INDEPENDENT TRANSPORT SAFETY REGULATOR

Rail Industry Safety Report

2010–11

ITSR

Safe transport for NSW

Contents

Abbreviations

ARTC	Australian Rail Track Corporation
ATSB	Australian Transport Safety Bureau
BOCSAR	Bureau of Crime Statistics and Research (NSW)
CRN	Country Regional Network
CSB	Controlled Signal Blocking
DIRN	Defined Interstate Rail Network
LOW	Lookout Working
LPA	Local Possession Authority
MRA	Metropolitan Rail Area
NAR	No Authority Required
OTSI	Office of Transport Safety Investigations
RSRP	Rail Safety Regulators' Panel
SPAD	Signal Passed at Danger (without authority)
TOA	Track Occupancy Authority
TWA	Track Work Authority

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Executive summary

This is the eighth NSW annual Rail Industry Safety Report prepared by the Independent Transport Safety Regulator (ITSR).

It summarises safety performance on the NSW rail network in 2010–11 and considers trends over time. The NSW rail network includes the Metropolitan Rail Area (MRA) network, the Defined Interstate Rail Network (DIRN), the Country Regional Network (CRN), the Hunter Valley Rail Network (Hunter) as well as various heritage and tourist rail systems and private sidings.

The information presented in the report is based primarily on occurrence notification records – the initial written advice of a safety occurrence that a rail transport operator must submit to ITSR in accordance with the *Rail Safety Act 2008*.

The report considers three aspects of rail safety performance:

- *fatality and injury* – fatal and serious injuries as direct measures of harm to people associated with railway operations
- *rail accidents* – those safety occurrences that result in injury or damage, with a focus on accidents with potential for multiple casualties such as passenger train collisions
- *accident precursors* – safety occurrences which do not directly cause harm but serve as warning signs of failures in safety risk controls, for example, a broken rail.

The key findings in relation to each of these areas are summarised below.

Fatality and injury

Passengers

- Two passengers were fatally injured in separate occurrences in 2010–11. One person was struck by a train after falling from a platform. The other died as a result of an alleged assault.
- The number of passenger fatalities has decreased over the past two decades. The rate of serious passenger injury (per passenger journey) in 2010–11 was comparable to that for the previous two years. Almost 85% of serious injuries were the result of falls.
- Two passengers were seriously injured in separate occurrences when struck by a train at a station platform. Six of the eight passenger deaths since 2003-04 were of this nature.

Railway employees

- No employees were killed in NSW in 2010–11. The annual number of employee fatalities over the longer term remains steady at about one per year.
- No employees were seriously injured in train accidents in 2010–11. However, 24 employees were injured as a result of assault, falls and occupational-type incidents.

Members of the public (other than trespass and suspected suicide incidents)

- Three members of the public were killed in 2010–11. All incidents happened at level crossings. Only one was the result of a collision with a train and road vehicle. The remaining incidents were road traffic accidents not involving trains.
- The number of public fatalities associated with train collisions at level crossings has decreased over the past two decades.

Trespass and suspected suicide

- Twenty-eight fatalities in 2010–11 were the result of trespass or suspected suicide. This is the highest annual count since 2005–06.

Rail accidents

Train derailment

- Five running line passenger train derailments occurred in 2010–11. Two of the five incidents involved empty services. Two others occurred on isolated tourist and heritage railways and one on the alpine railway at Perisher.
- Twenty-two running line freight train derailments occurred in 2010–11. Two-thirds of these were associated with low speed movements to or from yards. Several derailments are being investigated by ITSR including the run-away of 28 wagons within Enfield yard in Sydney.
- The rates of running line passenger and freight train derailment (per train km travelled) in 2010–11 were consistent with those for the previous four years.

Train collision

- Ten level crossing collisions between trains and road vehicles occurred in 2010–11. Two of these were potentially higher risk occurrences involving CountryLink passenger trains travelling at high speed and striking cars on the level crossings.
- The number of level crossing collisions has decreased steadily over the past two decades. Contributing factors to this reduction were a large number of crossing closures and level crossing safety upgrades.
- Seven running line collisions between trains occurred in 2010–11. Three incidents involved passenger trains. Two of these involved low speed collisions of empty trains. The other comprised a smashed passenger carriage window from a loose strap on a passing freight train.

Fire

- About 90% of the 176 fires on passenger trains in 2010–11 were associated with arson on the MRA. The incident rate (per passenger journey) was consistent with that for the previous four years.
- The rate of rolling stock-related fire on passenger trains (per train km travelled) has decreased in recent years. Despite this improvement, several occurrences in 2010–11 were serious and involved the evacuation of passengers from trains.
- Twenty-six freight train fires were notified in 2010–11, associated primarily with locomotive faults. The rate of rolling stock-related fire on freight trains (per train km travelled) has increased over the past five years.

Accident precursors

Safeworking system

- The number of signals passed at danger without authority (SPAD) by passenger trains on the MRA has decreased over the past five years.
- A high number of serious failures in the systems to manage the safety of track workers occurred in 2010–11, including several near miss occurrences.

Signal and track

- The number of serious signal and level crossing irregularities in 2010–11 remains low and consistent with historical data.
- The number of broken rails has decreased over time on the MRA and remained steady for the other networks.
- The number of track misalignments has increased on segments of the DIRN.

Rolling stock

- The rates of braking system irregularity and door fault on passenger trains (per train km travelled) have decreased over time.
- The rate of braking system irregularity on freight trains (per train km travelled) has increased over time. Also, axle bearing-related faults on freight wagons were the cause of three running line derailments in 2010–11.

Freight load

- The rates of open door (primarily container doors) and load shift on freight trains (per million train km travelled) have decreased over the past five years.
- There was a marked rise in the number of incidents involving the uneven distribution of load on trains in 2010-11. This is thought to reflect, in part, a reporting change following the issue of an industry alert by ITSR in mid-2010.

Fitness for duty

- The amount of drug and alcohol testing performed by industry in 2010–11 was the highest of the past five years. A large increase in the rate of drug testing was observed for passenger operators. A large increase in alcohol testing for infrastructure maintainers was influenced by one operator increasing their number of tests more than 10-fold.
- The overall detection rate for drugs increased from 0.95% in 2009–10 to 1.05% in 2010–11, with freight operator reports responsible for the majority of the increase.
- The overall detection rate for alcohol decreased from 0.09% in 2009–10 to 0.05% in 2010–11. However results were heavily influenced by the testing activity of one operator. The rate of detection after exclusion of this operator was comparable to that for 2009–10.

Many aspects of the 2010–11 safety performance analysis point towards an improvement in rail safety. Despite two passenger fatalities in 2010–11 there has been a steady decrease in the annual number of passenger fatalities in NSW over the past two decades. Similarly, the number of level crossing collisions has also decreased steadily over the longer term. While level crossing collisions remain one of the major contributors to rail safety risk in NSW, the risks to rail and road users have decreased over time due to a number of safety initiatives undertaken by road and rail authorities under the coordination of the NSW Level Crossing Strategy Council.

A reduction in the underlying risk of certain types of accidents is also suggested, based on decreasing occurrence rates for some key accident precursors. For example, the number of both passenger train SPADs and broken rails on the MRA have decreased over time. ITSR has also noted improvements in the rate of some precursor incidents which previously exhibited adverse trends. These include a decrease in some types of freight train load irregularities over time such as open container doors. This reduces the likelihood of collisions and associated risks particularly on those networks shared with passenger services.

Despite some favourable trends in specific areas, the potential for catastrophic rail accidents on the NSW rail system remains. Two level crossing collisions in 2010–11 involved intercity passenger trains travelling at relatively high speed, thereby exposing passengers and crew of these trains to the chance of serious injury. Twenty-two freight train derailments were notified in 2010–11. While no fatalities or serious injuries were reported for any of these occurrences, they resulted in significant damage and disruption. These derailments arose from a variety of causes including rolling stock failure, human error and track faults.

As well as risks to passengers and train crew, the safety of railways remains vulnerable to faults or deficiencies in procedural-based systems of safeworking. A key issue in this regard is the threat to safety of workers on or about the track. Fortunately there were no track worker fatalities in 2010–11. However, there were more than 100 serious incidents involving failures in the procedural systems used for protecting workers on track, including incidents where the system to prevent trains entering the protected area had failed. The reliance on procedural methods for controlling train movements on non-signalled track, or when normal signalled systems become unavailable, also resulted in a significant number of serious incidents in 2010–11.

Under the co-regulatory model of regulation used across Australia, rail transport operators are responsible for assessing and managing safety risks posed by their operations. ITSR's role as the regulator[1], is to verify and enhance the competency of rail transport operators in this regard. Strategic engagement through education and promotion of better practice is one means by which ITSR achieves its objectives. Examples in 2010–11 included a new program to promote effective lifecycle management of physical rail assets by industry as well as the development of vulnerability and fault tree analysis to focus industry on weaknesses within the systems for protecting workers on track.

Education and promotion is supported by other regulatory approaches as needed. The continued high number of serious irregularities in the management of workers on track required strong regulatory focus. In 2010–11 ITSR conducted 65 inspections of worksites and commenced 18 investigations into specific incidents. A number of issues were also highlighted within the freight sector such as adverse trends in rolling stock fires, brake faults and SPADs. In 2010–11 ITSR undertook more than 50 inspections of freight operators to verify that the risks associated with their operations were being adequately investigated and managed.

For particularly serious incidents or where significant harm was narrowly avoided, ITSR will initiate formal investigation to determine whether breaches of legislation have occurred. In 2010–11 ITSR undertook more than 50 compliance investigations. These included a serious freight train derailment in the Hunter associated with wagon failure and a freight train SPAD at Unanderra in which a train passed a signal at danger by 500 metres.

ITSR's enforcement powers range from facilitation, through statutory notices and up to suspension of accreditation or prosecution in the case of serious breaches of legislation. In 2010–11 ITSR commenced prosecutions of the rail operators involved in a shunting incident at Griffith in 2009 where wagons left rail property and blocked a public road. ITSR also commenced six prosecutions of rail safety workers for offences under the drug and alcohol provisions of the NSW rail safety legislation.

ITSR's 2010–11 regulatory program and operational priorities are described fully in ITSR's Annual Report 2010–11[2].

1 In addition to enforcing the *Rail Safety Act 2008*
2 See ITSR's website <http://www.transportregulator.nsw.gov.au>

1. Introduction

1.1 Industry overview

For ITSR's purposes, a railway is a guided system designed to transport passengers or freight on a railway track, together with related infrastructure and rolling stock. This includes the heavy rail systems of RailCorp and the Australian Rail Track Corporation (ARTC) as well as light rail, monorail and various tourist and heritage operations.

The heavy rail sector in NSW comprises two key segments:

- *below-rail* or track and infrastructure networks
- *above-rail* or fleet and train operations on the networks.

The sector also incorporates ancillary facilities including terminals, stations and sidings and support services such as construction and maintenance of infrastructure.

Below-rail

There are four primary below-rail networks in NSW[3] (Figure 1):

- The Metropolitan Rail Area (MRA) network is centred in Sydney and comprises about 2,000 km of track. It is under the management and control of RailCorp and mainly used by CityRail passenger trains. It also services national and intrastate freight transport.
- The Defined Interstate Rail Network (DIRN) covers almost 3,300 km of track. The DIRN extends beyond NSW and connects the MRA with the other mainland state capitals. It is under the management and control of ARTC and is used primarily for freight transport and long distance passenger trains including CountryLink.
- The Hunter Valley (Hunter) network is about 700 km in length and runs to the port of Newcastle. It is under the management and control of ARTC and mainly used for coal freight. It is also used for other freight and passenger services.
- The Country Regional Network (CRN) covers some 2,700 km of operational and 3,200 km of non-operational lines. It is under the management and control of ARTC on behalf of the Country Rail Infrastructure Authority. The main traffic on this network is bulk commodities including grain. It is also used for other freight and passenger services.

Above-rail

The above-rail segment comprises rail fleets for passenger and freight tasks. A summary of passenger and freight movements over the past five years is shown in Figures 2 to 4.

The passenger segment is dominated by the RailCorp-owned CityRail (Table 1). This is a commuter railway with about 1,700 carriages, 307 stations and providing about 2,600 services per weekday. CityRail provided 294 million passenger journeys in 2010–11 (Table 1), representing more than 99% of all passenger journeys in NSW.

CountryLink, also owned by RailCorp, is the principal provider of long distance passenger rail services. In 2010–11 the CountryLink fleet undertook some 1.9 million passenger journeys to regional NSW and interstate destinations including Melbourne and Brisbane.

Heritage railways also carry passengers in NSW (Table 2). Operators include Zig Zag Railway Co-op Ltd and Sydney Tramway Museum. Some operators use their own track, while others operate on the MRA and the DIRN.

The freight task comprises two main elements – bulk freight such as coal and grain and intermodal freight such as containerised goods. In NSW the largest freight task is coal haulage in the Hunter Valley. Pacific National is the biggest rail freight hauler in NSW (Table 3), representing almost 74% of total freight train km travelled in NSW. For the first time in several years total freight train movements in NSW increased, rising almost 8% from 16.7 million train km in 2009–10 to 17.9 million train km in 2010–11 (Figure 4).

3 In this report, the allocation of incidents to networks (DIRN, MRA etc) is generally based on the nearest reported location as supplied in the occurrence notification. The statistics for each network type may include incidents in yards that adjoin the running line of each network.

Ancillary facilities

Ancillary facilities include stations, terminals and private line connections to the networks. Nearly all operational stations in NSW are controlled by RailCorp. The light rail and monorail tracks and facilities in Sydney, including respective stations, are controlled by Veolia Transport.

Some terminals are owned by above-rail freight operators, for example the Sydney Freight Terminal at Chullora is owned by Pacific National. Other terminals are controlled by third parties, for example Port Waratah (Newcastle) by Port Waratah Coal Services.

Privately owned lines and sidings connected to the NSW network include balloon loops from coal mines, grain silo sidings and lines in industrial areas such as Port Kembla.

Support services

Organisations that construct or maintain infrastructure or rolling stock also need to comply with the *Rail Safety Act 2008*. Some rail transport operators conduct a substantial amount of maintenance in-house. However, for some tasks such as infrastructure maintenance, a comparatively high proportion of work is undertaken by contracting organisations.

Regulation

Rail safety regulation in Australia is based on a co-regulatory model. Under this model, the government determines the legislative framework after consulting with the rail industry. Rail transport operators are responsible for assessing the risks to safety associated with their railway operations and establishing an effective safety management system (SMS) to mitigate the risks either by elimination or by implementing appropriate controls. Rail safety regulators are responsible for accrediting rail transport operators. The purpose of accreditation is to verify a rail transport operator has the systems, capacity and competency to implement its SMS, effectively manage safety risks and assure the safety of its operations. Regulators also monitor the safety performance of rail transport operators through compliance and enforcement activities including audits, targeted inspections and compliance investigations.

Figure 1: Major rail networks in NSW, 2010-11

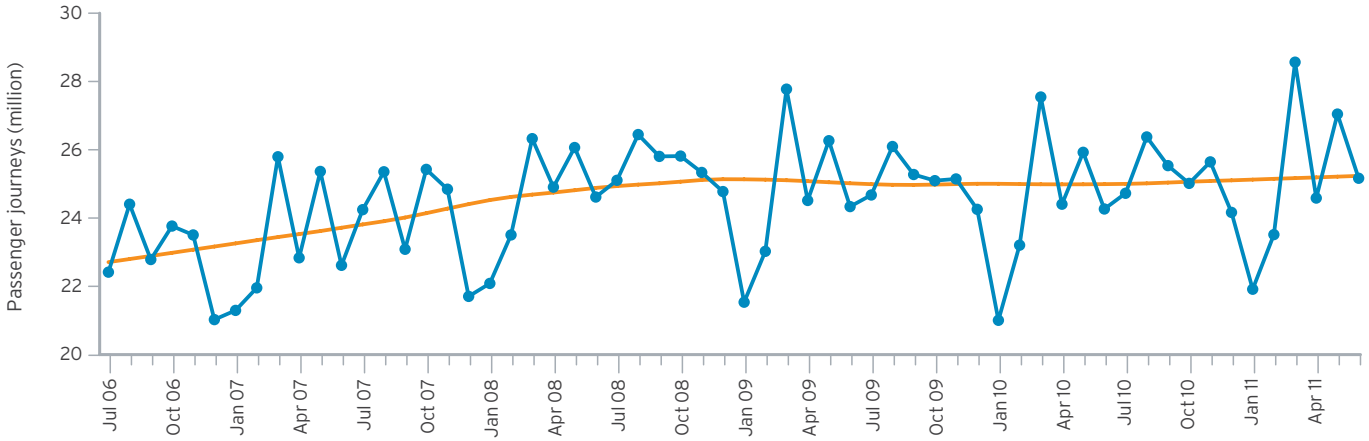


Figure 2: Passenger journeys on the NSW rail network, 2006-07 to 2010-11

Shows monthly total passenger journeys and smoothed trend. Based on data provided by NSW rail transport operators.

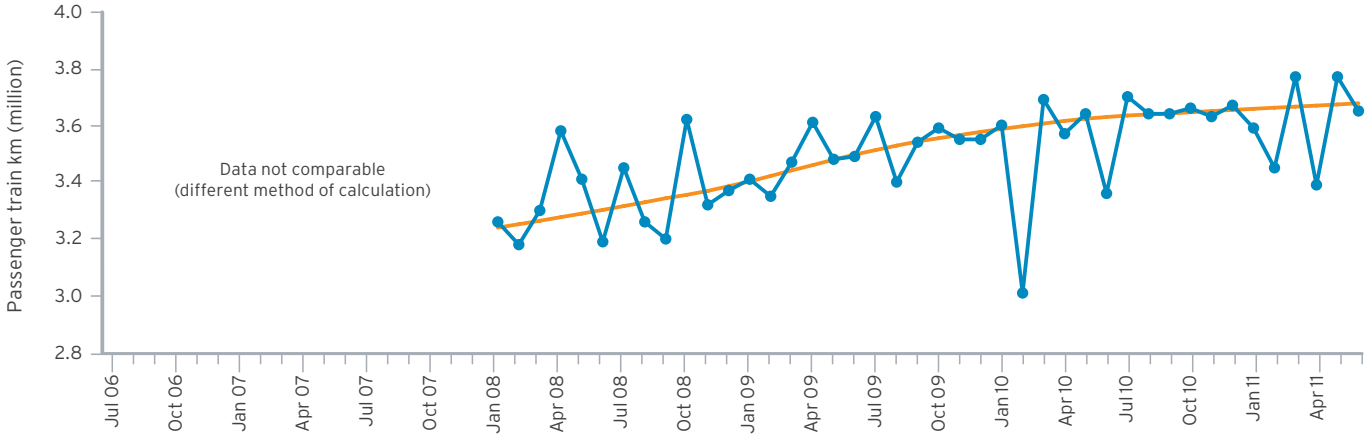


Figure 3: Passenger train km on the NSW rail network, 2006-07 to 2010-11

Shows monthly total passenger train km and smoothed trend. Based on data provided by NSW rail transport operators. Data prior to 2008 not shown due to a change in method of calculation by RailCorp which limits comparability over time.

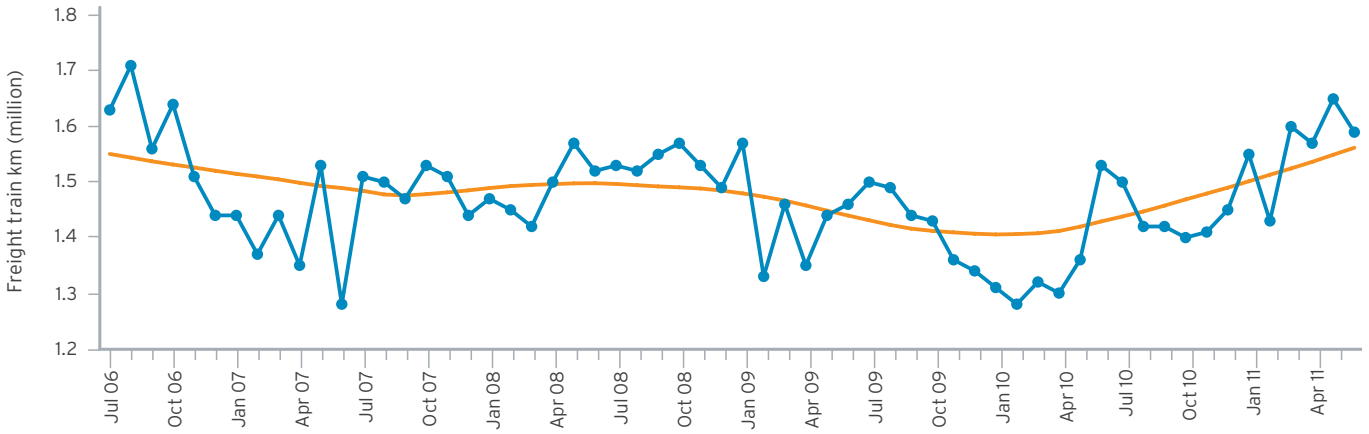


Figure 4: Freight train km on the NSW rail network, 2006-07 to 2010-11

Shows monthly total freight train km and smoothed trend. Based on data provided by NSW rail transport operators.

Table 1: Top five commercial passenger rolling stock operators in NSW (by passenger journeys) 2010–11

Operator	Passenger journeys	Passenger train km
RailCorp – CityRail	294,457,239	37,393,002
Veolia Transport – Light Rail	2,739,053	458,237
Veolia Transport – Monorail	2,363,136	202,689
RailCorp – CountryLink	1,888,346	5,122,960
Perisher Blue Pty Ltd	219,727	76,755

Table 2: Top five tourist and heritage rolling stock operators in NSW (by passenger journeys) 2010–11 (operating as at 30 June 2011)

Operator	Passenger journeys	Passenger train km
Sydney Tramway Museum	83,635	6,608
Zig Zag Railway Co-op Ltd	76,408	30,392
NSW Rail Transport Museum	28,369	22,743
Lachlan Valley Railway Society Co-op Ltd	14,625	18,315
3801 Limited	10,662	13,319

Table 3: Top five freight rolling stock operators in NSW (by freight train km travelled) 2010–11

Operator	Freight train km
Pacific National Pty Ltd	13,399,479
Queensland Rail Pty Ltd	1,227,004
Interail Australia Pty Ltd	840,805
South Spur Rail Services Pty Ltd	728,319
Independent Railways of Australia Pty Ltd	647,381

1.2 Rail safety reporting

Background

Section 63 of the *Rail Safety Act 2008* requires rail transport operators to notify ITSR of safety-related incidents on the NSW rail network. The specific types of incidents to be notified, termed notifiable occurrences, are defined in clause 27 of the *NSW Rail Safety (General) Regulation 2008* and summarised in section 7.

