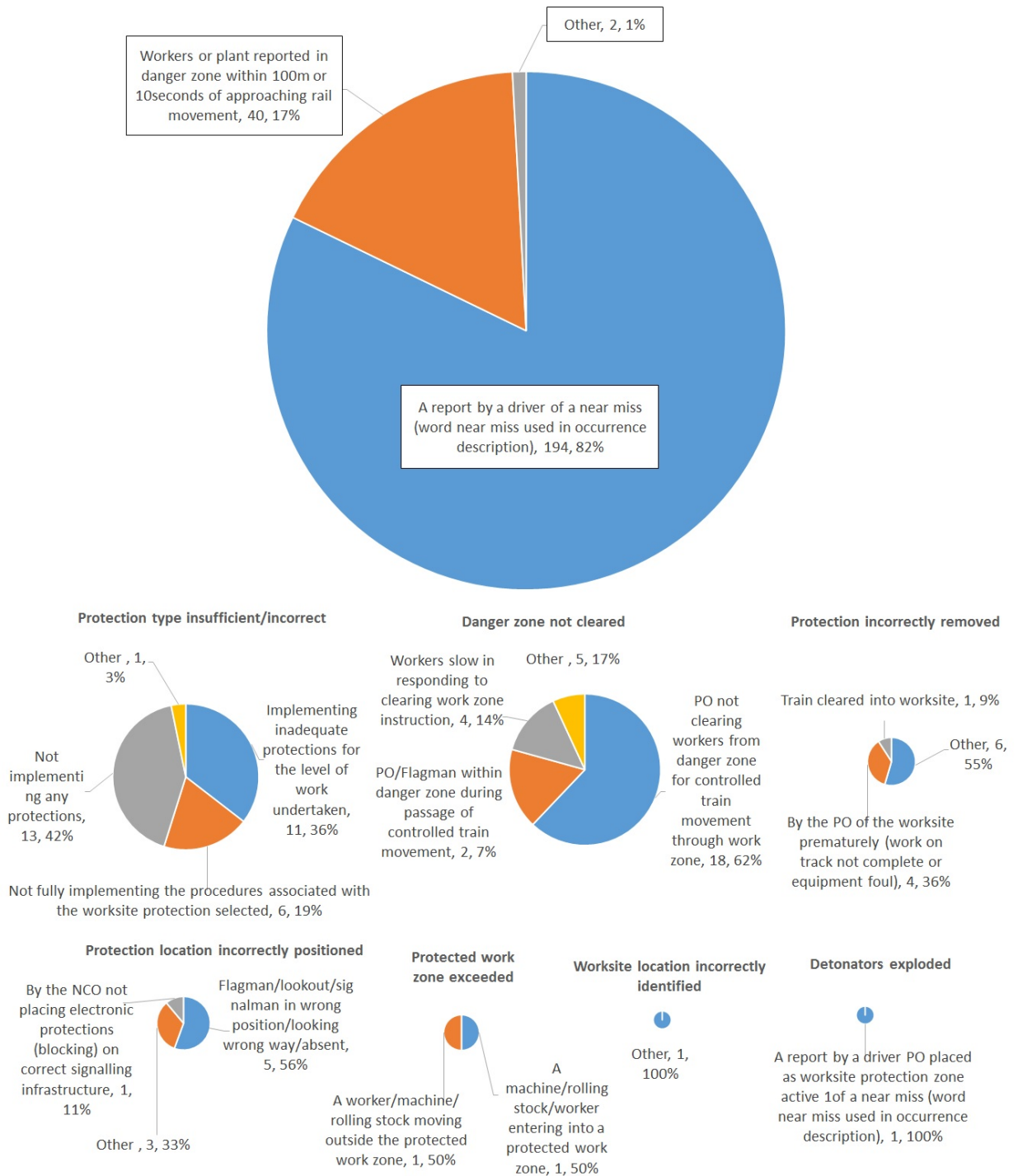


Table 8: Near miss track worker

The 236 recorded occurrences where the danger zone had not been cleared and the subcategories describing the likely antecedents.

Occurrence category		Subcategories	
Near miss track worker	236	A report by a driver of a near miss (word near miss used in occurrence description)	194
		Workers or plant reported in danger zone within 100m or 10seconds of approaching rail movement.	40
		Other	2

The 84 recorded occurrences which featured in seven other occurrence categories, and their respective subcategories.

Occurrence categories associated with near miss track worker			
Protection type insufficient/incorrect	31	Implementing inadequate protections for the level of work undertaken	11
		Not fully implementing the procedures associated with the worksite protection selected	6
		Not implementing any protections	13
		Other	1
Danger zone not cleared	29	PO not clearing workers from danger zone for controlled train movement through work zone	18
		Other	5
		Workers slow in responding to clearing work zone instruction	4
		PO/Flagman within danger zone during passage of controlled train movement	2
		Other	6
Protection incorrectly removed	11	By the PO of the worksite prematurely (work on track not complete or equipment foul)	4
		Train cleared into worksite	1
		Other	6
Protection location incorrectly positioned	9	Flagman/lookout/signalman in wrong position/looking wrong way/absent	5
		Other	3
		By the NCO not placing electronic protections (blocking) on correct signalling infrastructure	1
Protected work zone exceeded	2	A machine/rolling stock/worker entering into a protected work zone	1
		A worker/machine/rolling stock moving outside the protected work zone	1

Examples - Near miss track worker

Examples of de-identified occurrence reports are provided below.

- The driver of a train reported a near miss with track workers following receipt of a green hand signal by the flagman, who appeared to operating without detonators even though the gang was still working on the track.
- The driver of a train loaded with 4500 tonnes of coal and 844 metres long travelling at about 25 km/h reported having a near miss with a track. The track worker had walked out from behind another train travelling in the opposite direction. The crew of the coal train estimated that they missed the person by approximately 1 metre.

D7 - Detonators exploded

Figure 18 illustrates the types of events (likely antecedents) which resulted in occurrences (163) where detonators exploded. The diagram also illustrates the 131 recorded occurrences which featured in seven other occurrence categories.

Detailed distribution is shown in Table 9.

Figure 18: Detonators exploded

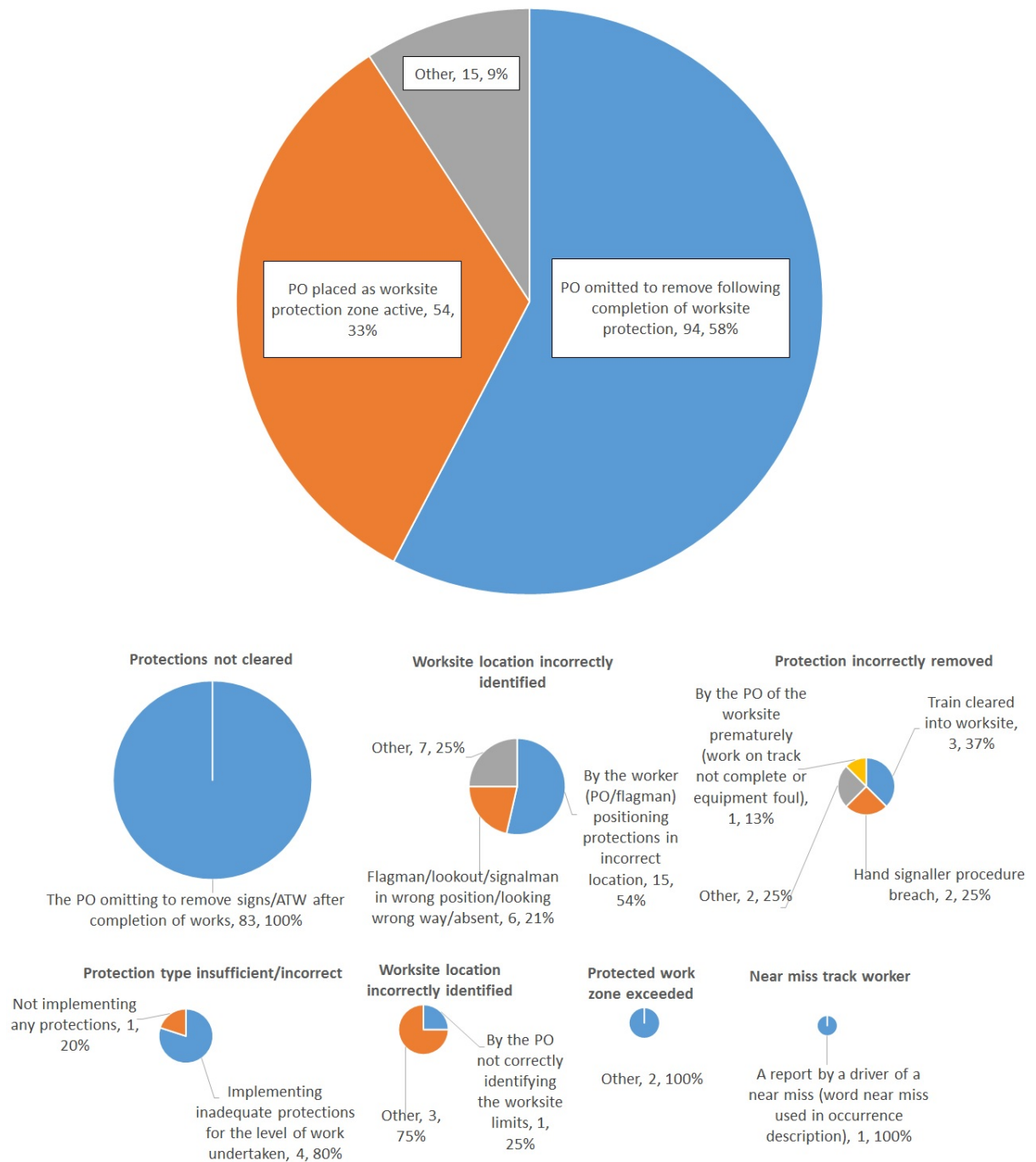


Table 9: Detonators exploded

The 163 recorded occurrences where the danger zone had not been cleared and the subcategories describing the likely antecedents.