Notifiable occurrences must be reported to ITSR within 72 hours of the rail transport operator becoming aware of the occurrence taking place. Occurrence reports are submitted using a standard form, with the specific information to be provided based on the national guideline for reporting notifiable occurrences (ON-S1 2008)[4].

Notifiable occurrence statistics

For the purpose of analysis and reporting, each notifiable occurrence report received by ITSR is classified into one of the standard national occurrence categories defined in the national occurrence classification guideline (OC-G1, 2008)[5]. Classification is generally done by rail transport operators at the time of notification based on the information available at that time. However, in some circumstances the classification of an occurrence record may change at a later date as further information comes to hand.

4 Rail Safety Regulators' Panel, *Guideline for the Reporting of Notifiable Occurrences: Occurrence Notification – Standard One (ON-S1)*, RSRP, June 2008
5 Rail Safety Regulators' Panel, *Guideline for the Top Event Classification of Notifiable Occurrences: Occurrence Classification – Guideline One (OC-G1)*, RSRP, June 2008

The actual unit of classification under the national occurrence classification guideline is the *top event* of an occurrence. The top event is essentially the event with the greatest adverse outcome. A notifiable occurrence may often comprise several events, for example, a signal passed at danger (SPAD) followed by a derailment at catch points. Under the national occurrence classification guideline this example would be classified (and counted) as a derailment.

Changes in occurrence classification

The national occurrence reporting and classification scheme was revised in June 2008 and implemented by NSW rail transport operators in January 2009. All notifiable occurrence records held by ITSR prior to January 2009 were classified to a former version of the scheme[6]. ITSR continues to reclassify historical records for important types of occurrences to the June 2008 occurrence classification guideline.

Most statistical summaries in this report are based on the national occurrence categories. This includes summaries of related attributes such as person type (for example, *passenger, public, employee*) and train type (for example, *freight train, passenger train*). Where categories or related data items differ from the national occurrence reporting and classification scheme these are noted in the text.

Safety trends through time

ITSR's notifiable occurrence records extend back over 20 years. In this time there have been major changes in the legislative requirements for the type of occurrences to be notified, their classification, data custodianship and associated quality standards. Consequently, some of the observed changes in occurrence rates over time and between sectors are artefacts of changes in the processes governing incident data capture, coding and reporting.

For this report, most historical data series are restricted to the most recent five years, that is, from 1 July 2006. This period of data excludes most of the major changes to reporting processes in NSW. For example, on 1 January 2004, the administration and enforcement of the *Rail Safety Act 2002* was transferred to ITSR. From this time a larger number of rail transport operators undertaking a greater range of operations began notifying occurrences directly to ITSR. Also, the most recent structural changes to the rail industry in NSW occurred during 2004 and the national occurrence reporting and classification scheme was introduced in NSW at the end of that year. However, the period of data in this report is still subject to changes in the reporting process and these issues are noted in the text of relevant chapters.

Informing safety management

Analysis of notifiable occurrence data is important for identifying safety issues and emerging trends. However, notifiable occurrences are lag indicators of rail safety in that they represent failures in safety management that have already progressed to an unacceptable state such as a broken rail, or an adverse outcome such as injury or damage. Further, because of the requirement to notify in a timely manner, notifications often lack information on the underlying causal factors of incidents, which usually only come to light after investigation.

In order to prevent serious incidents such as train collisions and derailments, safety performance monitoring must also incorporate measures of the state of organisational, procedural and behavioural systems designed to prevent accidents. This ensures that safety deficiencies are identified at an early stage, before they escalate to the point of a failure or adverse outcome. Such measures are referred to as lead indicators of safety because they help to flag potential safety issues. Examples of lead indicators include the proportion of required training delivered and the proportion of scheduled safety audits performed.

ITSR therefore uses a variety of safety information, in addition to notifications, to measure safety performance and guide regulatory activity. These include findings from investigations of rail accidents, both within and outside NSW, to identify hazardous events and contributing factors relevant to NSW railways. Safety risk modelling also plays a critical role, particularly in relation to lower frequency, high consequence risks that may not be apparent over the decade or two that occurrence data is available. A large part of ITSR's regulatory activity comprises compliance inspections, which focus on rail transport operators' capacity and competency to identify safety risks relevant to their operations and ensure they are appropriately controlled[7].

6 Rail Safety Regulators' Panel, *Occurrence Categories and Definitions (ON-S1)*, RSRP, August 2004
7 *ITSR's* regulatory activities are described in *ITSR's Annual Report 2010–11*. See *ITSR's* website <http://www.transportregulator.nsw.gov.au>

2. Rail-related fatality and injury

Summary

- 2 passengers were fatally injured in separate incidents in 2010–11. One passenger was struck by a train after falling from a platform and the other died as a result of alleged assault.
- Falls (84%) and alleged assault (11%) account for most of the passenger injuries requiring transport to hospital in 2010–11. The rate of injury (per million passenger journeys) in 2010–11 was comparable to that for the previous two years of available data.
- The annual count of passenger fatalities (all causes) has decreased over the 22 years of available record.
- No employees were fatally injured in 2010–11. The annual number of employee fatalities remains stable at about one per year over the period of record.
- 3 members of the public were fatally injured in separate incidents at level crossings in 2010–11. Only one fatality was the result of a train colliding with a road vehicle. The other two incidents comprised road vehicle accidents on a level crossing.
- 28 fatalities in 2010–11 were the result of trespass or suspected suicide. This is the highest count of the past five years.

The specific threats to a person's safety arising from railway operations will vary, depending on the how that individual interacts with a railway. The national occurrence classification guideline defines four primary categories of 'person' based on an individual's relationship with a railway at the time of the occurrence – *passenger, worker, public* and *trespasser*. Injury statistics and trends for each of these four groups are presented in this section.

A note on injury severity

Under the national occurrence classification guideline, an injured person is counted as a *serious* injury if they are admitted to hospital for the injury. A person is counted as a *minor* injury if they require medical attention but not admission to hospital. The grading of injury severity is therefore based on the nature of medical care received.

Unfortunately, rail transport operators nationally have great difficulty in determining the specific nature of health care received by people after they have left railway premises, for example, determining whether or not a person transported to hospital was formally admitted. Alternative and various criteria are used by rail transport operators to grade injury severity, for example, workplace injury scales[8], and length of time of incapacitation. These criteria vary over time and between operators introducing inconsistency into data and limiting comparability[9].

In this report, instead of using the *hospital admission* definition, serious injury is based on a criterion of *ambulance transported*. Information to support this criterion is generally available in the occurrence narrative and provides an opportunity to delineate more significant injuries in a consistent manner. This criterion is far broader (more inclusive) than the hospital admittance criterion as less than half of all persons presenting at hospital will be admitted. It is, however, similar to definitions used elsewhere[10].

8 Standards Australia, *Workplace Injury and Disease Recording Standard*, AS 1885.11990, SA, Homebush, 1990
9 Issues with injury reporting and classification are within the scope of the National Data Strategy, led by the Rail Safety Regulators' Panel
10 For example, Office of Rail Regulation, *National rail trends 2010–11 yearbook*, ORR, London, 2011

2.1 Passengers

There were two passenger fatalities on the NSW rail network in 2010–11 (Table 4). One person was killed after falling from a platform and being struck by a train. The other fatality was the result of a security incident and has been classified as an *alleged assault*.

Another 539 passengers received injuries that required transport to hospital in 2010–11 (Figure 8). This corresponds to an injury rate of 1.79 episodes per million passenger journeys which is similar to that observed over the previous two years of available data (1.73). Almost 85% of injuries were associated with falls on railway property, primarily on stairs and platforms (Figure 6). Alleged assault accounted for 11% of all persons injured.

Patterns of injury and fatality over the shorter term are useful indicators of personal accident risk from incidents such as falls and assault, because these occur at sufficient frequency to monitor change. However, they do not accurately reflect the full risk profile of a railway, particularly in relation to potentially catastrophic rail accidents such as passenger train collisions and derailments. While such accidents remain relevant under the current level of risk control they are rare and by chance may not be captured in shorter data series.

The longer term pattern of annual passenger fatalities is shown in Figure 5. Passenger fatalities have decreased over the 22-year period of record from a median of six fatalities per year in the first decade to one fatality per year in the decade to 2010–11. The nature of fatal occurrences has also changed over time. The main cause of passenger fatality in the first decade was individual accidents associated with falls from trains. A program of central locking in urban and interurban passenger services in the late 1990s virtually eliminated this type of occurrence[11].

The main cause of passenger fatality in more recent years remains individual accidents. Six of the past eight passenger fatalities were the result of falls from platforms into the path of trains. The remaining two fatalities were the result of assaults. Longer term information on assault-related incidents[12] is compiled by the NSW Bureau of Crime Statistics and Research (BOCSAR) based on crimes reported to, or detected by, police. The rate of recorded criminal assault incidents on railway premises in 2010–11[13] (4.7 per million passenger journeys) remains the same as that observed over the longer term (Figure 7).

It has been more than eight years since the last multi-fatality passenger train accident in NSW (Waterfall accident, January 2003). While these types of accidents are rare they still contribute a significant proportion of total risk. The three multi-passenger fatality accidents in NSW shown in Figure 5 represent about 3% of all fatal incidents but almost 20% of all passenger fatalities. The absence of a catastrophic rail accident over an extended period in NSW does not necessarily mean the risk is no longer relevant. Section 4 of this report presents summary statistics for a range of accident precursors which serve as warning signs of accidents which are still possible under the current risk control framework of NSW railways.

Table 4: Fatalities on the NSW rail network, 2010–11

Excludes fatalities associated with trespass, suicide and ill-health.

Date	Category	Location	Description
1 September 2010	Level crossing collision - train and road vehicle	Wee Waa (CRN)	Light locomotives collided with utility at a passive level crossing. The driver of the car was fatally injured.
7 March 2011	Level crossing damage / interference	Tanyinna (DIRN)	Two cars collided and blocked a level crossing resulting in closure of rail line. Occupant of one road vehicle was fatally injured.
12 March 2011	Level crossing damage / interference	Old Junee (CRN)	Motorcycle struck and damaged level crossing infrastructure. The motorcycle rider was fatally injured.
13 March 2011	Train collision with person	Springwood (MRA)	Person fell from platform and was struck by CityRail interurban passenger service.
25 May 2011	Alleged assault	Bankstown (MRA)	Fight on platform between two groups of people. One person reported to have suffered fatal stab wounds.

11 Independent Transport Safety and Reliability Regulator, *Train door emergency egress and access and emergency evacuation procedures*, ITSRR, November 2004
12 As defined in: Australian Bureau of Statistics, *Australian and New Zealand standard offence classification (ANZOC)*, cat. no. 1234.0, ABS, 2011
13 NSW Bureau of Crime Statistics and Research, unpublished quarterly criminal incident statistics (quarterly update to end June 2011), 8 September 2011

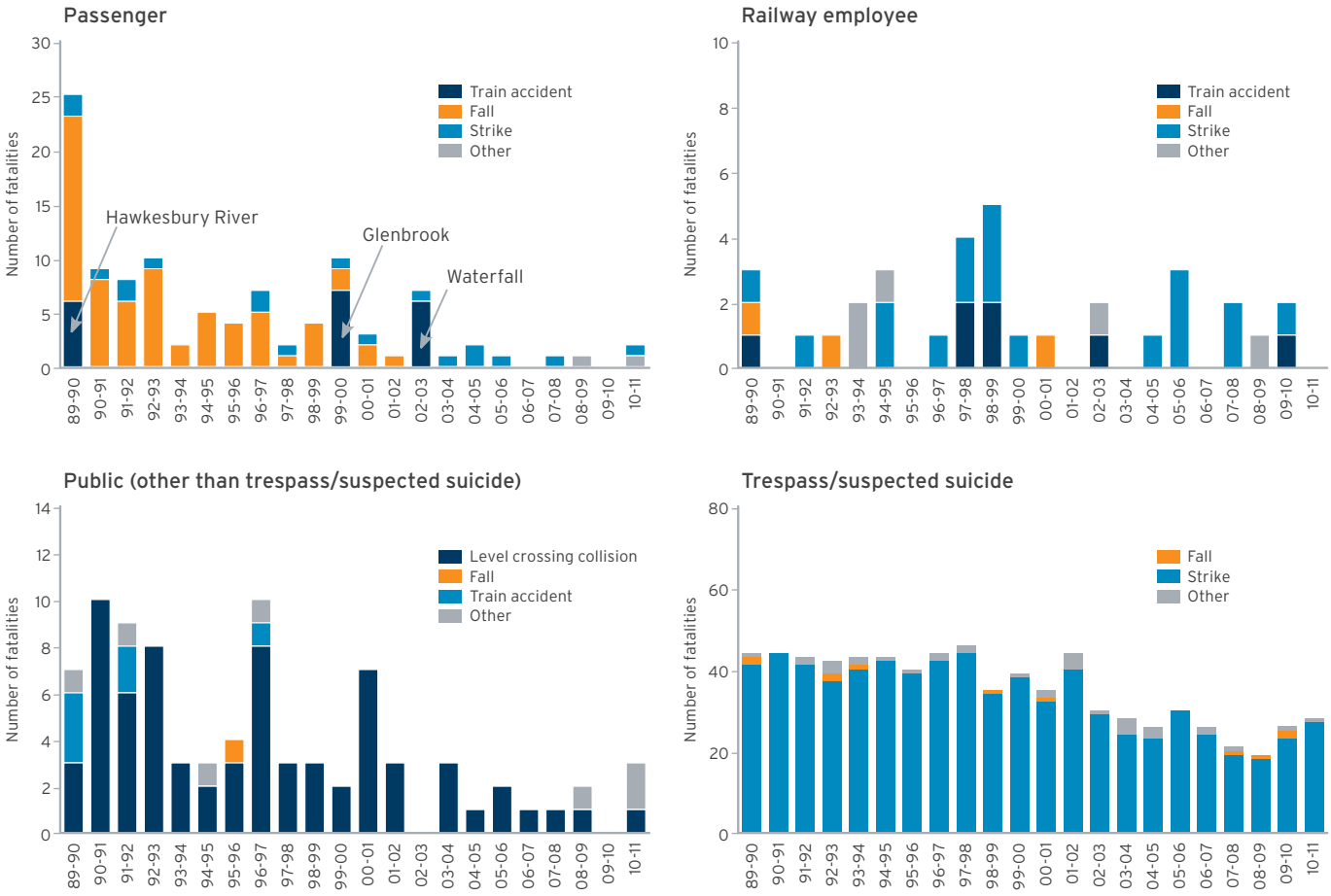


Figure 5: Rail-related fatality on the NSW rail network, 1989–90 to 2010–11

Vertical bar is annual fatality count. *Employee* includes *volunteer* and *contractor*. Excludes fatalities associated with ill-health for example, stroke. *Strike* is collision of train with person. Labelled bars for passenger fatalities indicate multi-fatality train accidents.

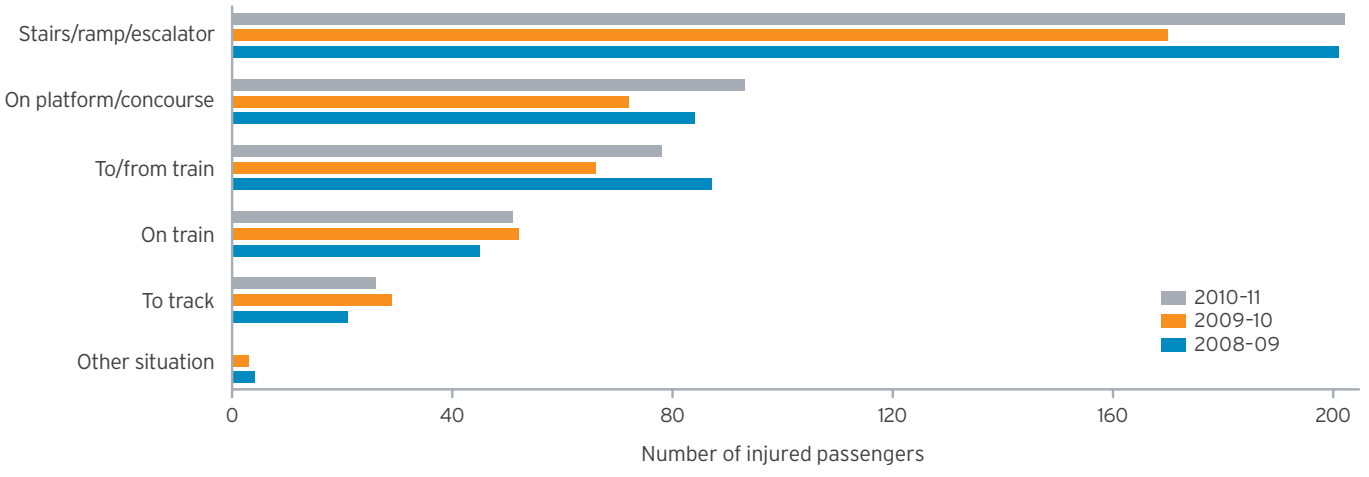


Figure 6: Fall-related passenger injury on the NSW rail network, 2008-09 to 2010-11

Passengers injured and requiring transport to hospital.

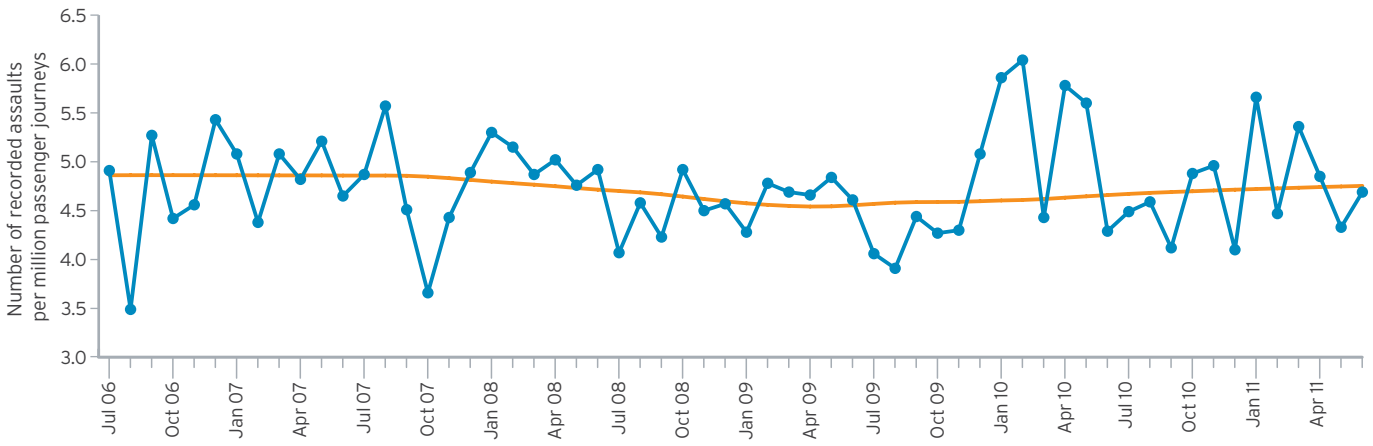


Figure 7: Assault on rail premises in NSW, 2006-07 to 2010-11

Shows monthly total rate and smoothed trend. Based on recorded criminal incidents from BOCSAR and passenger journey data reported to ITSR by rail transport operators.

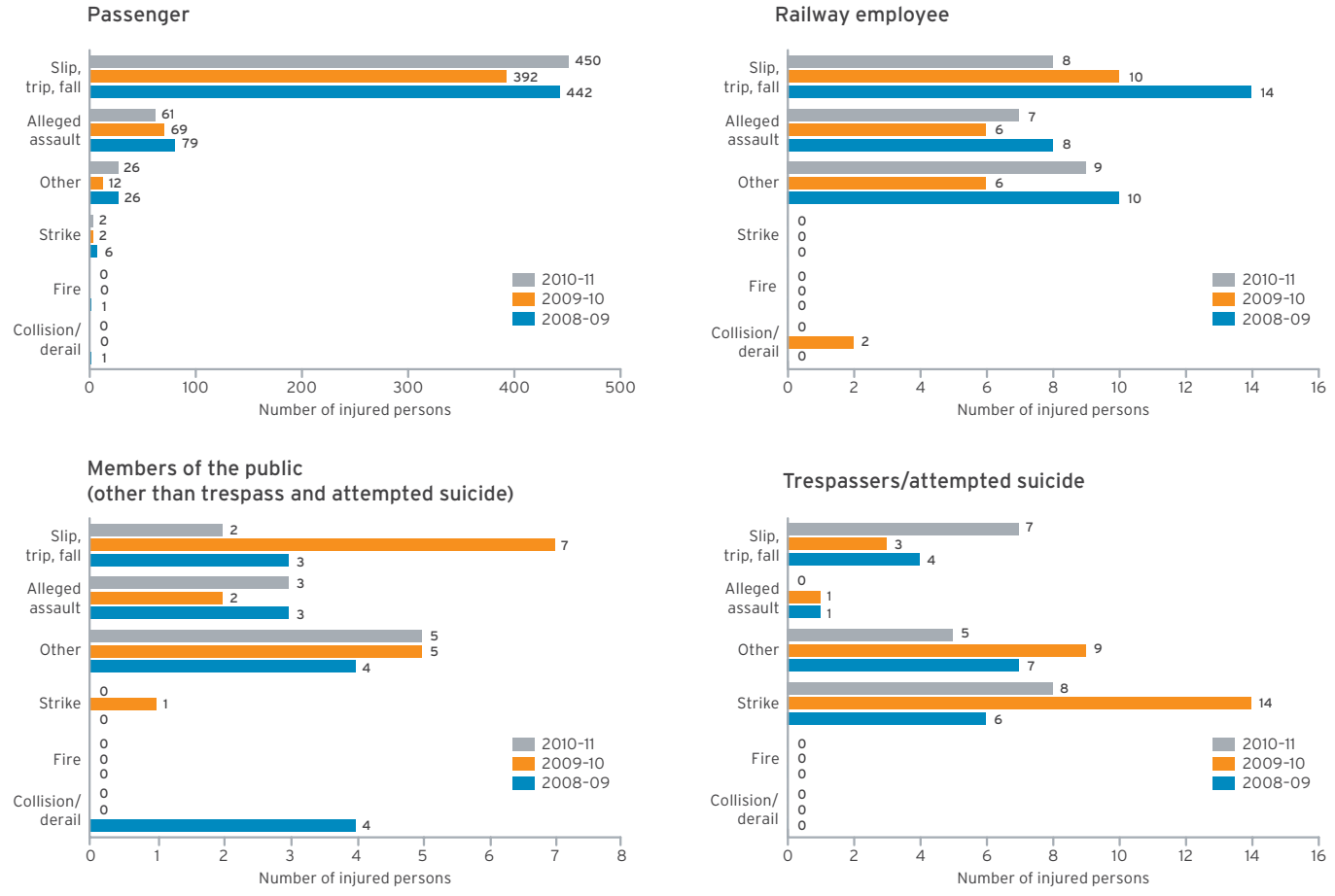


Figure 8: Number of people injured and transported to hospital on the NSW rail network, 2010-11

Totals for earlier years may differ from previously reported figures due to revisions. *Employee* includes *volunteer* and *contractor*. *Strike* is collision of train with person.