Occurrence category		Subcategories	
Detonators exploded	163	PO omitted to remove following completion of worksite protection	94
		PO placed as worksite protection zone active	54
		Other	15

The 131 recorded occurrences which featured in seven other occurrence categories, and their respective subcategories.

Occurrence categories associated with detonators exploded			
Protections not cleared	83	The PO omitting to remove signs/ATW after completion of works	83
Protection location incorrectly positioned	28	By the worker (PO/flagman) positioning protections in incorrect location	15
		Flagman/lookout/signalman in wrong position/looking wrong way/absent	6
		Other	7
Protection incorrectly removed	8	Train cleared into worksite	3
		Hand signaller procedure breach	2
		Other	2
Protection type insufficient/incorrect	5	By the PO of the worksite prematurely (work on track not complete or equipment foul)	1
		Implementing inadequate protections for the level of work undertaken	4
Worksite location incorrectly identified	4	Not implementing any protections	1
		By the PO not correctly identifying the worksite limits	1
Protected work zone exceeded	2	Other	3
		Other	2
Near miss track worker	1	A report by a driver of a near miss (word near miss used in occurrence description)	1

Examples - Detonators exploded

Examples of de-identified occurrence reports are provided below.

- The driver reported they had come to a stand after striking 3 three detonators on the down main line as they approached a signal. The PO was contacted and he advised that he had staff out in that area that were preparing for a planned TWA to be granted and one of them must have put the detonators out early without permission.
- The driver advised they ran over three detonators after being given a steady green flag to proceed. The driver also advised he had received an all clear signal from outer flagman after proceeding over two detonators. The driver brought the train to a stand after hitting three detonators and PO advised him that he was okay to proceed at normal speed as the worksite had been cleared.

D8 - Danger zone not cleared

Figure 19 illustrates the types of events (likely antecedents) which resulted in occurrences (103) where the danger zone had not been cleared when required. The diagram also illustrates the 36 recorded occurrences which featured in five other occurrence categories.

Detailed distribution is shown in Table 10.

Figure 19: Danger zone not cleared

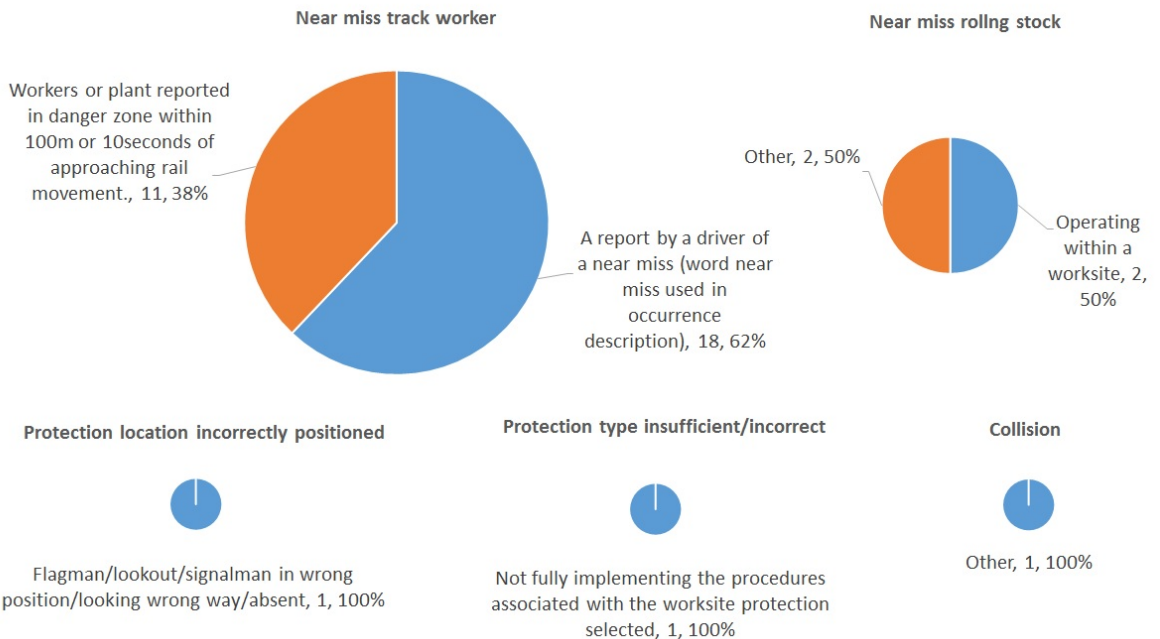
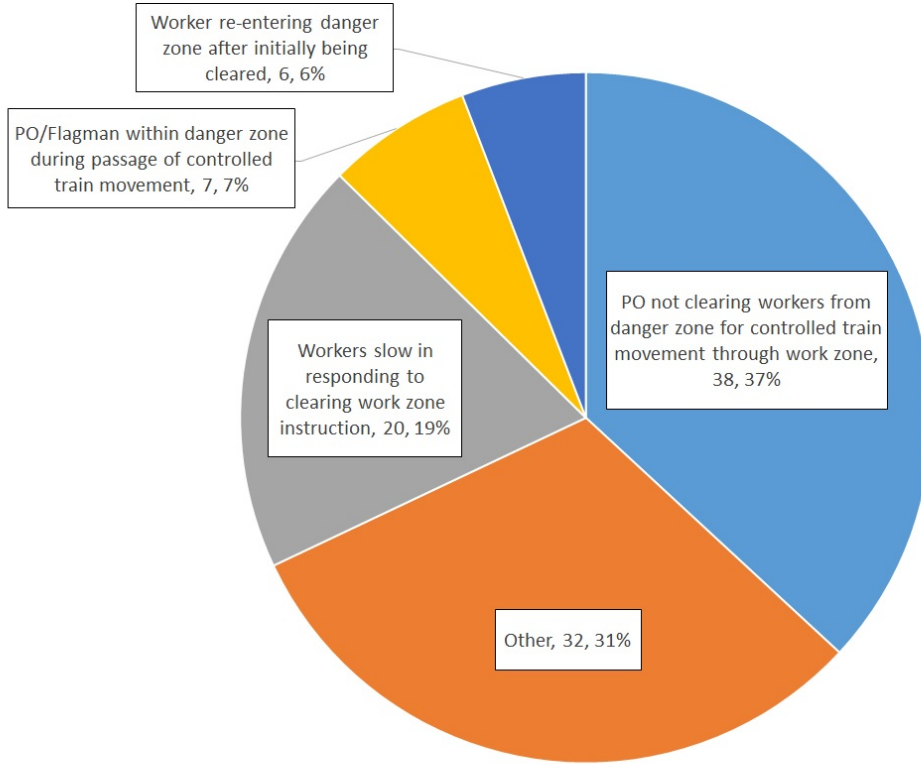


Table 10: Danger zone not cleared

The 103 recorded occurrences where the danger zone had not been cleared and the subcategories describing the likely antecedents.

Occurrence category		Subcategories	
Danger zone not cleared	103	PO not clearing workers from danger zone for controlled train movement through work zone	38
		Other	32
		Workers slow in responding to clearing work zone instruction	20
		PO/Flagman within danger zone during passage of controlled train movement	7
		Worker re-entering danger zone after initially being cleared	6

The 36 recorded occurrences which featured in five other occurrence categories, and their respective subcategories.

Associated Occurrence categories		Associated Subcategories	
Near miss track worker	29	A report by a driver of a near miss (word near miss used in occurrence description)	18
		Workers or plant reported in danger zone within 100m or 10seconds of approaching rail movement.	11
Near miss rolling stock	4	Operating within a worksite	2
Protection location incorrectly positioned	1	Other	2
Protection type insufficient/incorrect	1	Flagman/lookout/signalman in wrong position/looking wrong way/absent	1
Collision	1	Not fully implementing the procedures associated with the worksite protection selected	1
		Other	1

Examples - Danger zone not cleared

Examples of de-identified occurrence reports are provided below.

- The driver of a passenger train reported a near hit with three workers within the danger zone. The driver stated that the horn was sounded and acknowledged, however the workers failed to place themselves in a safe place, and a second warning whistle was sounded. The second warning was not acknowledged, as one of the workers had left a ballast spade beside the line. Believing that the ballast spade may have been foul of the approaching train, the PO directed the worker to remove it. The PO stated that at this time the driver sounded the second horn warning which was not acknowledged as the worker was fetching the spade and if an 'alright' hand signal was displayed it would have signified to the driver that his work crew were clear and in a safe place. The driver then sounded a third horn warning before the workers cleared themselves from the danger zone, at which point the train was estimated by the driver to be around 25m from the workers.
- The driver of a freight train reported that they had been in a near miss with an unidentified track worker. The driver reported that he was travelling at 60 km/h when he saw a worker who was facing in the opposite direction and speaking on a mobile phone. The train was approximately

50 to 100 metres away when the driver noticed the worker and blasted the horn to warn the worker. The worker, who was visibly shaken, was later identified to be a PO who had recently fulfilled a TOA at the location.

D9 - Collisions

Figure 20 illustrates the types of events (likely antecedents) which resulted in reported collisions (6). The diagram also illustrates the four recorded occurrences which featured in four other occurrence categories.

Detailed distribution is shown in Table 11.