2.2 Railway employees

There were no fatal accidents involving railway employees on the NSW rail network in 2010–11. The last two fatalities occurred in 2009–10 in separate occurrences. Both involved track workers fatally injured as a result of being struck by trains that entered the section of track where work was taking place. About one-third of all employee fatalities were associated with accidents of this nature, based on the 22-year fatality history (Figure 5).

While there were no track work-related fatalities in 2010–11 the risk is still present. Section 4.2 of this report describes in detail the large number of serious irregularities in systems for protecting workers on track including several near misses. The safety of track workers and the effectiveness of the available methods for their protection was a regulatory priority for ITSR in 2010–11 and this issue is also discussed further in section 4.2.

Non-fatal employee injuries were distributed equally among three occurrence categories – *slip, trip, fall; alleged assault* and *other* (Figure 8). The latter category comprised workplace-type incidents including crush injuries, persons struck by equipment and electrocution.

2.3 Members of the public (other than trespass and suicide)

Three members of the public were fatally injured in separate occurrences in 2010–11 (Table 4). All three incidents occurred at level crossings. However, only one involved a collision with a train. The remaining two comprised road vehicle accidents that damaged level crossing infrastructure.

Ten members of the public were injured in 2010–11 (Figure 8). This was comparable to the previous two years, noting the generally low counts and uncertainty concerning the relevance of some of these incidents to railway operations[14]. The most common form of public injury in 2010–11 was associated with road vehicle accidents on public roads where cars entered the rail corridor (four occurrences in 2010–11).

The 22-year history of public fatalities on the NSW rail network is shown in Figure 5. There has been a gradual decrease in public fatalities over this period from a median of 5.5 fatalities per year in the first decade to 1.5 fatalities per year in the decade to 2010–11. This improvement reflects the gradual reduction in train collisions at level crossings, which is the primary means members of the public (other than passengers) are exposed to rail-related risk.

Another relevant risk to the public in NSW is associated with pedestrians moving about the Sydney light rail system. One member of the public was struck by a light rail vehicle in 2010–11, receiving only minor injuries. There have been 12 such occurrences notified to ITSR in the five years to June 2011.

Table 5: Non-fatal injury (excluding falls) on the NSW rail network, 2010–11

Persons injured and requiring transport to hospital as a result of railway-related accidents. Excludes *slip, trip, fall; trespass, attempted suicide, alleged assault* and occurrences not classified under the national occurrence classification guideline, for example, some workplace-type injuries.

Date	Category	Location	Description
18 March 2011	Train collision – running line – with person	Central (MRA)	Passenger fell on platform and struck side of departing train. Passenger taken to hospital by ambulance.
26 May 2011	Train collision – running line – with person	Flemington (MRA)	Two people fighting on platform fell into side of passing empty train. One person transported to hospital with head injuries.

14 For example, falls in areas accessed by both passengers and the general public

2.4 Trespassers (including suicide)

A note on trespasser casualty statistics

Trespasser casualties are considered separately from others because they are associated with wilful violations and are therefore beyond the direct control of railways. Trespass-related injury may be either accidental (for example, an unintended consequence of vandalism or taking a short cut across tracks) or the result of intentional self harm. It is important for railways to distinguish between accidental injury and intentional self harm because preventative strategies will differ according to motive. However, in this report the two types of casualty are combined because the specific intent of an injured or deceased person cannot be reliably determined at the time of the occurrence. In the case of fatality, a coronial inquiry is required to confirm a death as suicide and even then a statement of intent may not be made by the coroner.[15]

There were 28 fatalities associated with acts of trespass or suspected suicide in 2010–11. Based on the initial description of incident circumstances at the time of notification, about 80% of these incidents appeared to be acts of suicide.

All but one of the fatalities were the result of a person struck by a train. The remaining fatality involved a person electrocuted while riding on the roof of a passenger carriage. Twenty-six of the occurrences were on the MRA.

Twenty people required transport to hospital for injuries associated with trespass or attempted suicide in 2010–11 (Figure 8). Eight of these occurrences involved persons being struck by a train. The remainder involves injuries associated with falling or jumping on/from rail premises.

Previous rail industry safety reports have noted a decrease over time in the annual count of trespass / suspected suicide fatality since the late 1990s. However, the number of fatalities in 2010–11 was markedly higher than expected based on the historically observed decreasing trend (Figure 5). It also represents the second successive year of increase from a historical low of 18 fatalities in 2008–09.

While these types of occurrences are beyond the direct control of railways, rail transport operators seek to influence behaviour and reduce trespass by various means including surveillance, education, and maintenance of fencing along higher risk areas of the corridor. These types of incidents can also introduce other safety risks associated with interruptions to services, crowding on platforms etc.

15 To improve the accuracy of coding with regard to intent ITSR will undertake a project in 2011-12 to validate notifiable occurrence records against records held in the National Coroners Information System <National Coroners Information System, Victorian Institute of Forensic Medicine>

3. Accidents and other key rail safety occurrences

This section presents statistics for the four national occurrence categories that are most closely associated with significant accidents: *derailment, level crossing collision, train collision* and *fire*. Subsets of incidents within each of these national categories represent high risk occurrences, that is, with potential to cause multiple injuries and fatalities. It is the higher risk occurrences that are the focus of this chapter.

3.1 Train derailment

Summary

- 41 derailments on or affecting the safety of running lines were notified in 2010–11.
- 5 running line passenger train derailments were notified in 2010–11 with no injuries reported for any of these occurrences.
- 22 freight train derailments were notified in 2010–11 with no injuries reported for any of these occurrences. Two thirds of these were associated with movements to or from yards.

Derailments arise from a number of causes including rolling stock irregularities, track irregularities and human error. A total of 41 running line and 167 yard derailments were notified to ITSR in 2010–11. Running line derailments are typically the higher risk of the two subcategories and are summarised in Figure 9.

Eighteen of the 41 running line derailments notified in 2010–11 occurred on the DIRN and Hunter network (Figure 9). Almost half of running line derailments since 2006–07 have occurred on the DIRN and Hunter network. The majority of the remaining running line derailments in 2010–11 occurred on the CRN and MRA (12 and 6 occurrences respectively). This remains within the pattern observed over the previous years (Figure 10).

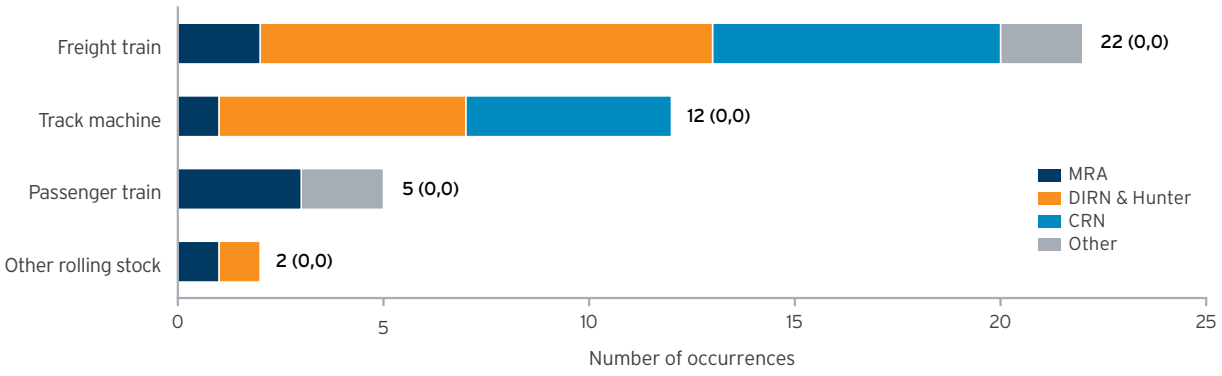


Figure 9: Derailment (running line) on the NSW rail network, 2010–11

In brackets are number of fatalities and number of injured people transported to hospital respectively. *Other rolling stock* comprises light locomotives and non-powered rolling stock such as freight wagons.

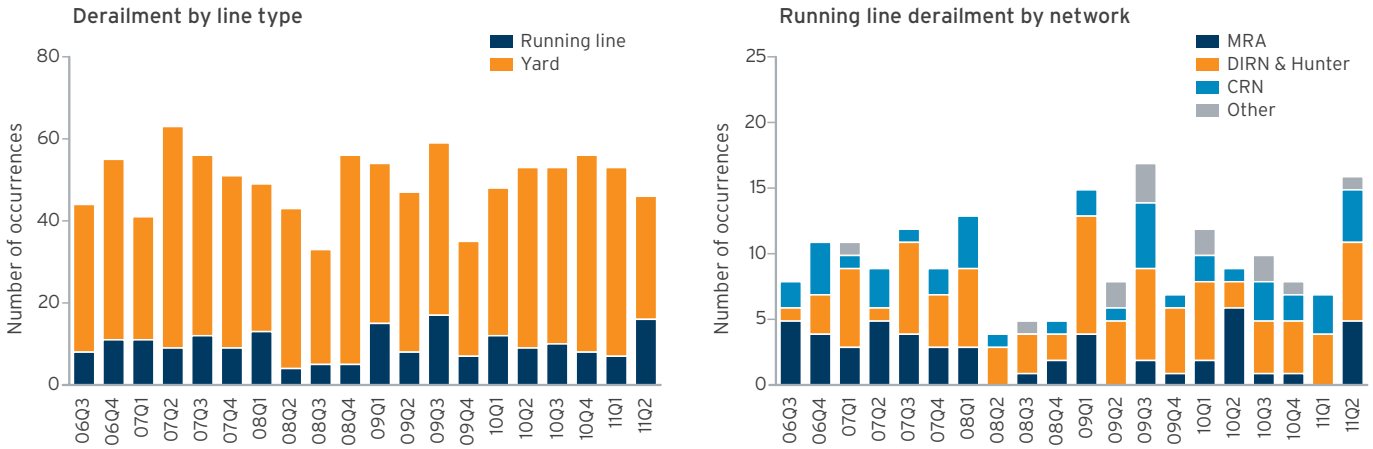


Figure 10: Derailment on the NSW rail network, 2006–07 to 2010–11

Vertical bar is quarterly occurrence count. *Line type* is defined by the national occurrence classification guideline.

Table 6: Passenger train derailments (running line) on the NSW rail network, 2010–11

Network in brackets

Date	Train type	Location	Description
4 August 2010	Passenger – non-urban	Bullocks Flat (Skitube – Alpine Railway)	Passenger train derailed on points. Passengers and driver were transported to Perisher Terminal by another train. No injuries reported.
30 August 2010	Passenger – non-urban	Bomaderry (MRA)	Empty passenger train derailed on points after exiting fuel siding back onto main line. No injuries reported.
21 November 2010	Tourist and heritage	Sydney Olympic Park (Millenium Parklands Railway)	Passenger train derailed after splitting points. No injuries reported.
12 April 2011	Passenger – non-urban	Sydney Terminal (MRA)	Empty CountryLink train returning to yard passed a signal at stop and derailed one bogie on catch points. No injuries reported.
22 May 2011	Tourist and heritage	Toronto (Lake Macquarie Light Rail)	Passenger train was descending hill when the leading wheel climbed above the rail causing the train to derail. No injuries reported.

Passenger trains accounted for five running line derailments in 2010–11, representing a rate of 0.11 per million passenger train km travelled. Despite an increase in the rate from 2009–10 (0.07), the result remains consistent with the pattern observed over the longer term (Figure 11). Each of the occurrences in 2010–11 is summarised in Table 6. Three of the five derailments involved trains with passengers on board at the time of the occurrence. The most significant of these was the derailment of a passenger train on the Perisher Skitube railway in the NSW snowfields. The service derailed after running through incorrectly set points.

Freight trains were involved in 22 running line derailments in 2010–11 (Figure 9), which equalled a rate of 1.22 per million freight train km travelled. Both the count and rate of derailment in 2010–11 were comparable to their respective figures over the past four years.

More than two-thirds of the running line freight train derailment occurrences in 2010–11 were associated with low speed movements of trains to/from yards. In some cases the point of derailment was within a yard but the safety of a running line was affected. These are typically lower risk occurrences, yet still have the potential for serious consequences. The Office of Transport Safety Investigations (OTSI) and ITSR are investigating a serious occurrence at Enfield yard in which a rake of 28 loaded wagons had the hand brakes fail and ran uncontrolled over 400m before colliding with a rake of 15 empty fuel tanker wagons, derailing both vehicles with the fuel tankers foul of the main line. The runaway and subsequent collision and derailment caused significant damage to rolling stock, overhead wiring equipment and track and signalling infrastructure. There were no injuries reported as a result of the incident.

Running line freight train derailments in 2010–11, other than those associated with yards, are summarised in Table 7. These incidents often occur at running line speeds and pose a greater potential for serious consequences, particularly on networks shared with passenger services. A range of factors were highlighted as the cause of the derailments, including track and rolling stock irregularities as well as human error. Three of the derailments were the result of a seized wheel bearing leading to a sheared axle – ITSR is investigating one of these occurrences. These types of occurrences and other rolling stock related precursors are discussed further in section 4.

Table 7: Freight train derailments (running line) on the NSW rail network, 2010–11

Excludes derailments associated with entry to/from yards, shunting and track possession.

Date	Location	Description
23 August 2010	Drayton Colliery (Drayton coal mine branch)	Three locomotives and two wagons of a freight train derailed as it continued past a signal at stop and derailed on catch points. The initial cause for passing the signal at stop was a suspected brake fault.
1 September 2010	Coonamble (CRN)	Freight train derailed eight wagons across a level crossing access road to local properties. Suspected cause was spread track.
17 September 2010	Martins Creek[1] (DIRN)	Freight train derailed one wagon. Wheel/axle on derailed wagon was missing and almost 20 km of track was damaged. Suspected cause was a sheared axle due to wheel bearing fault.
29 September 2010	Menindee (DIRN)	Freight train derailed one wagon. Suspected cause was a sheared axle due to wheel bearing fault.
26 November 2010	Newdell Junction[1] (DIRN)	Freight train derailed as wagon collapsed onto track. Suspected cause was corrosion and fracture of the wagon's underframe.
15 January 2011	Stuart Town (CRN)	Freight train derailed one wagon. Suspected cause was a sheared axle due to wheel bearing fault.
11 May 2011	Rhodes (MRA)	Freight train passed a signal at danger and derailed two locomotives on catch points. Suspected cause was the driver misreading a signal indication.

1 Subject of compliance investigation by ITSR

Previous rail industry safety reports have noted a decrease in the number of freight train derailments over time, based on data extending back over a decade. This trend was not apparent in the most recent five years of data (Figure 11). However, the number of running line freight train derailments in 2010–11 remains historically low.

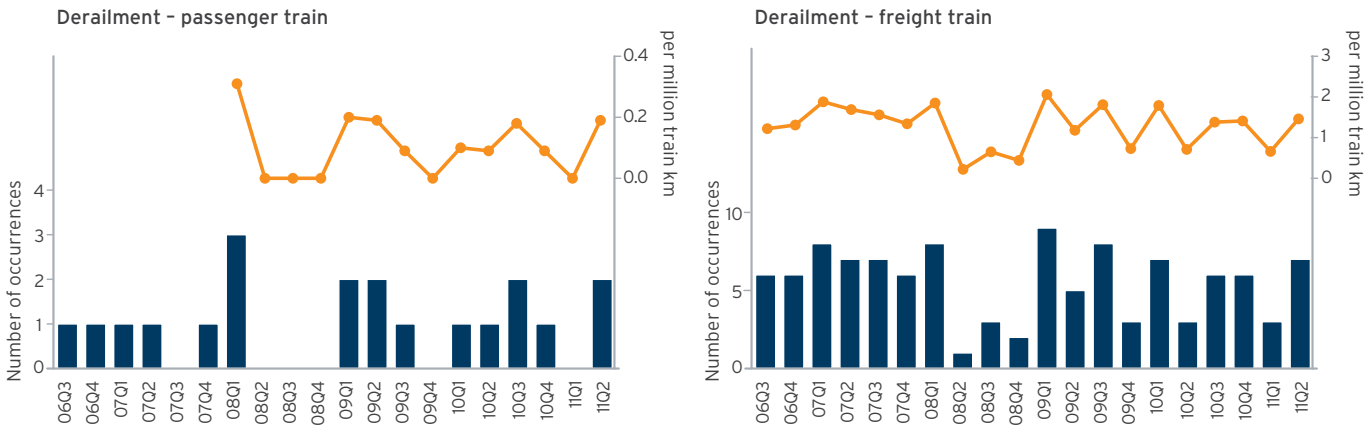


Figure 11: Passenger and freight train derailment (running line) on the NSW rail network, 2006–07 to 2010–11

Vertical bar is quarterly occurrence count. Solid line is quarterly occurrence rate (count per million train km travelled). Passenger train rate prior to 2008 excluded due to change in RailCorp's method of train km calculation.

Yard derailments are typically lower risk in terms of their potential for casualties and significant damage. However, serious accidents do occasionally occur. ITSR is investigating one such incident that occurred in a siding at Narrandera in March 2011. During shunting in a private siding a locomotive pushed four empty wagons through a stop block at the end of the siding. The last wagon ran away downhill and came to rest on a public road. While no injuries were reported, the wagons sustained significant damage. Further to this and several other similar occurrences, ITSR issued a transport safety alert in April 2011[16] to highlight the need for rail transport operators to reassess the adequacy of their management of this risk. ITSR also initiated prosecutions against the rail operators involved in a yard derailment at Griffith in 2009 where, as a result of a shunting incident, wagons left rail property, blocked a public road and came to rest on private property.

3.2 Level crossing collision

Summary

- 10 level crossing collisions between a train and road vehicle were notified in 2010–11. One collision resulted in a fatality to the driver of a light passenger road vehicle.
- The annual count of collisions between trains and road vehicles at level crossings has decreased gradually over the past two decades.
- 120 level crossings have been closed in NSW since 2002. In 2010–11 upgrade works progressed on 38 level crossings, with major upgrades completed at six.

Level crossings provide the main point of interaction between rail and road traffic and therefore present a high risk for serious collisions between trains and road vehicles. Collisions between road vehicles and trains at level crossings account for about 30% of rail-related fatalities in Australia over the past five years[17].

There are more than 3,000 level crossings in NSW[18] and most are located in regional areas. More than half of all crossings in NSW are associated with private roads and/or rail yards and the majority of these are passively controlled. The remaining crossings intersect public roads and running lines of the NSW rail network. About one-quarter of these crossings are actively controlled and the remainder are passively controlled.

There were 10 collisions between trains and road vehicles at separate level crossings in 2010–11, summarised in Table 8 and Figure 12. One of the incidents resulted in a fatality.

Five of the incidents occurred at actively controlled crossings. Based on the circumstances described in the initial notifications crossing equipment was certified as working correctly at the time of the incident.

While half of the 10 collisions in 2010–11 occurred at passively controlled crossings, this type of crossing accounts for about two-thirds of all collisions over the 22-year period of available record. This reflects, in part, the far larger number of passive crossings in NSW compared to active crossings. However, other factors are relevant in such comparisons including volumes of road and rail traffic and greater safety offered by higher levels of protection, for example, boom gates over stop signs.

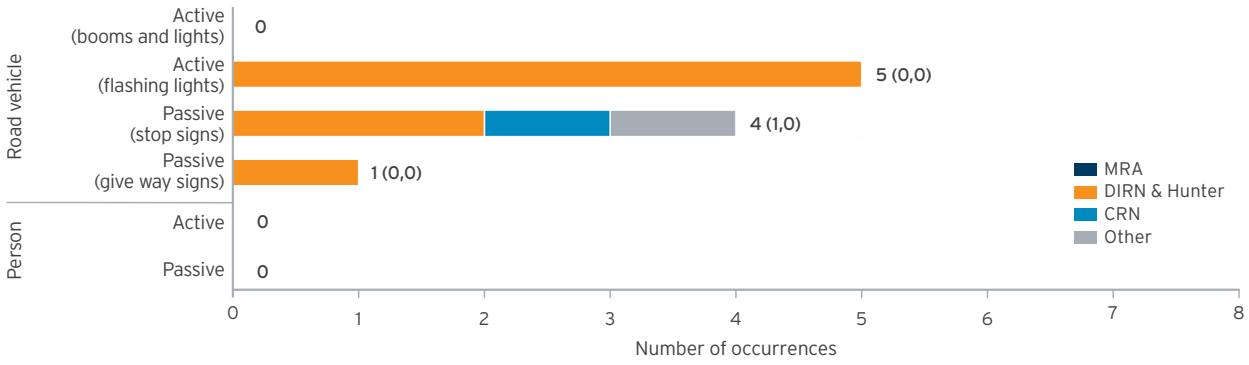


Figure 12: Level crossing collision on the NSW rail network, 2010–11

In brackets are number of fatalities and number of injured people transported to hospital respectively.

16 Transport Safety Alert No. 36, *Effective securement with handbrakes and stopblock functionality*, ITSR, April 2011
17 Excluding incidents involving suspected suicide; (Source: Independent Transport Safety Regulator. *Level crossing accidents in Australia*, ITSR, Sydney, August 2011)
18 NSW Level Crossing Strategy Council, *Yearly Report 2010/11, Level Crossing Safety Improvement Programs*, LCSC, 2011

The most important types of level crossing collision in terms of potential for multiple casualties are those involving passenger trains. While road vehicle occupants are the typical victims in level crossing collisions (56 killed in 50 separate fatal occurrences over the 22 years to 2010–11 in the state), a single collision between a road vehicle and passenger train exposes a large number of people (passengers and train crew) to potential harm. There were two such occurrences in 2010–11. Both collisions occurred on the DIRN and involved CountryLink trains travelling at speed. In one occurrence the occupant of a car was conveyed to hospital for observation.

The eight remaining collisions in 2010–11 involved freight trains or light locomotives. One of the passive crossing incidents was a relatively lower risk incident associated with shunting in a yard.

The full history of level crossing collisions over time and across networks is shown in Figures 13 and 14 respectively. Historically, most collisions at passive crossings occurred on the CRN and most collisions at active crossings on the MRA and DIRN. There was a decrease in the number of collisions at both active and passive crossings over the 22-year record, across each of the main networks. The number of fatalities associated with level crossing collisions has also dropped (see section 2.1).