Figure 20: Collision occurrences

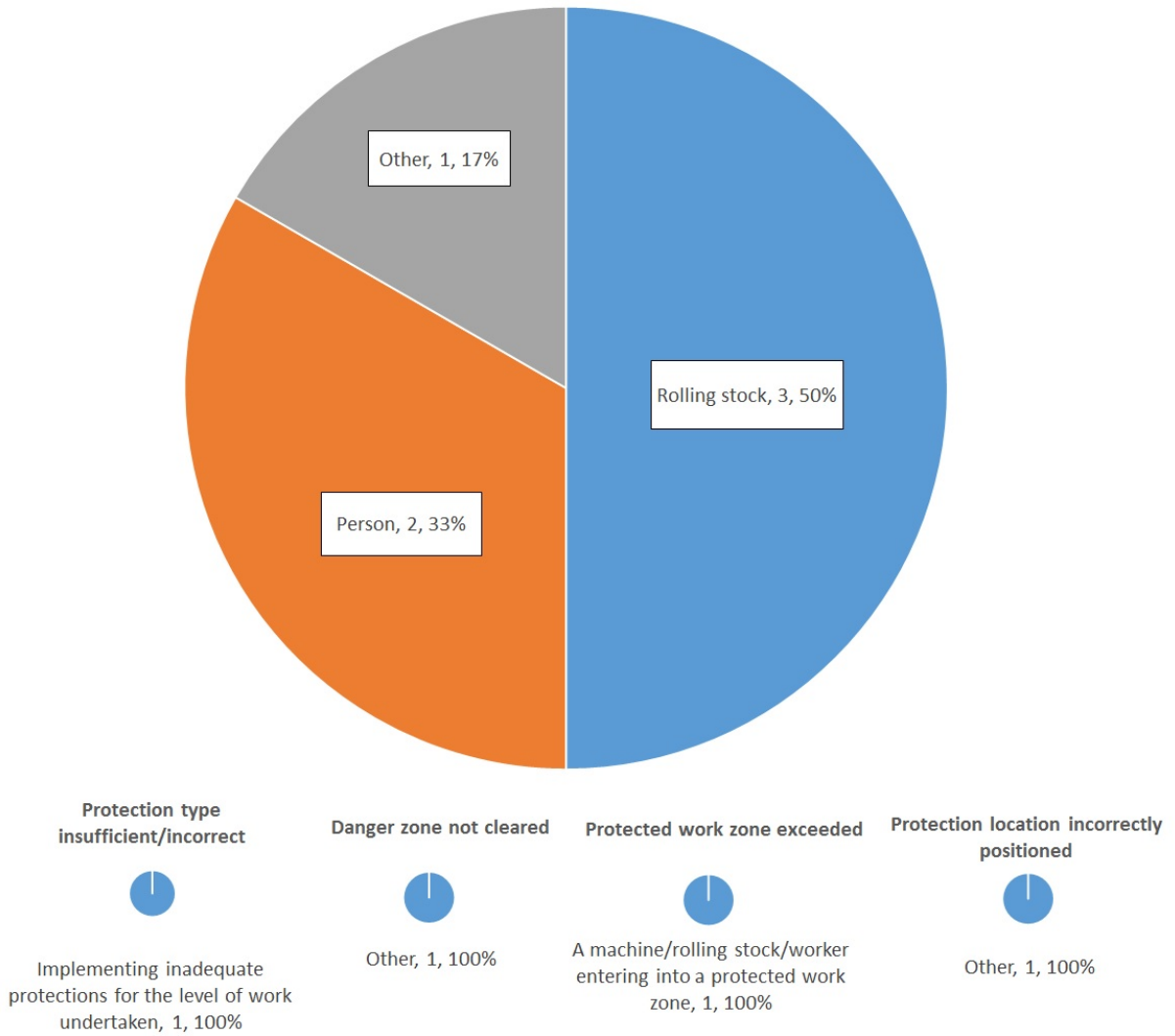


Table 11: Collision occurrences

The six recorded occurrences where the danger zone had not been cleared and the subcategories describing the likely antecedents.

Occurrence category		Subcategories	
Collision	6	Rolling stock	3
		Person	2
		Other	1

The four recorded occurrences which featured in four other occurrence categories, and their respective subcategories.

Occurrence categories associated with collision			
Protection type insufficient/incorrect	1	Implementing inadequate protections for the level of work undertaken	1
Danger zone not cleared	1	Other	1
Protected work zone exceeded	1	A machine/rolling stock/worker entering into a protected work zone	1
Protection location incorrectly positioned	1	Other	1

Examples - Collision occurrences

Six occurrences in the data set were recorded as collisions. Three of these involved collisions with rolling stock. One of these involved a collision between a freight train and an (unoccupied) excavator (ATSB investigation [RO-2011-018](#)), the second occurrence involved a collision between a ballast regulator and road rail vehicle, and the third involved a collision between a train and a road rail (Hi-Rail) vehicle. Of the two collisions with track workers, one occurrence involved a collision between a passenger train and an occupied hi-rail excavator. This occurrence is the only fatality identified in the occurrence notification data set and was investigated by the ATSB (investigation number [RO-2010-004](#)). The other occurrence involved a train striking a lookout. The collision occurrences coded as collision – other, involved a train striking a rail drill with no injuries or damage to track.