A contributing factor to the improvement in level crossing safety in NSW over the longer term is a number of safety initiatives undertaken by NSW rail and road authorities under the coordination of the NSW Level Crossing Strategy Council[19]. These included[20]:

- Level crossing closures: a total of 120 level crossings have been closed since 2002. In 2010–11 no level crossings were closed.
- Level crossing safety upgrades: in 2010–11 major safety upgrades were completed at six level crossings and minor works were completed at 10 sites. In addition to works completed, concept designs were prepared for another nine projects and 13 projects proceeded to the detailed design stage.
- Awareness and enforcement actions: the vast majority of level crossing collisions are the result of road user behaviour. Targeted awareness and enforcement actions are a critical element of managing the risk at level crossings. In 2010–11 the NSW Police Force was involved in ongoing and targeted patrols of level crossings to improve road user behaviour.

Table 8: Level crossing collisions between trains and road vehicles on the NSW rail network, 2010–11

Date	Crossing control	Location	Description
2 July 2010	Passive – give way signs	Mulwala (DIRN)	Car at a passive crossing struck the third locomotive of a freight train travelling between 40km/h and 45km/h. No injuries reported. Train and car sustained minor damage.
1 September 2010	Passive – stop signs	Wee Waa (CRN)	Collision between utility and light locomotives at a passive level crossing. The driver of the car was fatally injured.
5 September 2010	Active - lights	Coramba (DIRN)	Freight train collided with abandoned road vehicle on an active crossing. Train sustained serious damage. No injuries reported.
10 October 2010	Passive – stop signs	Cedar Point (DIRN)	CountryLink train travelling between 80km/h and 90km/h struck an abandoned car at a passive crossing. Train sustained minor damage. No injuries reported.
16 February 2011	Active - lights	Beni (DIRN)	Freight train travelling at 40km/h struck by a semi trailer at an active crossing. The truck driver suffered minor injuries and was taken to hospital for observation.
23 February 2011	Passive – stop signs	Newcastle (Private Siding)	During shunting operations a freight wagon clipped the rear of a car at a passive crossing. The car sustained minor damage. No injuries reported.
29 March 2011	Passive – stop signs	Merrygoen (DIRN)	Freight train was struck by car towing a trailer at a passive crossing. The car received considerable damage. Driver of car was transferred to hospital for observation.
5 May 2011	Active – lights	Calwalla (DIRN)	Freight train was struck by utility at an active crossing. The driver of the car was trapped inside and suffered minor injuries.
8 May 2011	Active – lights	Moss Vale (DIRN)	Freight train was struck by car at an active crossing. The car was lodged under the front locomotive. No injuries were reported.
17 June 2011	Active – lights	Dubbo (DIRN)	CountryLink train travelling at 120km/h struck car at an active crossing. Two occupants of road vehicle were conveyed to hospital for observation.

19 See the Transport for NSW level crossing website <http://www.transport.nsw.gov.au/levelcrossings>
20 NSW Level Crossing Strategy Council, *Yearly Report 2010/11*, Level Crossing Safety Improvement Programs, LCSC, 2011

During 2010–11, one of ITSR's main priorities was on interface agreements for road and rail crossings. Under the *Rail Safety Act 2008*, rail infrastructure managers and road authorities are required to seek to enter into interface agreements for road and rail crossings on public roads by 1 January 2012. ITSR has consulted with and monitored major rail infrastructure managers and road authorities on this work and most interface agreements are currently well progressed. Guidance was also published on ITSR's website.

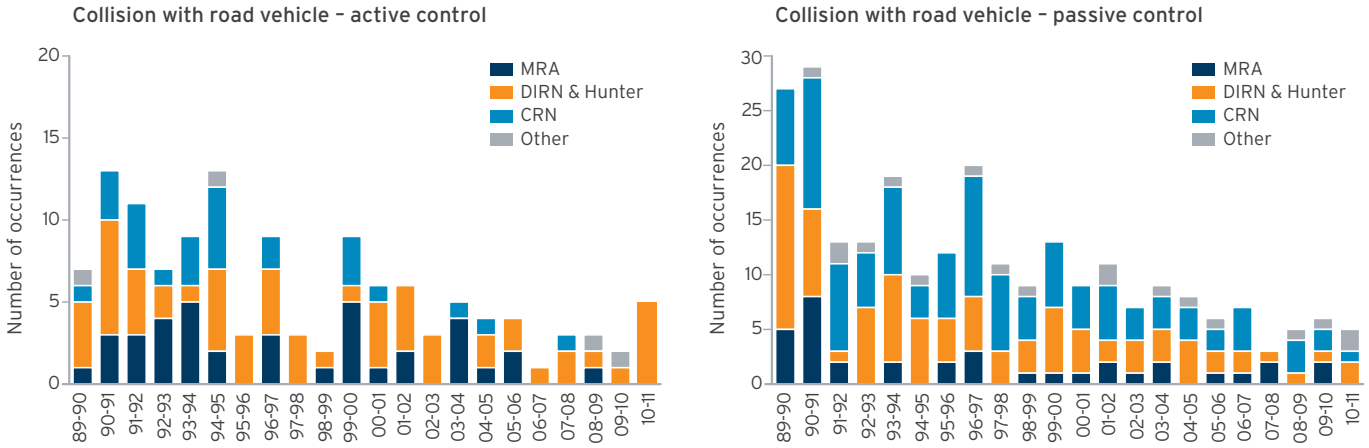


Figure 13: Level crossing train and road vehicle collision on the NSW rail network, 1989–90 to 2010–11
Vertical bar is annual occurrence count.

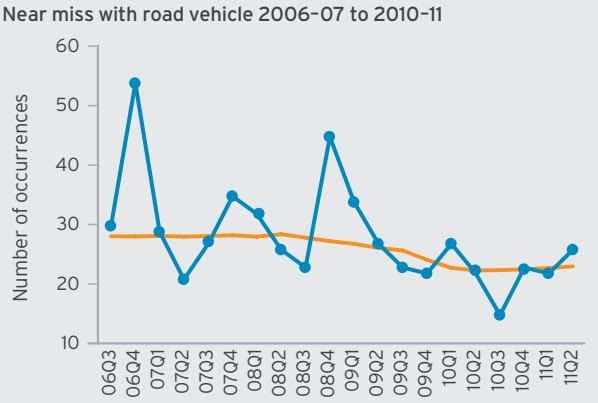
Level crossing near miss

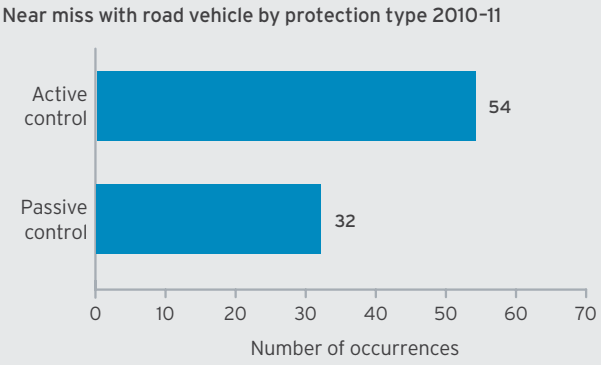
Near miss incidents at level crossings were not routinely notified as occurrences until their introduction within the national occurrence reporting and classification scheme in 2005 and subsequent definition within legislation in 2006.

Near miss incidents represent a sequence of events that has progressed to a point just short of actual harm occurring. Patterns in near miss data, such as repeat incidents at specific crossings, serve as potential warning signs of a high risk crossing.

There was a decrease in the number of reported near misses over time which is consistent with the decrease in collisions. However, the relationship between near miss incidents and collisions is not straightforward. For example, crossings with a history of near misses are not necessarily ones where collisions occur and vice versa. Further, two-thirds of collisions occur at passive crossings whereas active crossings dominate the near miss statistics.

The complex relationship between near miss and collision incidents highlight the fact that many factors contribute to collisions at level crossings. The monitoring and assessment of risk therefore requires the use of various types of information in addition to near miss data, for example, risk modelling and site assessment.





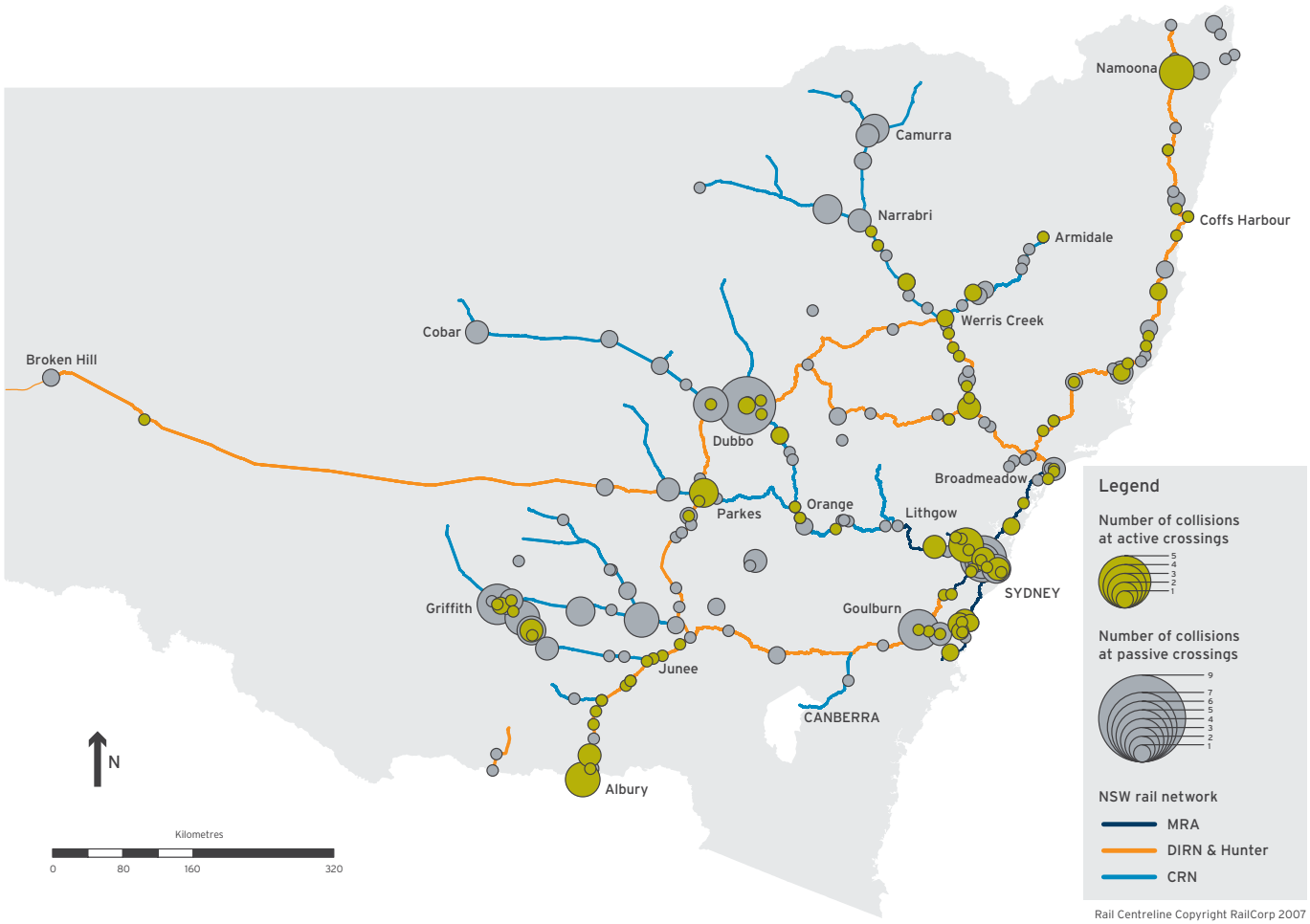


Figure 14: Level crossing train and road vehicle collision across the NSW rail network, 1989–90 to 2010–11

Shows level of control at the time of the accident. Some crossings have now been closed or upgraded.

3.3 Collision other than at level crossing

Summary

- 7 running line collisions between trains were notified in 2010–11. No fatalities or serious injuries were reported for any of these incidents.
- A head-on collision between an unloaded passenger train and a track maintenance vehicle on an isolated tourist and heritage line resulted in significant damage to rolling stock and track. The two occupants of the track maintenance vehicle suffered minor injuries.
- ITSR and the Australian Transport Safety Bureau (ATSB) investigated a potentially serious collision between two freight trains at Yass Junction in December 2010. A communication breakdown resulted in one train colliding with the rear of another, with both trains receiving minor damage. No injuries were reported.

The national safety occurrence category *collision* comprises a broad range of occurrences, all of which involve a train (or rolling stock) striking, or being struck by, something else. Collisions on or affecting the safety of running lines are also classified separately from those in yards. The former are typically the higher risk occurrences and are summarised in Figure 15.

More than 90% of occurrences in 2010–11 comprised trains hitting animals and smaller objects on or about the track. While these types of incidents are relatively frequent, they usually result in no injuries to passengers or train crew and little or no damage. The most important types of running line collision in Figure 15, in terms of safety risk, are the less frequent occurrences. For example, a collision between trains has the potential to cause multiple casualties in a single occurrence and a collision with person will typically result in injury to the person struck.

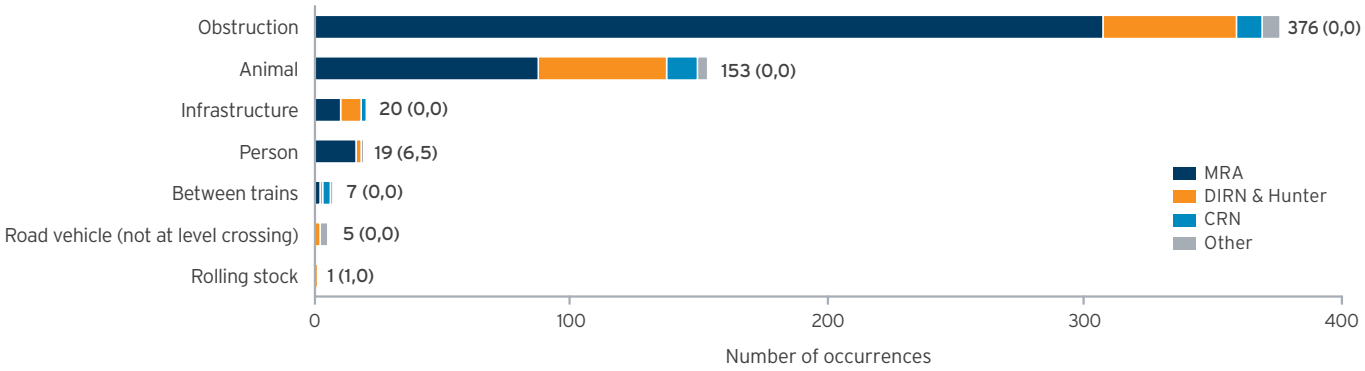


Figure 15: Running line train collision other than level crossing on the NSW rail network, 2010–11

In brackets are the number of fatalities and number of seriously injured people transported to hospital respectively. Excludes occurrences classified as *suspected/attempted suicide*.

There were seven running line collisions between trains in 2010–11 (Table 9), which is consistent with that observed over the previous four years (Figure 16). Incidents involving in-service passenger trains are of particular concern because of the exposure of multiple people to potential harm (Figure 5). Three collisions involved passenger trains in 2010–11. The most serious of these occurred on an isolated tourist and heritage railway and involved a head-on collision with a track maintenance vehicle following a communication breakdown. Only employees were on the train at the time of the collision, with both occupants of the track maintenance vehicle suffering minor injuries. The incident is currently the subject of an investigation by ITSR and OTSI.

Running line collisions involving freight trains have the potential to lead to significant damage and disruption as well as risks to passenger services on shared networks. Two occurrences in 2010–11 involved single line collisions between rolling stock. ITSR and the ATSB investigated one of these at Yass Junction in December 2010. After being given an indication to switch tracks to allow another service to pass, the freight train rounded a bend at night in inclement weather and collided with the rear of another freight train whose location had not been communicated. The train was travelling at 15km/h at the time and emergency brakes were applied.

Table 9: Collision between trains (running line) on the NSW rail network, 2010–11

Date	Location	Train type	Description
11 October 2010	Minto (MRA)	Passenger – freight	Loose straps on wagon of freight train struck and smashed a window on passing passenger train.
29 November 2010	Bellata (CRN)[1]	Freight – freight	Freight train scraped the rear wagon of a passing freight train that was stationary in a siding. No injuries reported.
9 December 2010	Yass Junction (DIRN)[1,3]	Freight – freight	A freight train collided at low speed with the rear wagon of another freight train. Both trains sustained minor damage. No injuries reported.
7 March 2011	Breeza (CRN)	Track machine – track machine	Collision between two track machines during transfer. Minimal damage and no injuries reported.
18 March 2011	Gosford (MRA)	Passenger – passenger	An empty passenger train about to begin service rolled backwards 1 metre into another unloaded passenger train while stopped at platform because parking brake wasn't applied. No damage or injuries reported.
1 April 2011	Top Points – Zig Zag (Zig Zag Railway)[1,2]	Passenger – track machine	An in-service but empty tourist and heritage passenger train collided head on with a track maintenance vehicle at low speed. The employees in the track maintenance vehicle were conveyed to hospital for observation.
11 May 2011	Murrobo (CRN)	Freight – freight	Open container door on freight train struck passing freight train. Minor damage and no injuries reported.

1 Subject of compliance investigation by ITSR
2 Subject of investigation by OTSI
3 Subject of investigation by ATSB

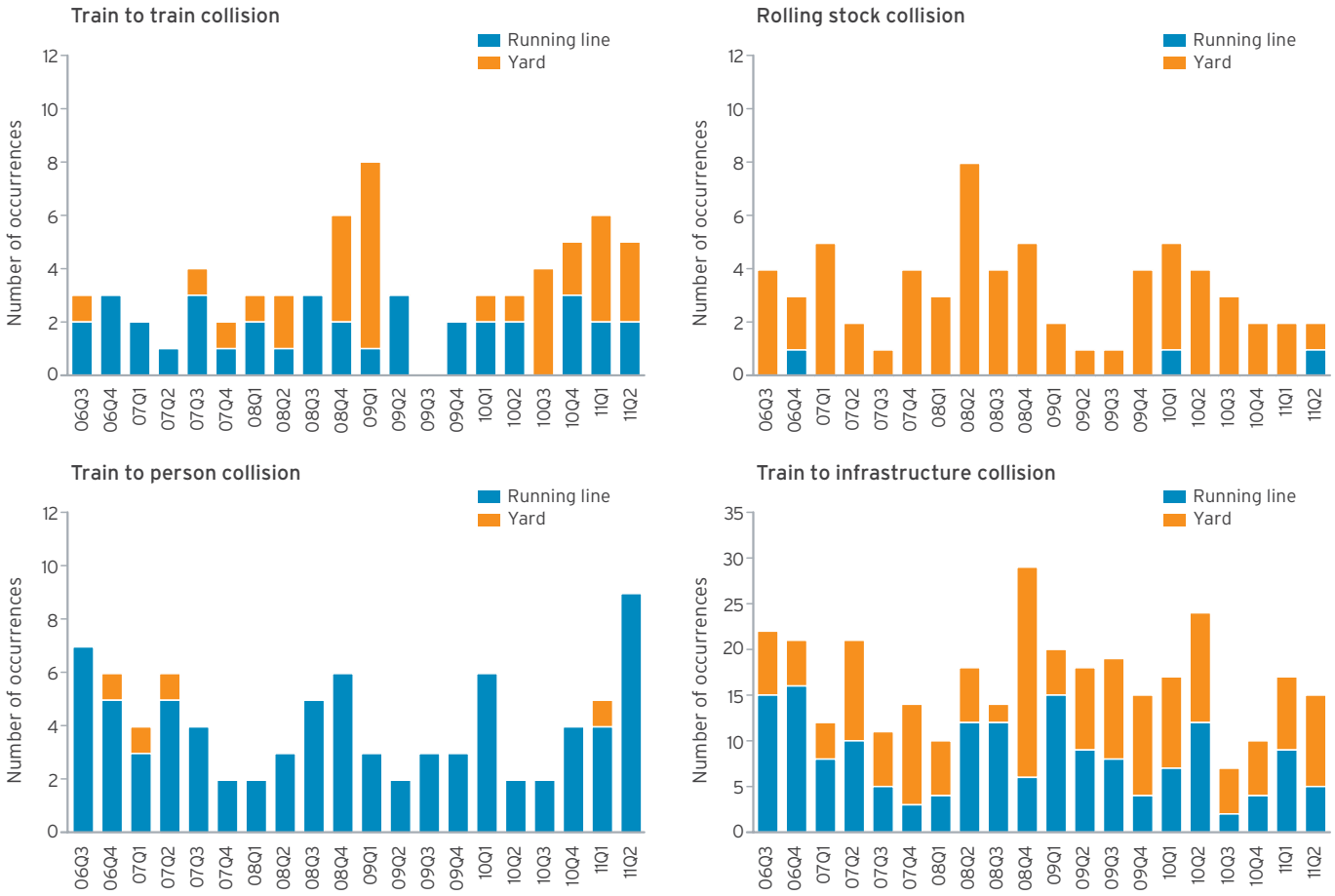


Figure 16: Train and rolling stock collisions on the NSW rail network, 2006–07 to 2010–11

Vertical bar is quarterly occurrence count. *Train to person collision* excludes occurrences classified as *suspected/attempted suicide* and occurrences at level crossings.

Figure 17 shows the distribution of train to train collisions across the state for the past five years. Just over one-third of all collisions occurred on the section of the DIRN between Sydney and the Victorian border which carries a large amount of the state's rail traffic. All but one of the collisions along this section of track involved out of gauge equipment or the load of one train protruding into the path of an oncoming train. Two thirds of collisions between trains across the state over the past five years were of this nature.

While much of the collision-related safety risk is associated with accidents on running lines, collisions in yards are also monitored by ITSR. In 2010–11 several collisions occurred over a relatively short space of time at Port Botany in Sydney. These incidents followed a significant upgrade to the yard and train crew knowledge of the new layout may have been a contributing factor. ITSR has commenced compliance investigations into several of these incidents.

There were 19 collisions with persons notified in 2010–11. Caution must be attached to these results because they include trespass incidents but exclude occurrences classified as *suspected suicide* and the distinction between the two is not reliable (see note section 2.1). However, some of the 19 incidents were under the direct control of railways, namely, trains striking passengers and employees. One of the fatalities and two of the five serious injuries in 2010–11 involved passengers struck by trains (Table 5). Passenger behaviour appeared to be a contributing factor in several incidents, for example, falls due to intoxication, fighting.

There were 20 collisions between trains and infrastructure on running lines in 2010–11. A range of infrastructure was involved including signals, platforms and buffer stops. Causes included out of gauge rolling stock, human error and infrastructure fouling the line. The number of occurrences in 2010–11 was the lowest observed of the five-year period (Figure 16) and there appears to be a potential decreasing trend in the rate of incidents (per train km travelled) over this period. Despite this suggested improvement several incidents in 2010–11 did warrant investigation. ITSR is investigating two incidents at Glebe in Sydney in February 2011 in which light rail vehicles made contact with the platform due to the track moving in extreme heat. No injuries and only minor damage to the trains were reported.