D10 - Near collision ('near miss') with rolling stock

Figure 21 illustrates the types of events (likely antecedents) which resulted in reported near misses with rolling stock (21). The diagram also illustrates the seven recorded occurrences which featured in three other occurrence categories.

Detailed distribution is shown in Table 12.

Figure 21: Near miss rolling stock

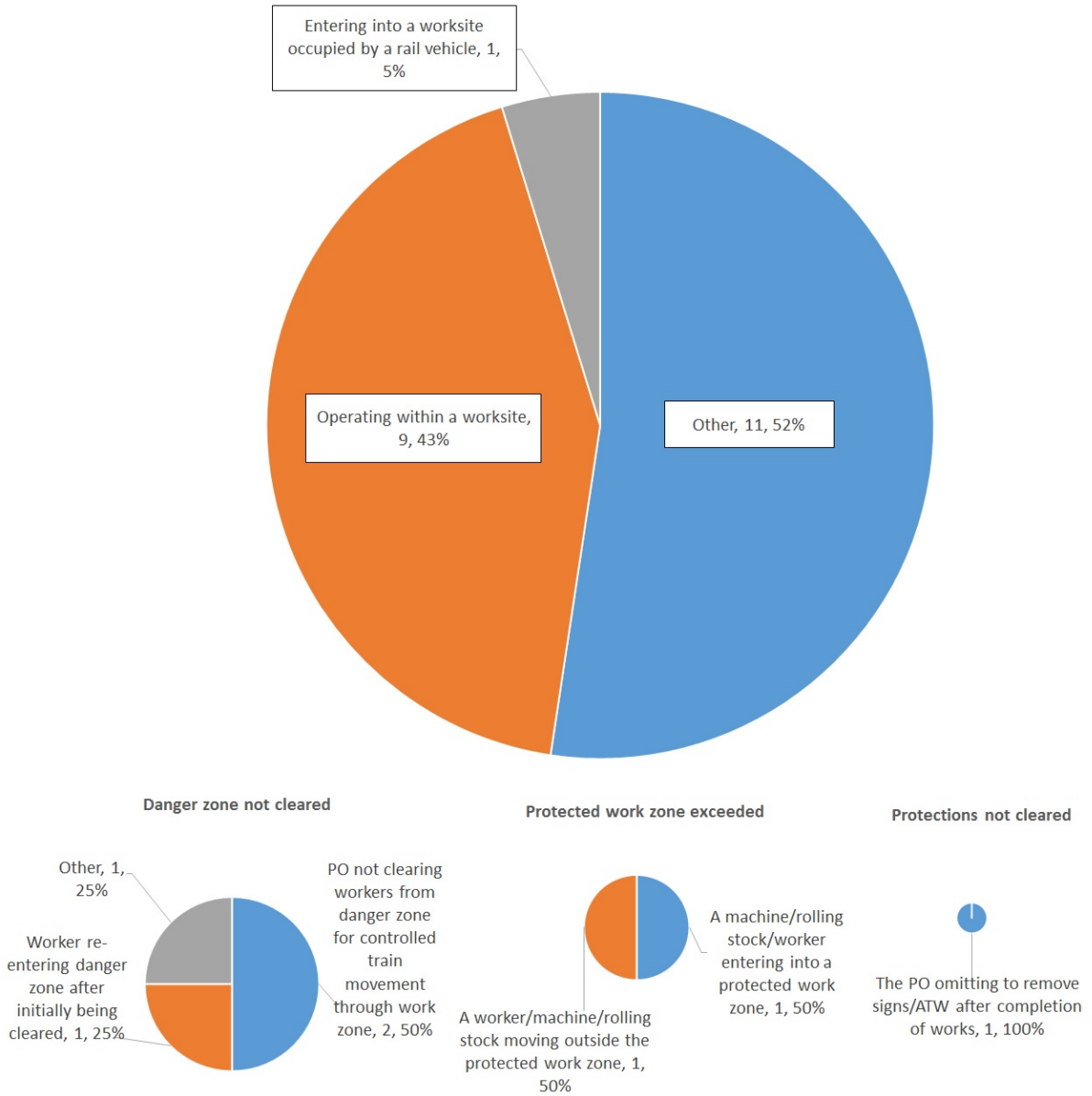


Table 12: Near miss rolling stock

The 21 recorded occurrences where the danger zone had not been cleared and the subcategories describing the likely antecedents.

Occurrence category		Subcategories	
Near miss rolling stock	21	Other	11
		Operating within a worksite	9
		Entering into a worksite occupied by a rail vehicle	1

The seven recorded occurrences which featured in three other occurrence categories, and their respective subcategories.

Occurrence categories associated with near rolling stock			
Danger zone not cleared	4	PO not clearing workers from danger zone for controlled train movement through work zone	2
		Worker re-entering danger zone after initially being cleared	1
		Other	1
Protected work zone exceeded	2	A machine/rolling stock/worker entering into a protected work zone	1
		A worker/machine/rolling stock moving outside the protected work zone	1
Protections not cleared	1	The PO omitting to remove signs/ATW after completion of works	1

Examples - Near miss rolling stock

Examples of de-identified occurrence reports are provided below.

- The driver of a train reported a near miss with a work crew near the track who were unloading sleepers off a truck with an excavator. The arm of excavator swung over track in front train and was cleared when train was 150 metres from work group.
- A train crew reported a near miss with a tip truck with trailer that was backed up against shoulder ballast removing old sleepers. The crew reported missing the truck by approximately 2 feet.

D11 - Protections not cleared

Figure 22 illustrates the types of events (likely antecedents) which resulted in reported near misses with rolling stock (155). The diagram also illustrates the 85 recorded occurrences which featured in three other occurrence categories.

Detailed distribution is shown in Table 13.

Figure 22: Protections not cleared

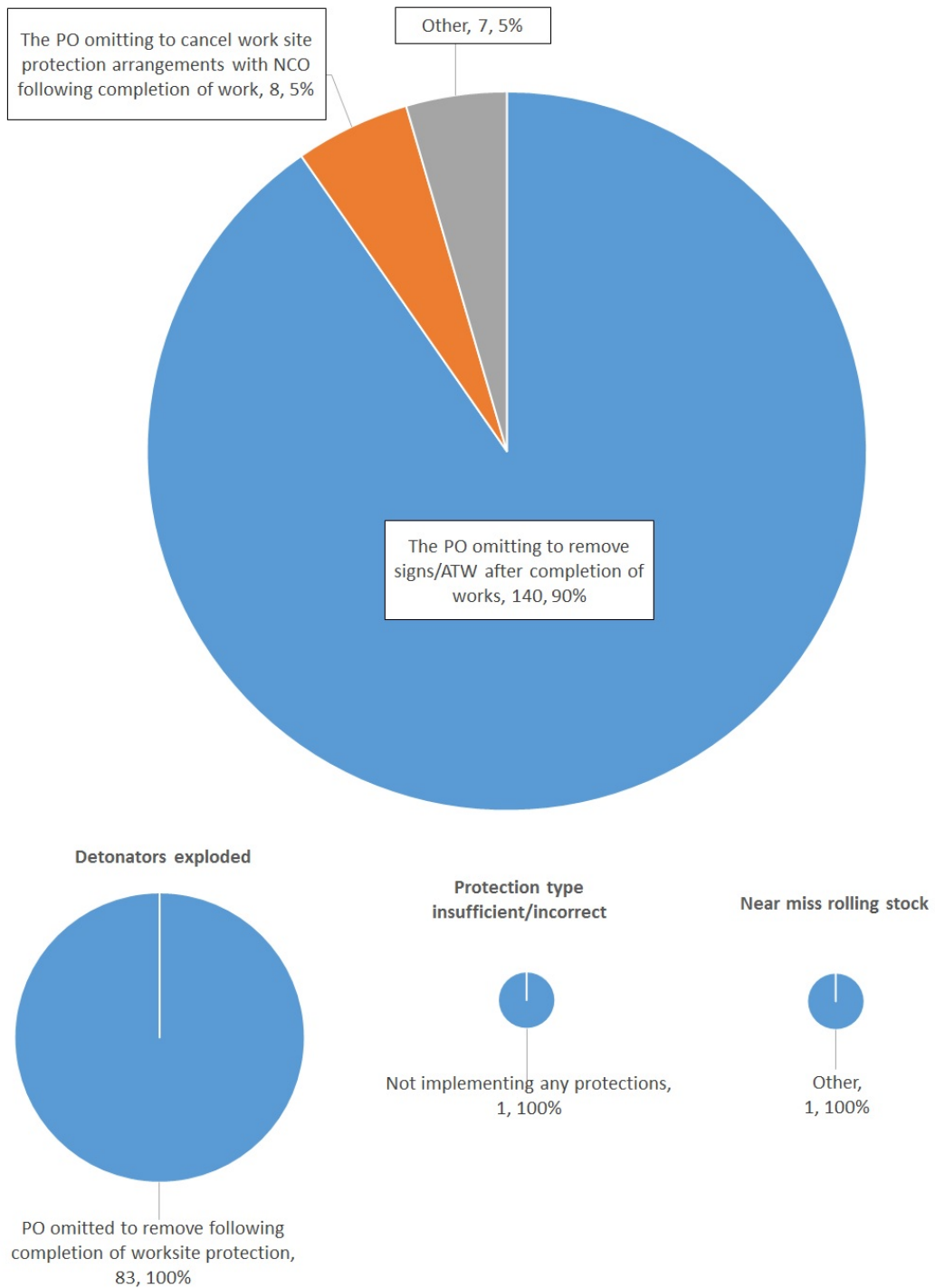


Table 13: Protections not cleared

The 155 recorded occurrences where the danger zone had not been cleared and the subcategories describing the likely antecedents.