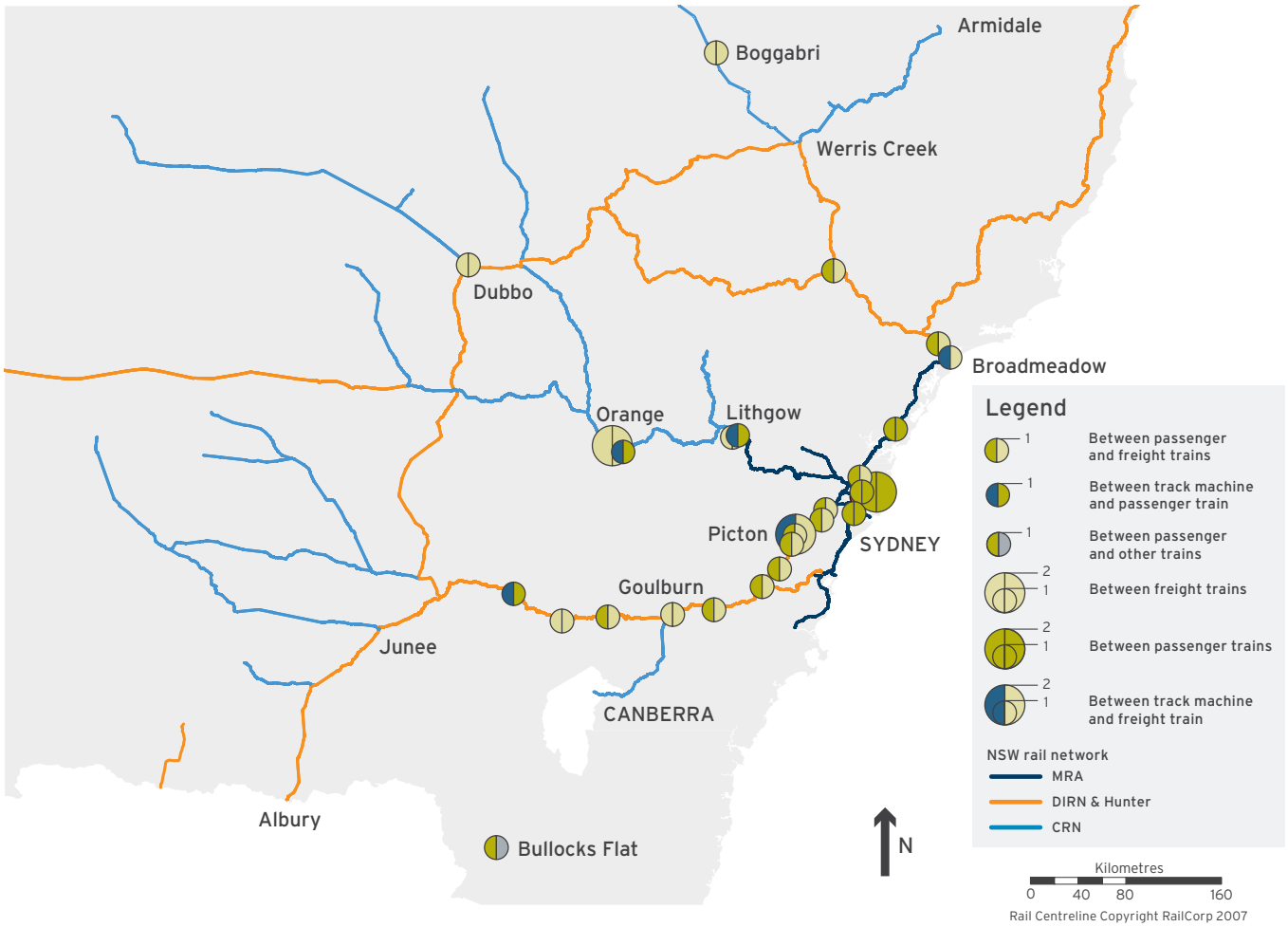


Figure 17: Collision between trains (running line) across the NSW rail network, 2006–07 to 2010–11

Excludes collisions between track machines. Mapped location is based on nearest reported location as notified by rail transport operators. Collision at Bullocks Flat occurred on an isolated passenger line.

3.4 Fire

Summary

- 433 fires were notified in 2010–11. None of the occurrences resulted in fatality or injury requiring transport to hospital.
- 176 passenger train fires were notified in 2010–11. About 90% of occurrences were associated with arson with a comparatively large number of incidents occurring on the western and south western lines of the MRA.
- 26 freight train fires were notified in 2010–11. Most incidents involved locomotive fires. The rate of freight train fire (per million train km travelled) has increased in recent years.

There were 433 fires notified in 2010–11 (Figure 18), with no serious injuries reported for any of the occurrences. More than 90% of incidents occurred on the MRA, remaining consistent with results observed over the past four years and reflecting this network's comparatively greater volume of rail traffic and higher station density.

Almost half of the notified fires in 2010–11 were associated with trains. Passenger train fires pose the greatest fire-related risk on the NSW rail network because of the potential to cause multiple casualties in a single occurrence. A total of 176 passenger train fires were notified in 2010–11 (Figure 19). The rate of fire in 2010–11 was 4.0 (per million train km travelled), and remains comparable to the rate of 4.1 (per million train km travelled) observed over the previous four years.

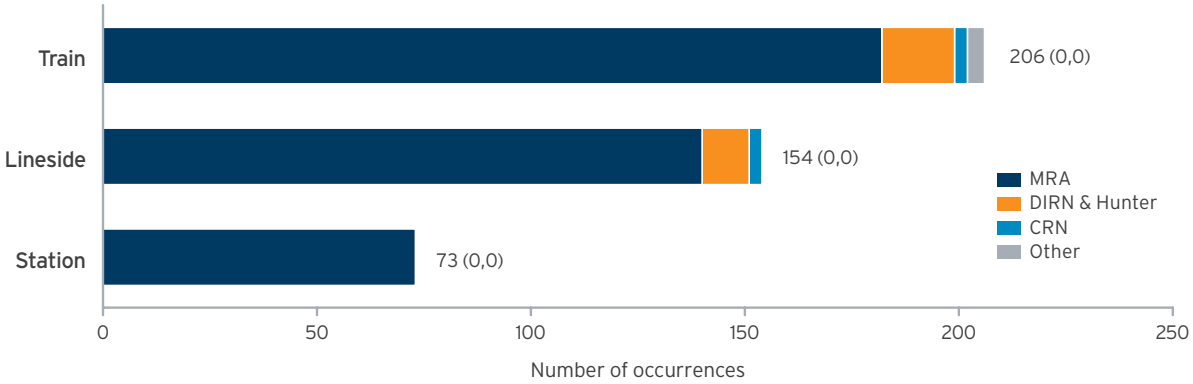


Figure 18: Fire on the NSW rail network, 2010–11

In brackets are number of fatalities and number of injured people transported to hospital respectively.

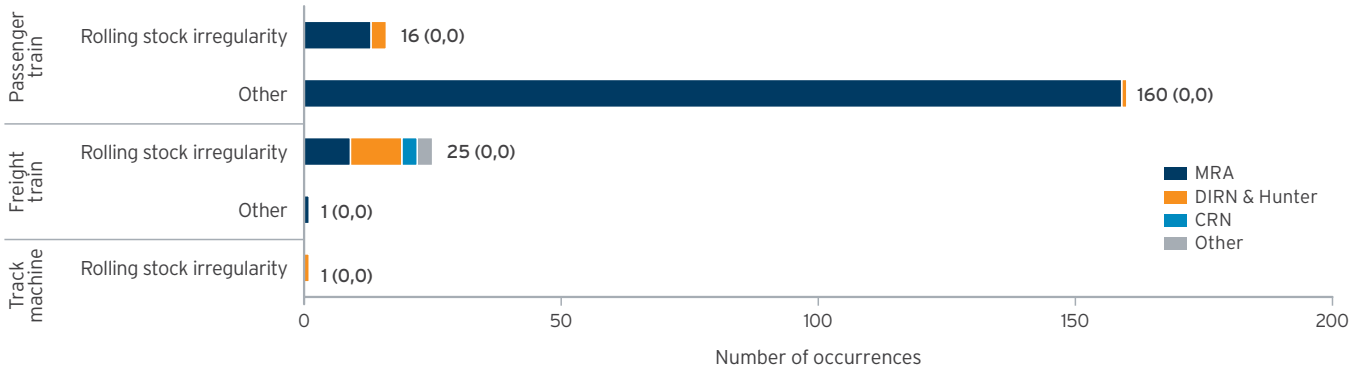


Figure 19: Train fire on the NSW rail network, 2010–11

In brackets are number of fatalities and number of injured people transported to hospital respectively.

About 90% of passenger train fires in 2010–11 were associated with arson on the MRA. Most incidents involved the lighting of newspapers or attempted lighting of seats with more than two-thirds of incidents occurring between the hours of 6pm and 1am. None of the fires in 2010–11 resulted in injury requiring transport to hospital. However, several occurrences led to the evacuation of passengers from the train and/or termination of the service. Figure 21 shows the pattern of incidents across the network over the past three years. A higher number of incidents were recorded for the lines running to the west and south-west of Sydney.

The five-year history of arson-related passenger train fires is shown in Figure 20. Both the count and rate (per million passenger journeys) of incidents across the MRA in 2010–11 were comparable to their respective figures over the past four years.

This suggests that previously reported measures implemented by RailCorp to manage this risk have had a positive effect.

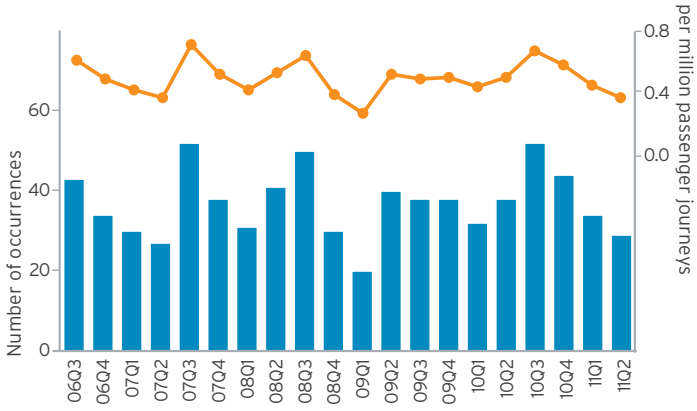


Figure 20: Arson-related passenger train fire on the NSW rail network, 2006–07 to 2010–11

Vertical bar is quarterly occurrence count. Solid line is quarterly occurrence rate (count per million passenger journeys).

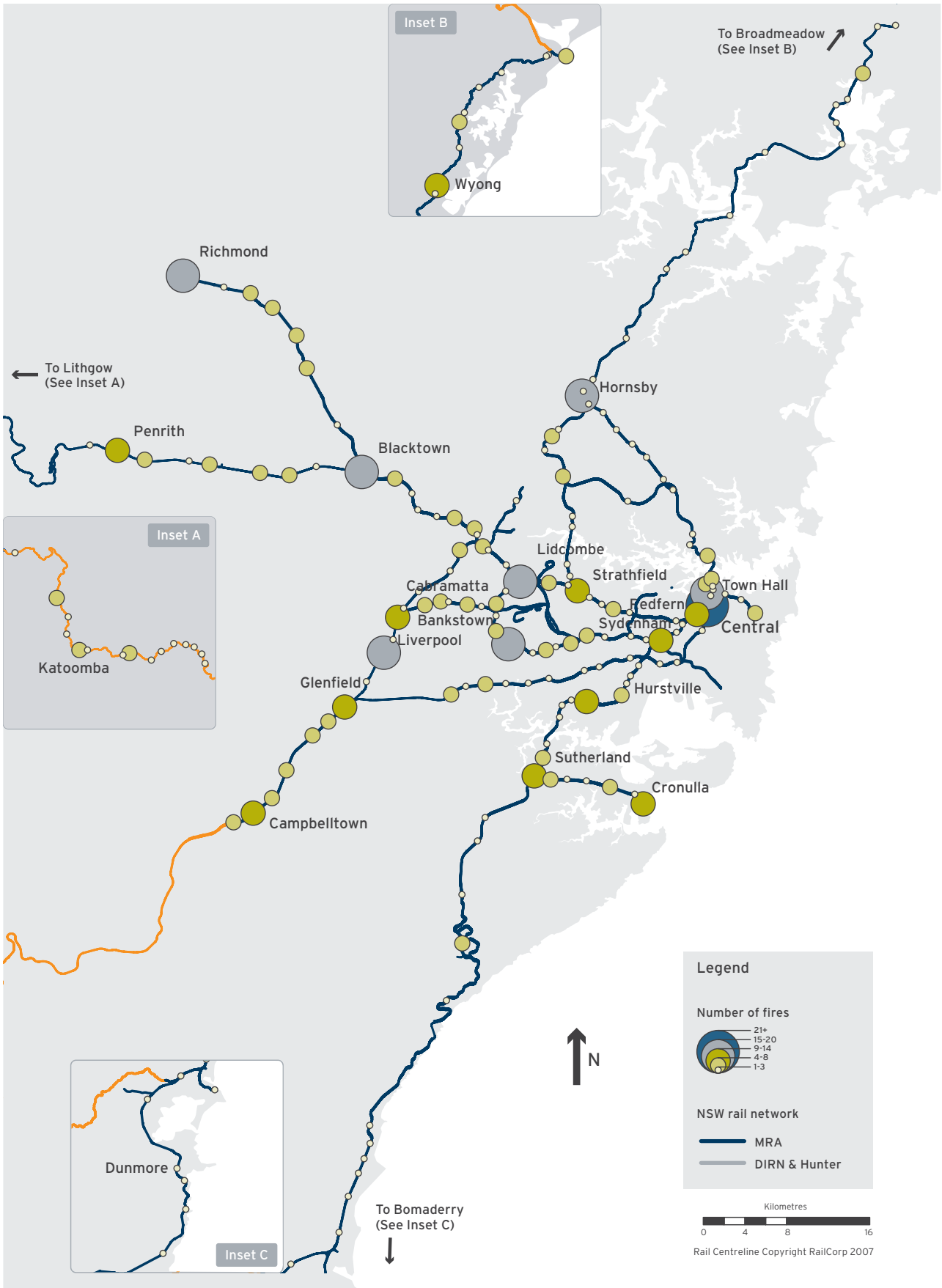


Figure 21: Passenger-related train fire across the MRA, 2008–09 to 2010–11

Mapped location is nearest reported location as notified and for some occurrences will represent the location where evidence of fire was first detected.

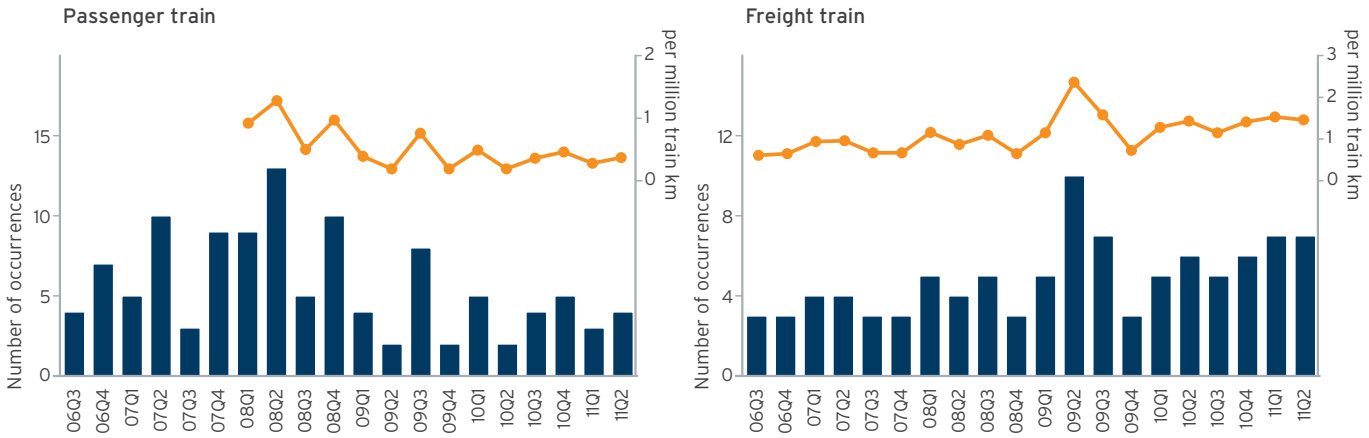


Figure 22: Rolling stock-related train fire on the NSW rail network, 2006–07 to 2010–11

Vertical bar is quarterly occurrence count. Solid line is quarterly occurrence rate (count per million train km travelled). Passenger train rate prior to 2008 excluded due to change in RailCorp's method of train km calculation.

Sixteen passenger train fires in 2010–11 were associated with rolling stock irregularities. Most fires were associated with traction motors and electrical equipment. The count for 2010–11 was less than that for the previous year (Figure 22) and, despite a truncated record due to reporting changes, there was a decreasing trend in the rate of rolling stock-related passenger train fires from 0.74 per million train km travelled in 2008-09 to 0.37 in 2010-11. Despite the suggested improvement over time, several occurrences in 2010–11 were serious and required the evacuation of passengers from trains.

There were 26 freight train fires notified in 2010–11. The number of incidents in 2010–11 was higher than the previous year (21) and the rate of fire has increased over the five-year period from 0.8 per million train km travelled in 2006–07 to 1.4 in 2010–11 (Figure 22). Of the 25 rolling stock-related freight train fires in 2010–11 all bar one were associated with locomotives. The remaining fire was associated with sticking brakes on a wagon.

More than half of all fire occurrences notified to ITSR in 2010–11 were lineside and station fires, with most occurring on the MRA (Figure 18). About one-third of lineside fires were classified as affecting safety-related infrastructure, the majority of which involved sleepers. Most station fires were associated with vandalism or careless acts, for example, discarded cigarettes. The longer term pattern of lineside and station fires is shown in Figure 23. The number of lineside fires in 2010–11 remains comparable with that observed historically, noting localised peaks in 2008 and 2009. The number of station fires has not changed appreciably over the five-year period.

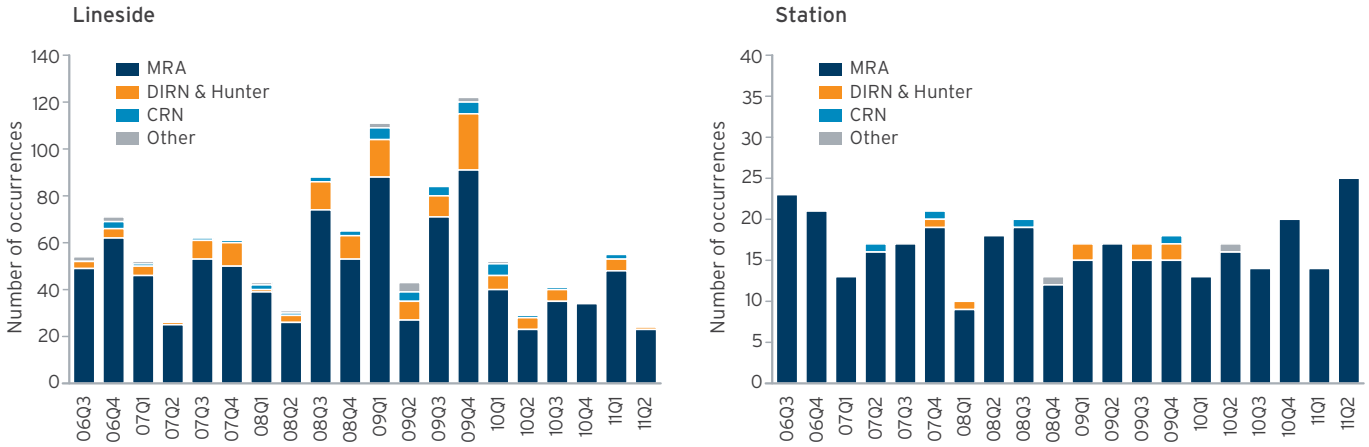


Figure 23: Lineside and station fire on the NSW rail network, 2006–07 to 2010–11

Vertical bar is quarterly occurrence count.

4. Precursor rail safety occurrences

Most of the rail safety occurrences notified in NSW each year do not result in an adverse outcome such as injury or damage. Many of these occurrences are precursor events – incidents that could, in combination with other events, progress to accidents and actual harm. Accident precursors serve as warning signs of failures in safety risk controls employed by rail transport operators. They are particularly important in providing insight to the underlying risks of infrequent, but serious, accidents that are still relevant to a railway under its current level of risk control but have not occurred in the period of available accident data.

This section summarises five key groups of accident precursor defined within the national occurrence classification guideline. Assessing longer term trends in precursor occurrences is complicated by changes in the legislative requirements to report them over time. These effects have been minimised in this report by restricting the analysis to more recent years, after the period of major changes. However, more recent data will still be subject to some reporting changes associated with improvement to rail transport operators' safety management systems and associated reporting processes.

4.1 Proceed authority irregularity

Summary

- The number of driver error signal passed at danger (SPADs) on the MRA has decreased over time. This occurred despite an increase in train movements on this network over the same period.
- The rate of driver error SPADs (per million train km travelled) for freight trains was about 50% higher than that for passenger trains, despite a greater proportion of freight train movements occurring on less densely signalled or unsignalled track.

In NSW there are four principal systems used to manage the movement of rail traffic in a way that ensures adequate separation of trains and prevents conflicting movements[21]. An integral part of each of these systems is a means to authorise the movement of a train from one section of track to another.

For the MRA and the majority of the DIRN and Hunter, the authority for a train to proceed is given by a signal indication. For much of the CRN and the western section of the DIRN, an authority to proceed is given via the train driver's possession of some form of token, for example, a metal rod (staff) and/or the issue of a written or verbal authority.

Figure 24 summarises occurrences in 2010–11 that involved a train exceeding the limit of its authorised movement, either by passing a signal or other form of limit.

Signal passed at danger (without authority)

SPADs are important precursor events to train collisions and derailments. For example, a freight train derailment at Rhodes in May 2011 (Table 7) was preceded by the train passing a signal at danger without authority.

A note on the signals passed at danger without authority

The number of SPADs alone does not provide a complete picture of the risk posed by occurrences of this type. This is because the actual risk of collision following a SPAD depends on many factors, including whether the signal is equipped with engineering defences which automatically stop a train once it has passed a red signal, how far the train travelled into another section and whether that section was occupied.

SPADs can rarely be attributed to a single cause such as driver error and are better understood by looking at the full range of contributing factors which may make human error more likely.

The most important types of SPAD in terms of accident risk are those that are due to driver error or train performance. These types of SPADs are referred to here as *non-technical* SPADs. In the national occurrence classification guideline most non-technical SPADs fall under two subcategories, *driver misjudged* and *completely missed*. However, the information provided in an occurrence notification is usually insufficient to distinguish between the two. For this reason, data for these two categories (together with *starting against signal*) are combined and presented as SPAD (non-technical) in Figures 24 to 26.

21 There is another series of systems to authorise train movements at times when the normal systems of safeworking are not available (see section 4.2)

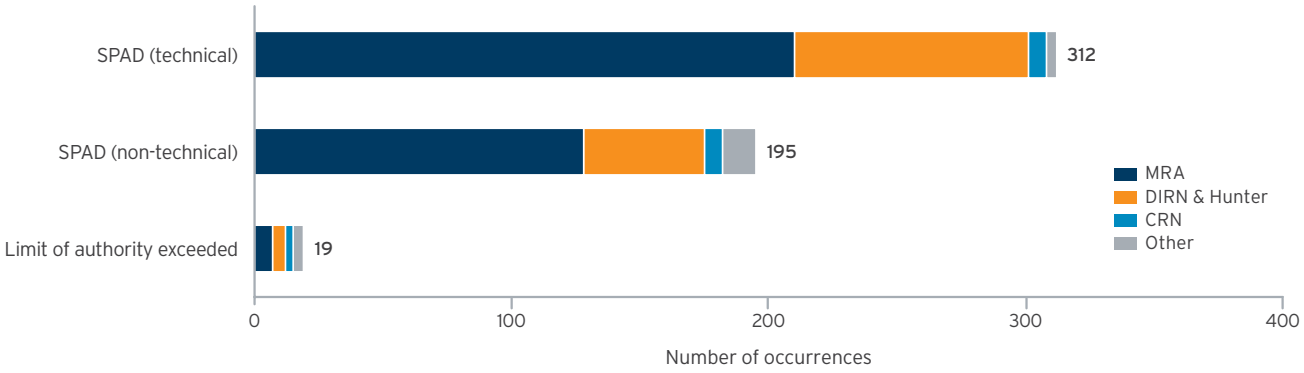


Figure 24: Limit of authority exceedance on the NSW rail network, 2010–11

Signal passed at danger (non-technical) comprises national categories *driver misjudged, completely missed* and *starting against signal.* Excludes occurrences classified as *signal passed at danger other.*

There were 195 non-technical SPADs in 2010–11 (Figure 24). Two-thirds of these occurred on the MRA, reflecting its greater volume of rail traffic and higher signal density compared to other networks. The number of incidents on the MRA in 2010–11 (128) was slightly higher than the previous year (119) but the nature of change varied between operators. Eighty-nine SPADs on the MRA in 2010–11 involved CityRail trains and the annual count of CityRail SPADs has decreased over the past five years despite an increase in CityRail train km travelled over the same period.

The rise in MRA SPADs was associated with freight and maintenance trains. ITSR and OTSI are currently investigating a freight train SPAD on the MRA. In February 2011 a freight train consisting of two locomotives and 40 loaded wheat wagons passed a signal at stop by more than 500 metres at Unanderra. The driver reported he was unable to control the train's speed as it descended a gradient.

Forty-seven of the 195 non-technical SPADs occurred on the DIRN and Hunter network with the majority involving freight (64%) which represents most of the rail traffic on this network. Passenger trains accounted for 28% of the non-technical SPADs on this network. Two incidents were the subject of an investigation by the ATSB both of which occurred in February 2011. One involved a freight train passing a signal at danger by 50 metres at Yerong Creek. The other occurred at Junee and involved a CountryLink train passing a signal at danger by 33 metres.

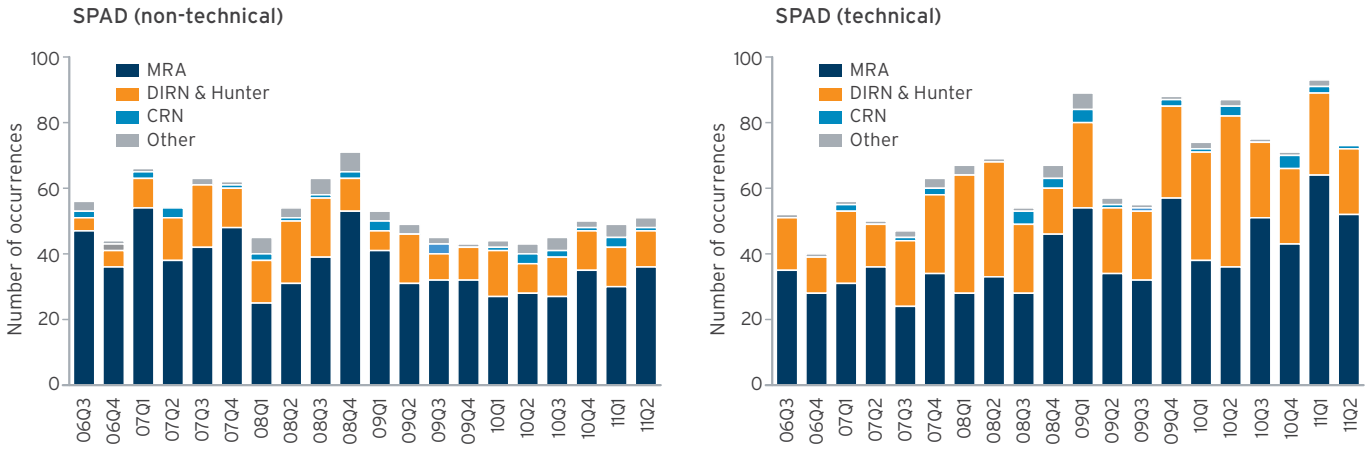


Figure 25: Signal passed at danger on the NSW rail network, 2006–07 to 2010–11

Signal passed at danger (non-technical) comprises national categories *driver misjudged, completely missed* and *starting against signal*. Excludes occurrences classified as *signal passed at danger other.* Vertical bar is quarterly occurrence count.

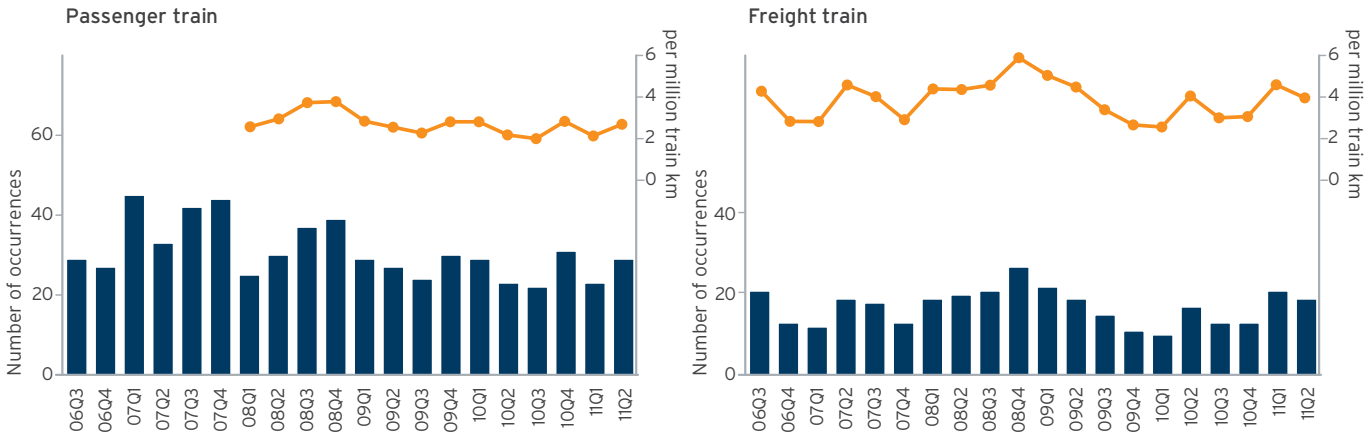


Figure 26: Signal passed at danger (non-technical) on the NSW rail network, 2006–07 to 2010–11

Vertical bar is quarterly occurrence count. Solid line is quarterly occurrence rate (count per million train km travelled). Passenger train rate prior to 2008 excluded due to change in RailCorp's method of train km calculation.

Figure 26 shows non-technical SPADs for passenger and freight trains. The SPAD rate for freight trains over the period of comparable data (4.0 per million train km travelled) was nearly 50% greater than that for passenger trains (2.7), despite freight trains undertaking a greater proportion of their movements on unsignalled track.

In 2010–11 ITSR undertook over 50 compliance inspections of freight rolling stock operators. An integral part of inspections for specific operators was ensuring they have systems in place to adequately manage risks and also to ensure each SPAD is investigated and findings are used to inform improved SPAD management. ITSR also published a safety bulletin[22] which included information on multi-SPAD signals and SPAD severity for the NSW rail networks. The bulletin will help rolling stock operators and network managers focus on those aspects of SPAD management requiring attention.

Technical SPADs

The most frequent type of SPAD notified to ITSR is a *technical* SPAD. In the national occurrence classification guideline these incidents are categorised as *signal restored as train approached*. They involve a signal indication changing from proceed to stop as a train approaches, with insufficient time given to the driver to stop the train. They are associated with a variety of causes including power failures, signaller error and track circuit failures. These SPADs do not pose a collision risk as the route ahead of the signal is clear for the train. However, they still pose a safety hazard because rapid deceleration associated with emergency braking may cause load shifts on freight trains and falls on passenger trains.

There were 312 such occurrences in 2010–11 (Figure 24), increasing from 304 in 2009–10 and continuing with the increasing trend over the previous four years (Figure 25). This rise in the number of occurrences was associated with the MRA and was still evident after taking into account an increase in train km travelled on this network over the period. In 2010–11 ITSR conducted a detailed review of all such occurrences extending back to the start of 2004. The analysis of incidents between July 2010 and March 2011 suggested the two leading causes of technical SPADs are power supply anomalies (25%) and signal controller / maintainer actions (20%). It also appears a significant number of these incidents could have been avoided. ITSR will communicate these findings back to track managers to verify that all reasonably practicable measures to reduce these occurrences are being taken.

Proceed authority exceeded

There were 19 notifications of trains exceeding the limit of their authorised movement under non-signalled systems of authorisation (Figure 24). The majority of incidents in 2010–11 involve trains passing stop boards in yards. Despite increasing from 12 notifications in 2009–10, the 2010–11 figure remains within the bounds of year to year fluctuation observed over the past four years (Figure 27).

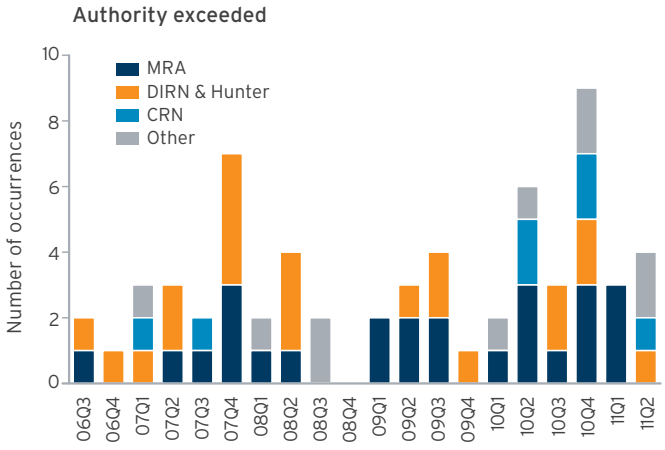


Figure 27: Authority exceeded on the NSW rail network, 2006–07 to 2010–11

Vertical bar is quarterly occurrence count.

22 Independent Transport Safety Regulator, *Transport safety bulletin, Focus on signals passed at danger*, ITSR, June 2011. This bulletin and associated information on better practice in SPAD management and tools for investigating SPADs are available for download from ITSR's website <http://www.transportregulator.nsw.gov.au>

4.2 Safeworking irregularity

Summary

- Over 150 notified occurrences in 2010–11 involved significant failures in the systems governing the safe operations of trains and protection of workers on track.
- There were no track worker fatalities in 2010–11 but there were several serious near miss occurrences where collisions between trains and people were only narrowly avoided.
- ITSR continued a major compliance campaign on track worker safety which included 18 compliance investigations and more than 60 worksite inspections to ensure compliance with network rules for track worker safety.

Safeworking systems comprise the procedures and technology governing the safe operation of trains and protection of people on or about the track. Section 4.1 of this report described a specific subset of irregularities associated with safeworking systems – those where a train exceeded the limit of its authorised movement. However there are other important elements of safeworking systems in which irregularities and threats to safety occur and these are considered below.

In mid-2006 ITSR began a broad and detailed review of serious irregularities in various safeworking systems. This section of the report is based on the data collected as part of this review. The statistical summaries presented are not based on the national occurrence categorisation, which only introduced a coarse level categorisation of these types of safety occurrences in 2008–09.

Procedural safeworking

Procedural safeworking explained

On rail vehicle detection track in NSW, the authorisation for a train to proceed is provided by fixed signals. The signal indications are determined largely by the status of interlockings and the location of trains as determined by track circuits and axle counters. As such, the integrity of the authority communication system does not rely on verbal communications or manual procedures.

On non-rail vehicle detection track, or when signalled track develops a fault, manual safeworking methods are used (albeit supported by hardware and/or software in some cases) and involve communications by telephone, train radio or other verbal forms. These manual methods of safeworking are referred to as *procedural safeworking*.

In such cases, a breakdown in procedure or a miscommunication of information can lead to situations where the blocking required to keep trains separated has, in effect, been compromised. This increases the potential for accidents such as derailments or collisions.

There were 26 procedural safeworking irregularities in 2010–11 (Figure 28). This number is consistent with the historical pattern of behaviour for these types of occurrences since mid-2006 (Figure 29).

Half of the irregularities in 2010–11 were associated with a form of procedural working referred to as *degraded working*. This type of working is used at the time when the normal method of safeworking has been suspended, for example, due to signal fault. Errors may then occur in the alternative procedural-based system for managing train movements such as hand signalling.

About 70% of degraded working irregularities in 2010–11 occurred on the MRA. The relatively high failure rate for this network reflects, in part, the large proportion of signalled track compared to other networks. When the normal signalled system becomes unavailable, only procedural methods of working trains are available, but these generally lack the inbuilt protections of the hardware-supported systems. Moreover, railway staff are required to work to these procedural methods only occasionally, and will have less experience and familiarity with the system compared to the normal signalled system of safeworking. This increases the likelihood that something will be missed or overlooked.

Three degraded working irregularities occurred on the DIRN and Hunter network in 2010–11. The ATSB completed an investigation of one incident at Bomen in September 2010[23] in which a signaller issued the incorrect authority for a freight train to pass a signal at stop. The investigation concluded a procedural error by the network controller was the main factor that contributed to the incident. ARTC has advised it has implemented measures to prevent a recurrence.

One degraded working occurrence was notified for the CRN in 2010–11. This incident involved a network controller issuing an authority (special proceed authority) to a freight train when another was already in the section travelling in the opposite direction. This incident is the subject of a compliance investigation by ITSR.

The remaining procedural irregularities in 2010–11 were associated with forms of procedural safeworking such as train order and staff and ticket. All incidents occurred on the DIRN and CRN (Figure 28) where these methods are used to control train movements in specific track sections. There was a marked but temporary rise in the number of train order irregularities in the last quarter of 2010 (Figure 29). This was associated with the commencement of train order working on segments of the CRN north of Werris Creek in mid-November 2010. There was also a serious occurrence involving an electric staff (token) at Narromine in July 2010 in which a freight train travelled on a section of track without authority. The crew of the freight train took the staff for the section without the required authority from the network controller. This occurrence is being investigated by ITSR.

23 Australian Transport Safety Bureau, *Safe working irregularity involving freight train 2CM3 at Bomen*, New South Wales, ATSB, Canberra, May 2011

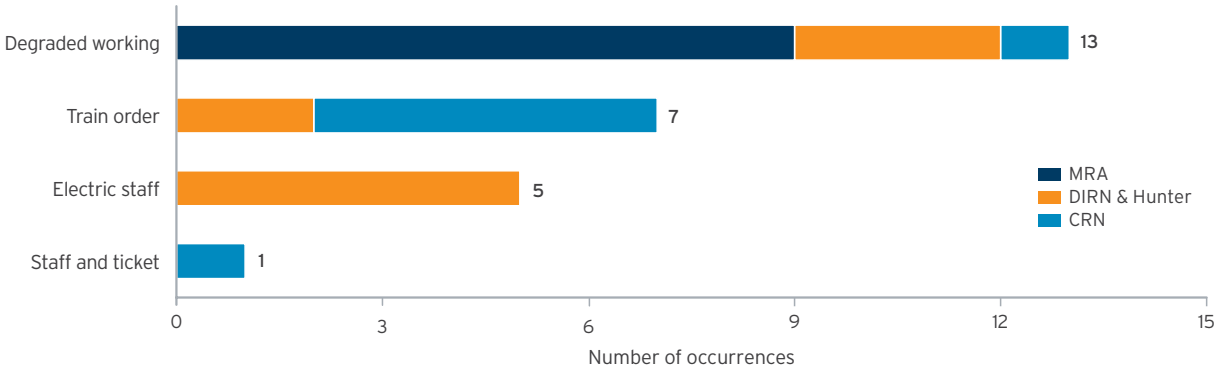


Figure 28: Procedural safeworking irregularity on the NSW rail network, 2010–11

Irregularities are a subset of safety occurrences (those with potential for collision or derailment) notified to ITSR.

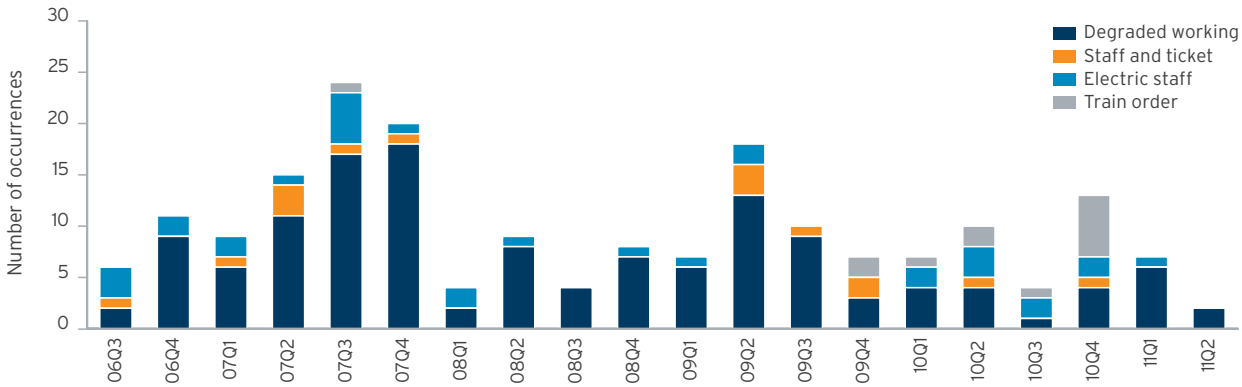


Figure 29: Procedural safeworking irregularity on the NSW rail network, 2006–07 to 2010–11

Vertical bar is quarterly occurrence count. Irregularities are a subset of safety occurrences (those with potential for collision or derailment) notified to ITSR.

Worksite protection

Worksite protection explained

Worksite protection refers to a specific set of safeworking rules and procedures designed to manage the safety of worksites and workers on track.

In NSW there are five different methods of worksite protection prescribed in the network rules. These range from low levels of protection, for example, where lookouts warn workers of approaching trains, through to exclusive 'possessions' where the protection arrangements are advertised in advance and no trains (other than work trains) are permitted to enter the worksite.

Serious irregularities for each of the five methods of worksite protection in 2010–11 are summarised in Figure 30. The data of Figure 30 represent a subset of more serious occurrences within the broader set of notified worksite-related incidents. They are incidents that represent a situation where the separation between trains and worksite(s) was not adequately ensured[24].

Fortunately there were no track worker fatalities associated with worksite protection in 2010–11. However, there were 100 serious irregularities notified in 2010–11 including several near miss incidents (Table 10), indicating the risk of fatality remains significant. In addition, there were another 28 irregularities where work appeared to have been undertaken without any approved work on track protection method being applied.

24 In 2010–11 ITSR revised its classification of serious worksite protection incidents to accommodate changes in safeworking rules and provide a more meaningful representation of certain types of failures. Part of this revision involved identification and classification of occurrences where work on track took place without any protection. These types of occurrences have not been reported previously and the summaries in this report are not directly comparable with previously published figures.

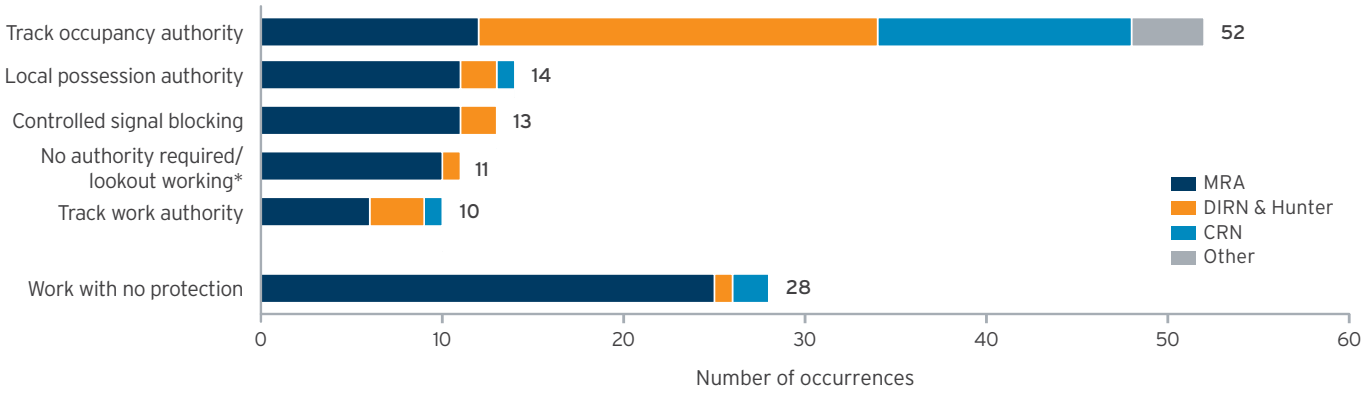


Figure 30: Worksite protection irregularity on the NSW rail network, 2010–11

The category *Work with no protection* is distinct from the five other categories in that it represents work performed without any approved work on track protection method being applied. The other five categories represent failures in the use of the approved method of protection. Excludes records lacking sufficient information for coding. *No authority required network rule was revised in December 2010 and renamed as lookout working. The count shown is the sum of irregularities for the two forms of working.