Occurrence category		Subcategories	
Protections not cleared	155	The PO omitting to remove signs/ATW after completion of works	140
		The PO omitting to cancel work site protection arrangements with NCO following completion of work	8
		Other	7

The 85 recorded occurrences which featured in three other occurrence categories, and their respective subcategories.

Occurrence categories associated with protections not cleared			
Detonators exploded	83	PO omitted to remove following completion of worksite protection	83
Protection type insufficient/incorrect	1	Not implementing any protections	1
Near miss rolling stock	1	Other	1

Examples - Protections not cleared

Examples of de-identified occurrence reports are provided below.

- The driver reported that they had exploded three detonators and was sitting facing a red flag. A PO had taken out a verbal TOA for a worksite but the work had ceased with the possession fulfilled.
- The driver reported running over three detonators. Detonators were left behind by a PO who had a TOA for a worksite which was fulfilled.
- The driver reported that he had struck three detonators and a flag at the. A track worker reported that he had sent a worker out to retrieve the detonators and flag when he fulfilled his TOA, however the worker had travelled in the wrong direction.
- A freight train came to a stand after running over three detonators and red light left on the line after track possession finished. The PO had delegated the task to another PO for completion but he did not acknowledge the location of the protection.
- Train ran over three detonators and red flag. The PO had TOA that was fulfilled. The network controller rang the PO to ask had he had lifted his detonators when he fulfilled his TOA; he said he had not. The driver was then informed that line ahead clear and to continue.

Glossary

ANRP:	Australian Network Rules and Procedures
ARTC:	The Australian Rail Track Corporation
ASB:	Absolute signal blocking
ATSB:	Australian Transport Safety Bureau
CSB:	Controlled signal blocking
LPA:	Local possession authority
NCO:	Network control officer
NTWSF:	National track worker safety forum
PO:	Protection officer
PPO:	Possession protection officer. Qualified worker to whom train control transferred control of a section of track and who is responsible for coordinating protection of worksites under a LPA.
PTA:	Public transport authority
RIM:	Rail infrastructure manager
RISSB:	Rail Industry Safety Standards Board
RTO:	Rail transport operator. A rail infrastructure manager, or a rolling stock operator, or a person who is both a rail infrastructure manager and a rolling stock operator.
TOA:	Track occupancy authority
TRI:	Train running information
TWA:	Track working authority

Australian Transport Safety Bureau

The Australian Transport Safety Bureau (ATSB) is an independent Commonwealth Government statutory agency. The ATSB is governed by a Commission and is entirely separate from transport regulators, policy makers and service providers. The ATSB's function is to improve safety and public confidence in the aviation, marine and rail modes of transport through excellence in: independent investigation of transport accidents and other safety occurrences; safety data recording, analysis and research; fostering safety awareness, knowledge and action.

The ATSB is responsible for investigating accidents and other transport safety matters involving civil aviation, marine and rail operations in Australia that fall within Commonwealth jurisdiction, as well as participating in overseas investigations involving Australian registered aircraft and ships. A primary concern is the safety of commercial transport, with particular regard to operations involving the travelling public.

The ATSB performs its functions in accordance with the provisions of the *Transport Safety Investigation Act 2003* and Regulations and, where applicable, relevant international agreements.

Purpose of safety investigations

The object of a safety investigation is to identify and reduce safety-related risk. ATSB investigations determine and communicate the factors related to the transport safety matter being investigated.

It is not a function of the ATSB to apportion blame or determine liability. At the same time, an investigation report must include factual material of sufficient weight to support the analysis and findings. At all times the ATSB endeavours to balance the use of material that could imply adverse comment with the need to properly explain what happened, and why, in a fair and unbiased manner.

Developing safety action

Central to the ATSB's investigation of transport safety matters is the early identification of safety issues in the transport environment. The ATSB prefers to encourage the relevant organisation(s) to initiate proactive safety action that addresses safety issues. Nevertheless, the ATSB may use its power to make a formal safety recommendation either during or at the end of an investigation, depending on the level of risk associated with a safety issue and the extent of corrective action undertaken by the relevant organisation.

When safety recommendations are issued, they focus on clearly describing the safety issue of concern, rather than providing instructions or opinions on a preferred method of corrective action. As with equivalent overseas organisations, the ATSB has no power to enforce the implementation of its recommendations. It is a matter for the body to which an ATSB recommendation is directed to assess the costs and benefits of any particular means of addressing a safety issue.

When the ATSB issues a safety recommendation to a person, organisation or agency, they must provide a written response within 90 days. That response must indicate whether they accept the recommendation, any reasons for not accepting part or all of the recommendation, and details of any proposed safety action to give effect to the recommendation.

The ATSB can also issue safety advisory notices suggesting that an organisation or an industry sector consider a safety issue and take action where it believes it appropriate. There is no requirement for a formal response to an advisory notice, although the ATSB will publish any response it receives.

Australian Transport Safety Bureau

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Investigation

ATSB Transport Safety Report Research Investigation

Safe work on track across Australia
Analysis of incident data, 2009 - 2014

RI-2014-011

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