Table 10: Worksite protection near miss occurrences on the NSW rail network, 2010–11

Examples of near miss occurrences which are the subject of investigation.

Date	Location	Protection type	Description
29 October 2010	Bankstown (MRA)[1]	No authority required	Driver of empty CityRail train travelling from Sefton to Sydenham observed a team of five track workers conducting rubbish removal work at Bankstown Station. The driver sounded the horn and engaged emergency braking, stopping the train an estimated 100 metres short of the workers.
29 January 2011	West Ryde (MRA)[2]	Track occupancy authority	Freight service travelling from Broadmeadow to Botany was approaching West Ryde when track workers were observed ahead on track. The driver sounded continuous whistle and engaged emergency braking. Workers jumped clear of the track.

1 Subject of investigation by OTSI
2 Subject of compliance investigation by ITSR

The nature and number of irregularities varied between networks. The most problematic method of protection on the DIRN, Hunter and CRN was track occupancy authority (TOA), consistent with it being the most common method of protection used on these networks. For the MRA, all five forms of protection had a significant proportion of irregularities recorded, reflecting the use of a wider variety of protection methods on the MRA compared to the other main networks. The MRA also recorded a comparatively large number of occurrences that involved work/workers on track without any approved method of protection in place at all[25].

Changes in the number of serious worksite protection incidents over time for each of the main networks are presented in Figure 31. The number of serious worksite protection occurrences in 2010–11 remains comparable to that observed over the past four years for each of the networks.

One potentially significant development in the management of this risk in 2010–11 was a change to the rules governing the lowest form of protection, no authority required (NAR). The Coroner's report into the Singleton double rail fatality of 2007[26] identified that improvements to the NAR rule were needed. A national project to examine operating rules resulted in several changes to NAR. The revised rule, now called *lookout working* (LOW), was implemented in December 2010 and is expected to improve the safety of track work under this method. ITSR has noted a potential decrease in the number of incidents coinciding with this change on sections of the network. However, the significance of the change is complicated by chance variation associated with low numbers of occurrences at these finer scales and shorter timeframes of analysis. In 2011–12 ITSR will monitor the effects of this rule change to determine its effectiveness in improving safety.

25 These data may not represent all risks associated with the different methods of worksite protection. For example, misjudgements by lookouts or other instances where no protection method was actually established may never be formally reported unless an accident or near miss occurs.
26 A copy of the Coroner's recommendations is available at ITSR's website <http://www.transportregulator.nsw.gov.au>

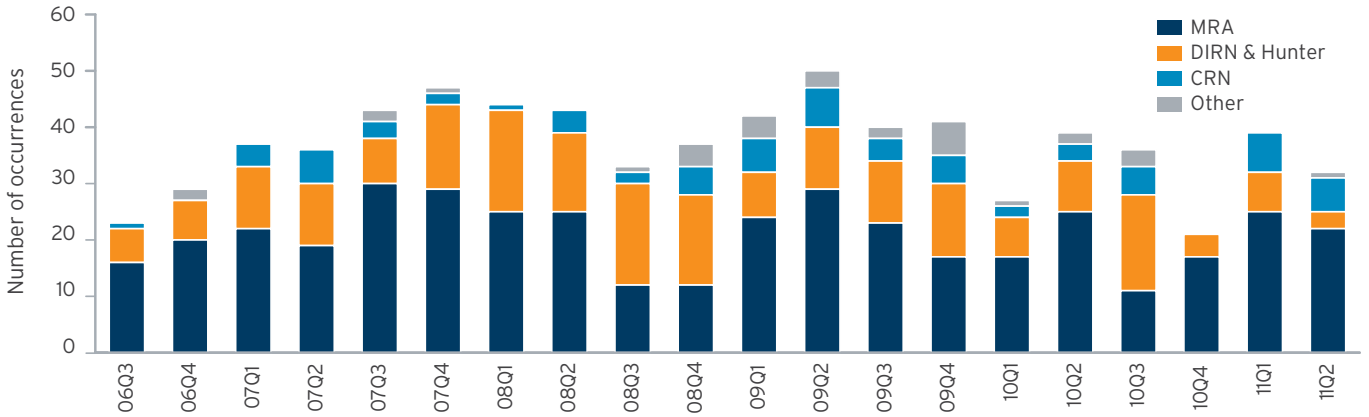


Figure 31: Worksite protection irregularity on the NSW rail network, 2006-07 to 2010-11

Excludes records lacking sufficient information for coding. Includes work performed without any approved work on track protection method being applied.

Failures in individual method of protection

Irregularities associated with each of the five approved methods of worksite protection have been further categorised by ITSR into specific failure types. This helps determine the specific weaknesses of each method of protection that need to be addressed by industry. A summary of findings from this work is presented in Figures 32 to 36.

LOW/NAR[27] is the lowest form of protection. It does not exclude trains from the worksite and requires workers to move to a safe place on the approach of a train. About 40% of failures for LOW/NAR (Figure 32) were associated with lookouts, for example, work undertaken without a lookout, or positioning the lookout in an unsuitable location.

Lookouts are a critical element of this system of protection because they are responsible for watching for approaching trains and warning workers to move away from the track in sufficient time. One near miss incident associated with NAR that is the subject of investigation is summarised in Table 10.

Another 25% of NAR/LOW failures involved use of the method when a higher form of protection was warranted for the nature of work intended, for example, when track work involves use of earthmoving vehicles on or near the track. ITSR's compliance program has found there has been a tendency for workers to use the lowest form of protection because it is easier and quicker to implement, and requires fewer resources.

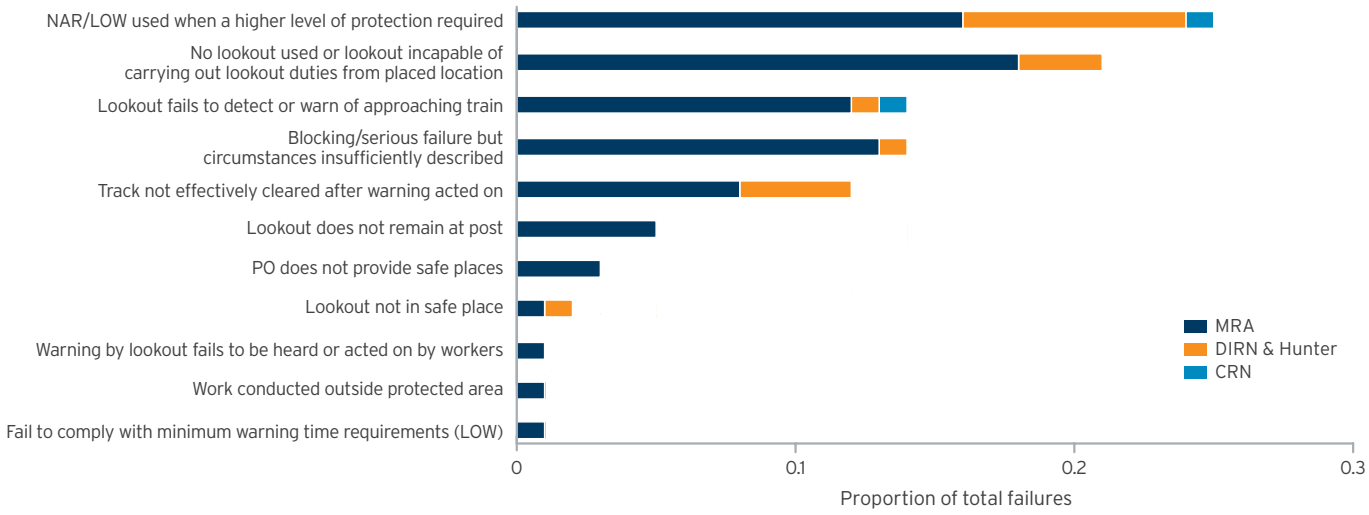


Figure 32: No authority required/lookout working failure on the NSW rail network, 2006–07 to 2010–11

PO = protection officer.

27 For this report, NAR and LOW statistics are combined

Controlled signal blocking (CSB) involves the use of signals to exclude traffic from a worksite. It was the method of protection in use when a track worker was struck and killed by a train at Kogarah in April 2010. Two types of failure accounted for almost 50% of CSB related incidents (Figure 33) – work conducted without CSB protection actually being in place, and work outside areas protected by CSB. ITSR investigated one such occurrence in 2010–11 where a truck and other work vehicles were moved across track with the intended protection applied to a place other than where transfer took place.

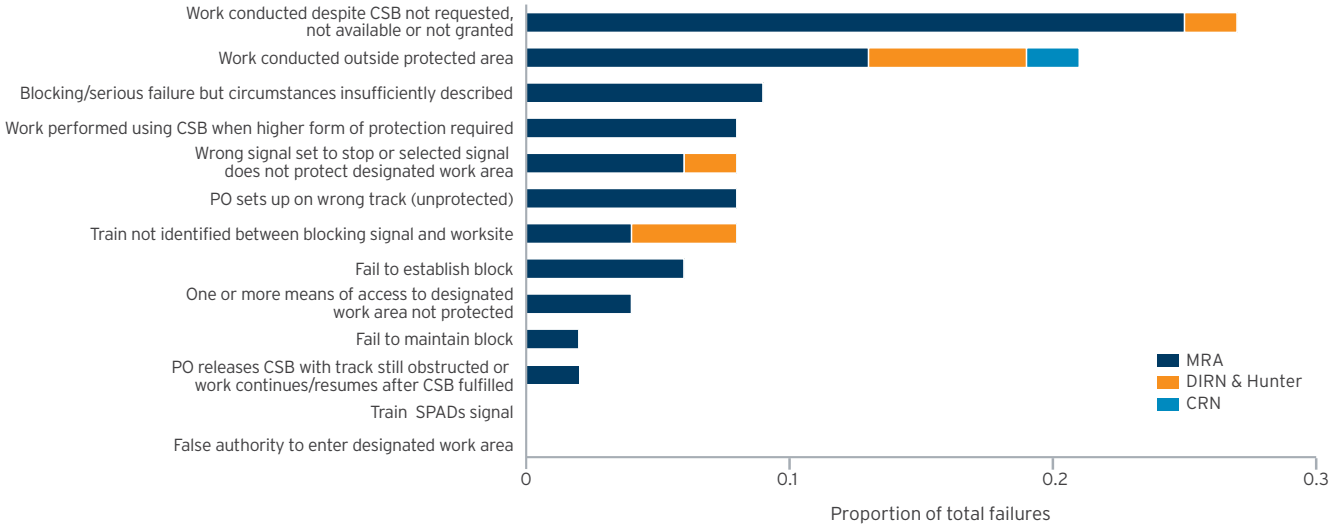


Figure 33: Controlled signal blocking failure on the NSW rail network, 2006–07 to 2010–11

PO = protection officer.

Track work authority (TWA) is an intermediate form of protection – it does not give exclusive occupancy but allows occupation of track by workers between rail traffic movements. Rail traffic is controlled by signallers and hand signallers. The apparent differences between TWA failure types of Figure 34 are unreliable due to the small number of failures distributed across a large number of categories. However, hand signaller errors collectively represented over 40% of such failures. Like NAR, hand signallers have a crucial role in the protection of workers under TWA in managing a train's approach towards, and passage through, a worksite in a safe manner.

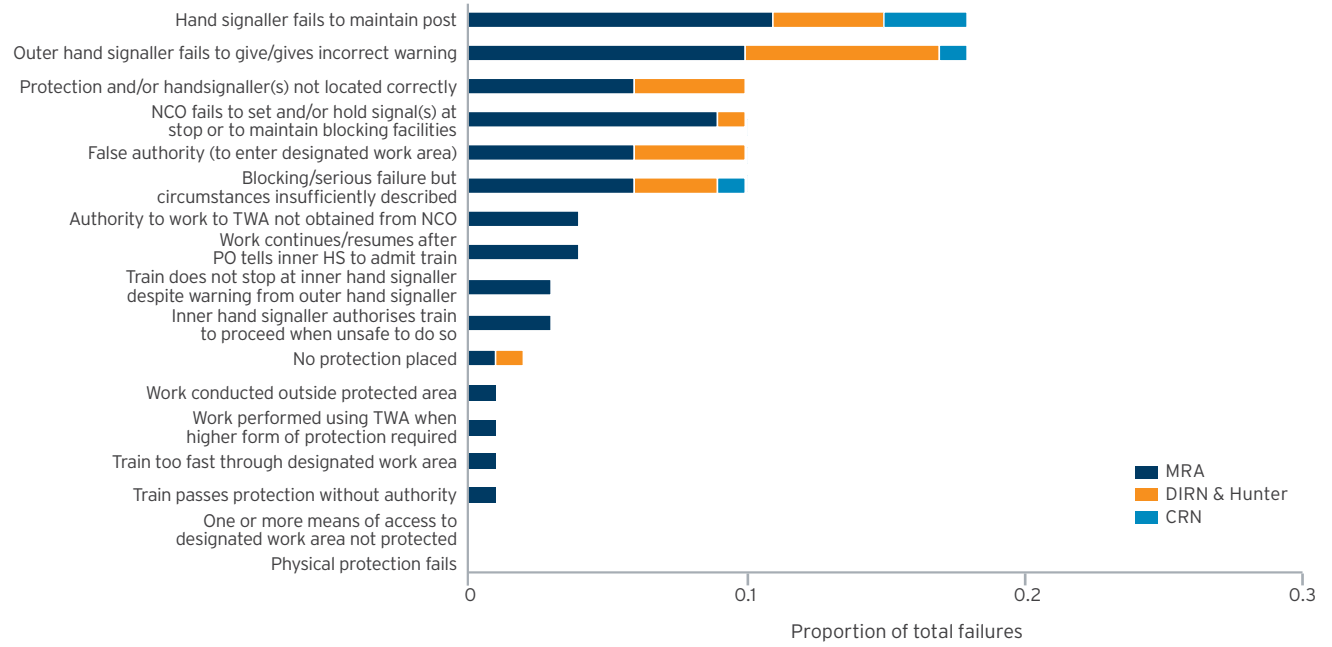


Figure 34: Track work authority failure on the NSW rail network, 2006–07 to 2010–11

HS = hand signaller. NCO = network control officer. PO = protection officer.

Figures 35 and 36 summarise the various types of failures for the two 'possession' types of track work, namely, track occupancy authority (TOA) and local possession authority (LPA) respectively. TOA and LPA represent the highest forms of worksite protection and are distinct from others in that they are intended to completely exclude trains from the protection area. However, the highest levels of protection are not without risk. A track work fatality at Newbridge in May 2010 in which a CountryLink train and an excavator collided was associated with the TOA method of protection.

About 25% of failures for TOA comprised track vehicles exceeding the limit of their authorised movement. These incidents are associated with a different application of TOA which does not involve a fixed worksite. In these cases TOA are used for the transfer of track machines between work locations or for hi-rail track inspections.

A common failure for both forms of possession was track work conducted outside the protected area. ITSR is investigating one occurrence at Harden in September 2010 where a truck extended into the path of adjacent (unprotected) lines and collided with a train.

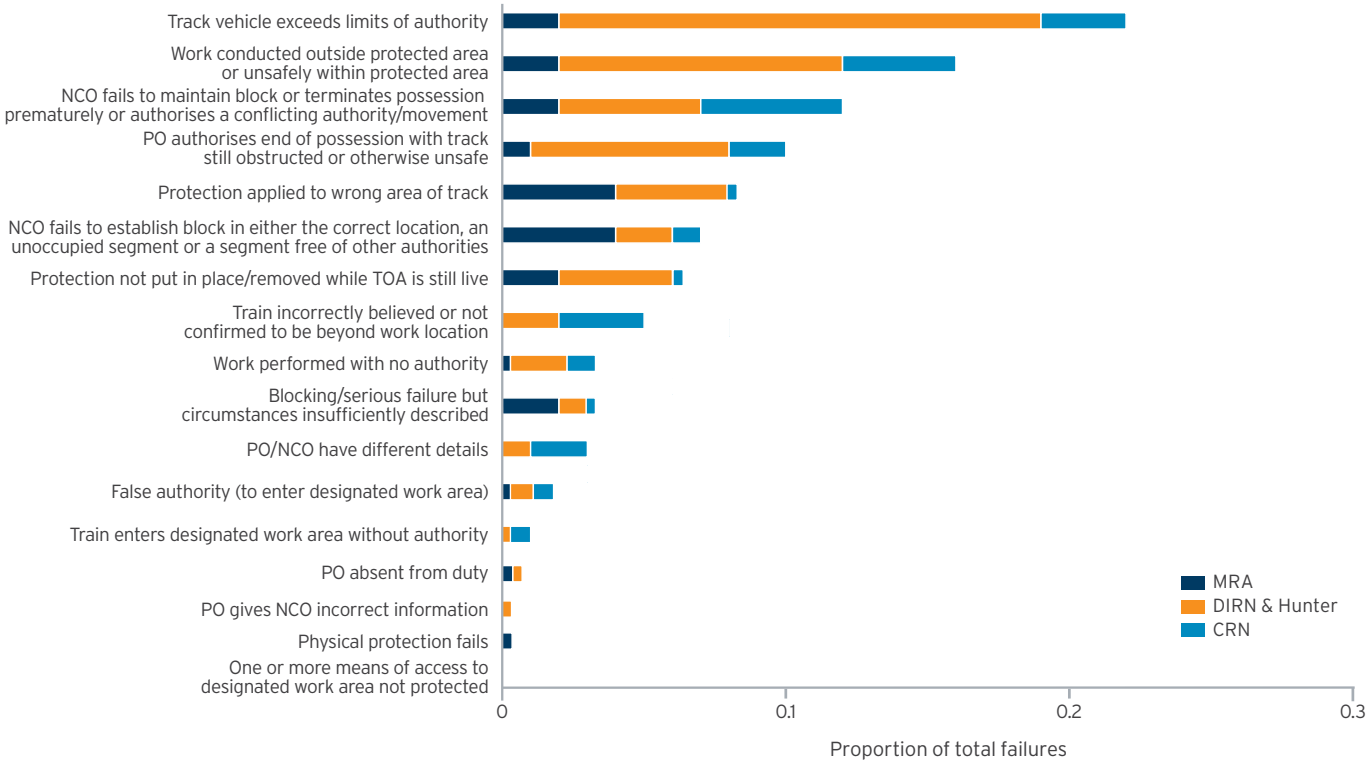


Figure 35: Track occupancy authority failure on the NSW rail network, 2006–07 to 2010–11

NCO = network control officer. PO = protection officer.

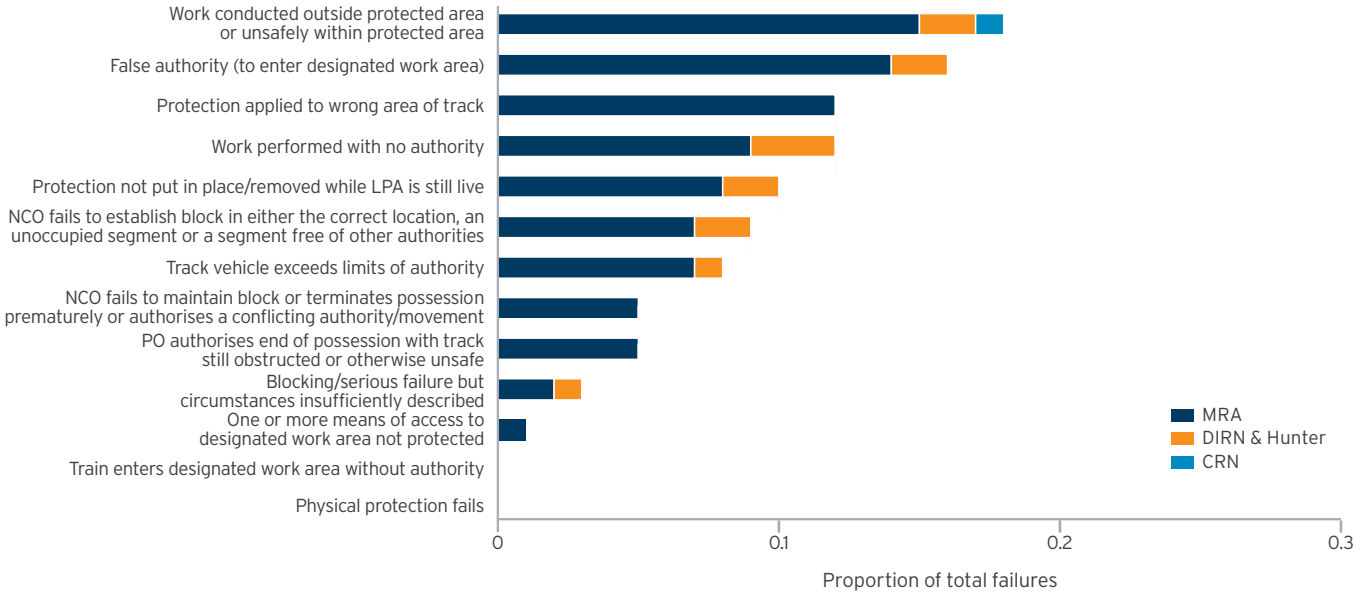


Figure 36: Local possession authority failure on the NSW rail network, 2006–07 to 2010–11

NCO = network control officer. PO = protection officer.

Rail transport operators' management of worksite-related safety risks has been an ITSR corporate priority since 2008–09. In 2010–11 ITSR continued targeted compliance activity on this issue which included:

- 65 inspections of worksites across NSW where the adequacy of protection and compliance with network rules were monitored and enforced
- 18 compliance investigations commenced into specific worksite protection incidents.

In 2010–11 ITSR also expanded its regulatory approach to encourage industry to improve its understanding of risks to inform more effective safety management. ITSR led the development of fault trees and vulnerability analysis to systematically identify contributing factors to incidents and faults in systems of each method of worksite protection[28]. These approaches were then presented at workshops with the network owners. RailCorp and ARTC are expected to further develop this work and strengthen their overall systems for worksite protection. ITSR will continue to work with industry to validate and refine these tools, as well as monitor industry's progress in addressing vulnerabilities identified.

4.3 Signal and track irregularity

Summary

- The number of broken rails on the MRA has decreased over time.
- The number of track misalignments[29] on sections of the DIRN has increased over time due, in part, to the development of mud holes on sections of the network.

Signal and other authority system irregularity

The national occurrence category *signal and other proceed authority system irregularity* comprises irregularities in the systems, components and equipment used to authorise train movements in a safe manner. There are four principal subcategories reflecting each of the main systems used nationally for issuing an authority to proceed. The categories are defined quite narrowly and are essentially limited to the most serious irregularities, such as wrong side failures.

Irregularities in the three main authority systems used in NSW to authorise movements of trains are shown in Figure 37.

There were no communication or token-based irregularities notified in 2010–11. There were six signal irregularities notified on the NSW rail network in 2010–11 which was consistent with that observed over the previous four years (Figure 38).

28 Fault trees utilise a graphical technique to identify the chain of events leading to a specific fault or failure. Vulnerability analysis is the process of identifying possible hidden or latent faults or weakness that could lead to system failure.

29 The definition of *track misalignment* in the national occurrence reporting and classification scheme is broader than that defined in the engineering standards used by industry for track inspection, maintenance and reporting (see note on the definition of track irregularities, Page 57).

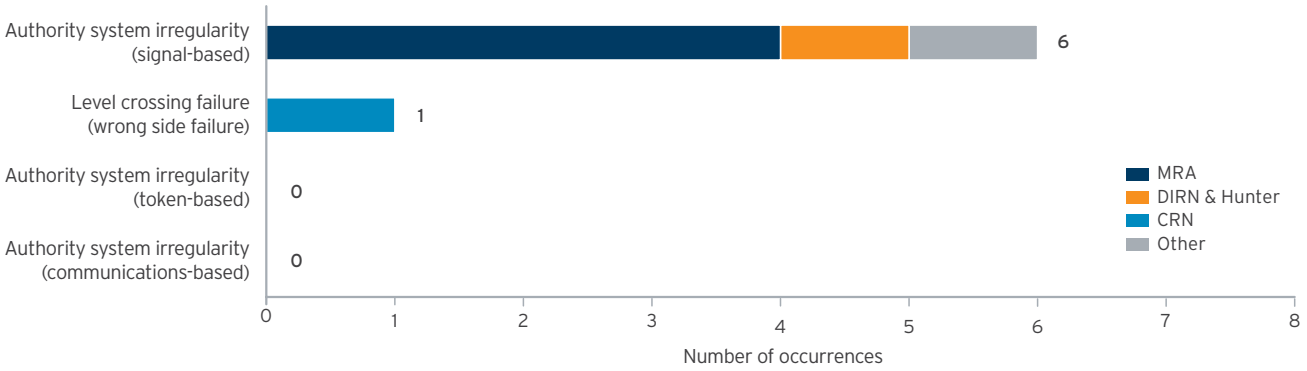


Figure 37: Signal and other proceed authority system irregularity on the NSW rail network, 2010–11

Figure 37 also includes serious defects in level crossing control equipment used to control the movement of vehicular and pedestrian traffic. Wrong side level crossing failures are associated with actively controlled crossings, for example, when the level crossing lights and bells do not operate as intended to warn road users of an approaching train. There was one occurrence in 2010–11 that comprised an actual or potential serious failure in the level crossing equipment (Figure 38).

Due to the serious nature of the failures summarised in Figure 37, each incident was reviewed by ITSR's specialist support team to ensure it was investigated by the rail infrastructure manager and associated risks were appropriately managed. Level crossing-related occurrences are also regularly reported to the NSW Level Crossing Strategy Council which coordinates level crossing safety between agencies.

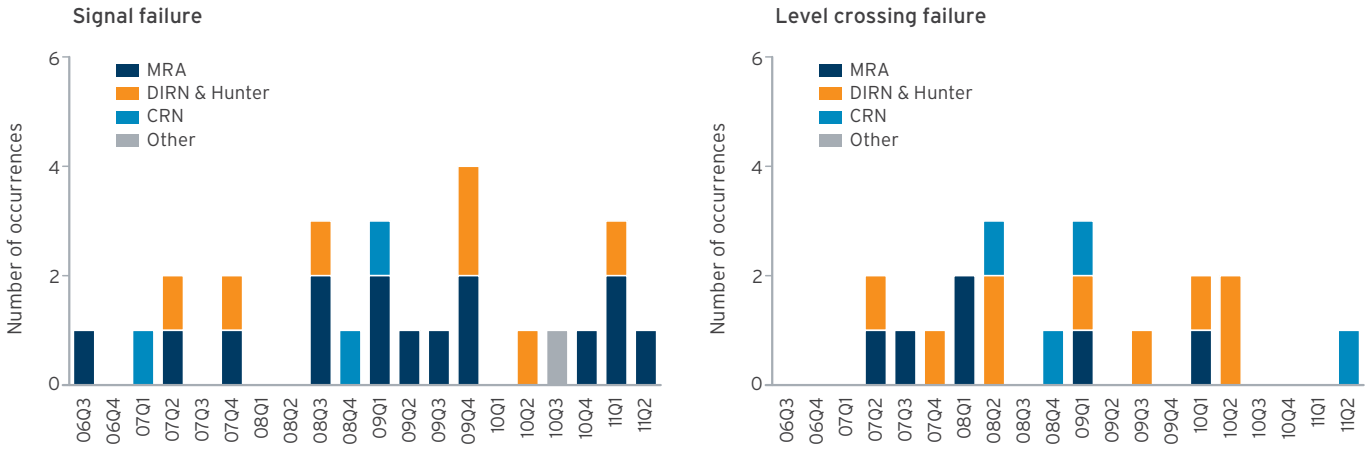


Figure 38: Signal and level crossing irregularity on the NSW rail network, 2006–07 to 2010–11
Vertical bar is quarterly occurrence count.

Track irregularity

A note on the definition of track irregularities

The definition of *broken rail* and *misaligned track* in the national occurrence classification guideline is different from the engineering standards used by industry for track inspection, maintenance and reporting. *Broken rail* (occurrence category 11.1) includes, but is not restricted to, complete breaks through the entire cross section of the rail. It may also include fractures and broken joints. *Misaligned track* (occurrence category 11.2) encompasses misalignment in both the horizontal and vertical planes as well as failures in the formation – the ground upon which the track is laid. *Misaligned track* in particular therefore comprises a diverse range of incident types that vary markedly in terms of their causes, consequences and safety risks posed.

Figure 39 provides a summary of three primary categories of track irregularity defined within the national occurrence classification guideline.

The most common type of track related irregularity in 2010–11 was *track obstruction*. Incidents within this category include material not only obstructing track but also interfering with broader rail infrastructure. There were 789 occurrences in 2010–11 and the incidents varied markedly in terms of their causes, nature and risks posed. The majority of obstructions comprised animals and trees within the rail corridor. Some involved rail-related material such as high ballast, sleepers, train seats and maintenance equipment. Several occurrences in 2010–11 involved cars entering the rail corridor as a result of traffic accidents on adjacent roads.

Broken rails and misaligned track are two key indicators of track condition and associated safety of the rail network. Notified track defects provide a valuable measure of the way the asset is being maintained in addition to their role as precursors for more serious incidents. At least one freight train derailment in 2010–11 was the result of a track irregularity (see section 3.1).

There were 85 broken rails notified in 2010–11 (Figure 39). More than 80% of these occurred during the cooler months of the year, specifically April to September. This seasonal pattern was also a feature of the longer term record (Figure 40) and reflects a seasonal increase in stresses associated with rail contraction during very cold weather. At such times, rail is more likely to break under load from rolling stock.

About 16% of broken rails notified in 2010–11 occurred on the MRA. Previous reports have noted a decreasing trend in the number of broken rails on the MRA. No trend is apparent in the most recent period of data (Figure 40) although the number of irregularities on the MRA remains at a historical low. About 70% of broken rails in 2010–11 occurred on the DIRN and Hunter network, remaining consistent with that observed over the previous four years (Figure 40).

The distribution of broken rails across NSW over the past five years is shown in Figure 41. The greatest concentration of breaks was in the Hunter region, between Maitland and Muswellbrook. The rate of broken rail in 2010–11 (per track length) was also far greater in the Hunter region (approximately 37 per 1,000 track km) compared to other networks (ranging from 3 to 10 per 1,000 track km approximately). Breaks on the DIRN were concentrated on the main southern corridor between Macarthur and Junee. On the CRN the highest counts are evident on the line running north-west from Werris Creek.

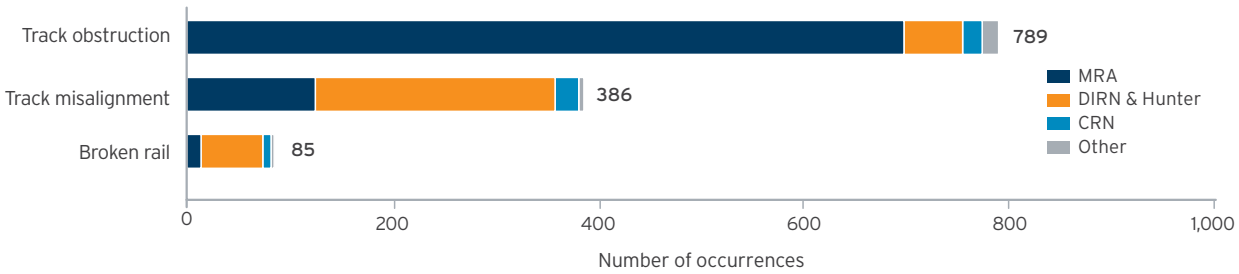


Figure 39: Track-related irregularity (running line) on the NSW rail network, 2010–11

Spread track is not shown (usually associated with another top event such as derailment).

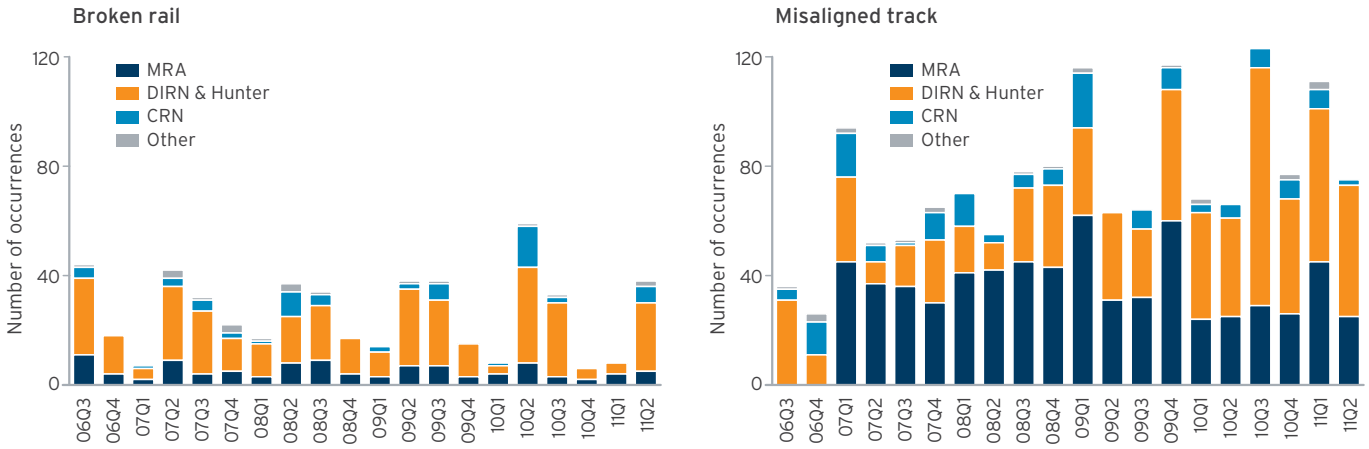


Figure 40: Track irregularity (running line) on the NSW rail network, 2006–07 to 2010–11

Vertical bar is quarterly occurrence count. Data excluded for *misaligned track* on the MRA prior to 2007 due to changes in RailCorp's reporting process.

Misaligned track, as defined under the national occurrence classification guideline, encompasses a particularly diverse range of defects (see note on the definition of track irregularities). It includes defects in horizontal geometry – often described as *buckles or kicks* – that occur more often in the warmer months when higher temperatures expand rail and increase its chance of buckling. The category also includes vertical irregularities, some of which are associated with defects in the ballast and underlying formation. While the seasonality of vertical irregularities is less pronounced, some such as bog holes and mud holes are more frequent in the months when rainfall and drainage issues become relevant.

More than 30% of all misalignments in 2010–11 occurred on the MRA. The record of misalignments on this network has been truncated due to a significant change in reporting of occurrences in late 2006. However, the number of occurrences in 2010–11 was consistent with historical records since the change in reporting.

About 60% of notified misalignments in 2010–11 occurred on the DIRN. The greatest concentration of occurrences was on the main southern corridor between Macarthur and the Victorian border (40%) and the Hunter (30%) (Figure 42). There was an increase in misalignments on the DIRN over the five-year period (Figure 40) associated primarily with the main southern corridor. This increase occurred towards the end of a major program of concrete resleepering, completed in 2008–09 by ARTC. The specific method of resleepering employed on this section of the DIRN led to disturbance of the track base, drainage problems and the formation of mud holes[30]. Speed restrictions have been imposed by ARTC to ensure safe operations along this corridor. However this has led to a marked increase in transit times which can, in turn, lead to other safety concerns such as driver fatigue[31]. In 2010–11 ITSR also noted an increase in misalignments on the DIRN between Parkes and Cootamundra since the installation of concrete sleepers on this section of track in late 2009. Many of the associated reports are related to mud holes. ITSR is communicating with ARTC on these observations to determine what measures are being taken to arrest this trend.

The number of misalignments on the CRN (23) was the same as the previous year and consistent with that observed over the past four years. Historical data shows the occurrences were concentrated on two sections of the network, from Wallerawang to Orange and Werris Creek to Narrabri (Figure 42).

ITSR's regulatory activity in relation to track issues such as broken rails and mud holes included monitoring rail infrastructure managers' adherence to applicable engineering standards and also verifying that the standards themselves provided the necessary margin of safety. In specific cases ITSR initiated regulatory action to obtain information and ensure track managers' systems for identifying and managing track-related risks were adequate. In 2010–11 ITSR commenced a new program to promote improved management of physical rail assets such as track and rolling stock. Effective asset management requires all elements of the asset lifecycle, from planning through to disposal, to be closely aligned to specified reliability and safety outcomes. The program will also encourage the use of asset management data as a lead indicator of safety performance to identify potential safety-related issues at an early stage, well before they escalate to the point of failure or harm. The project was successfully trialled within a section of RailCorp in 2010–11 and will be made available to the rest of the rail industry during 2011–12.

30 At the time of writing the Federal Minister for Infrastructure and Transport has requested the ATSB undertake a systemic investigation of rail operations on the interstate rail line between Sydney and Melbourne including the condition of the track and measures that have been put in place to maintain the safety of rail operations where track quality is below acceptable operational standards.

31 For example, average monthly transit time delays on this corridor for 2010–11 ranged between 9 and 24 minutes for the XPT and 20 and 49 minutes for superfreighters; Australian Rail Track Corporation, *2010–11 NSW Lease Annual Condition Report*, ARTC, South Australia, July 2011.

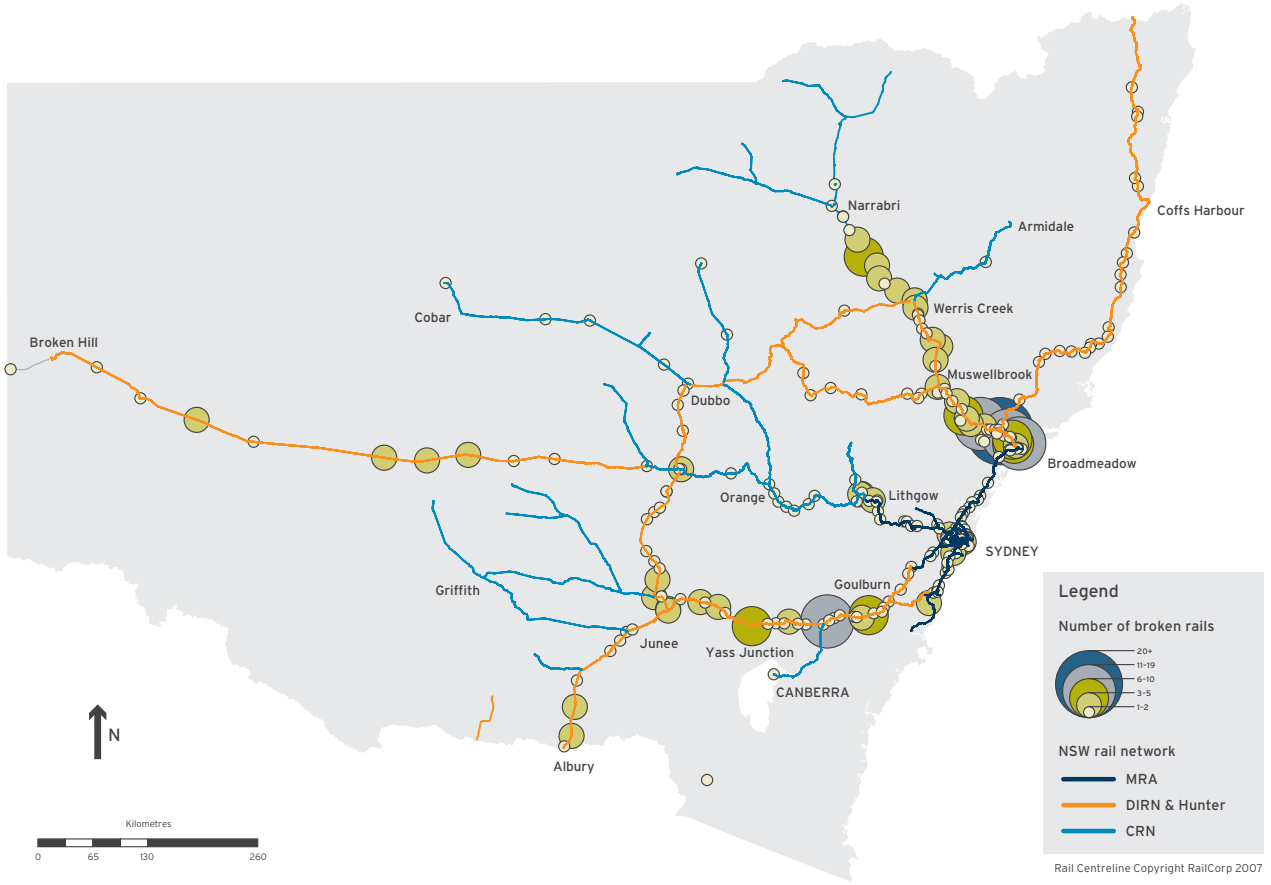


Figure 41: Broken rail (running line) across the NSW rail network, 2006–07 to 2010–11

Mapped location is based on nearest reported location as notified by rail transport operators.

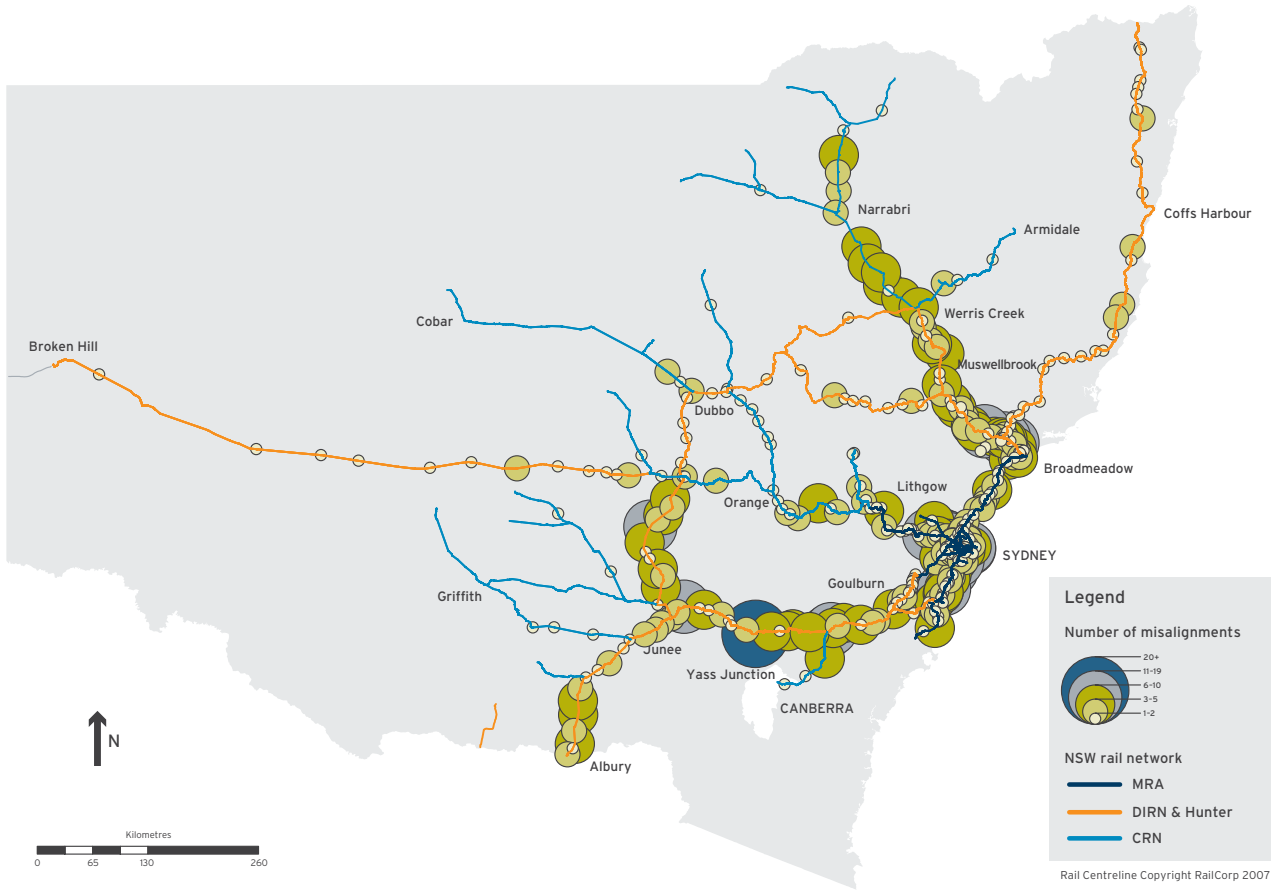


Figure 42: Misaligned track (running line) across the NSW rail network, 2006–07 to 2010–11

Misaligned track comprises vertical and horizontal misalignments as well as formation failures. Mapped location is based on nearest reported location as notified by rail transport operators.

4.4 Rolling stock irregularity

Summary

- The rate of braking system irregularity on passenger trains (per train km travelled) has decreased over time.
- The rate of braking system irregularity on freight trains (per train km travelled) has increased over time.
- The number of freight train partings has increased over time due, in part, to track-related irregularities on segments of the DIRN.

Rolling stock irregularities are important precursors to serious safety incidents. The national occurrence categories *wheel/axle failure* and *defective bearing* are the most significant in this regard. For example, a defective bearing can sometimes lead to sheared axle and train derailment. Rolling stock irregularities for 2010–11 are summarised in Figure 43 by irregularity and train type.

Passenger train

Two wheel irregularities were notified in 2010–11 which was within the bounds observed over the previous four years. One bearing-related irregularity was notified in 2010–11, remaining consistent with historical data (Figure 44). All these incidents were associated with CityRail passenger trains.

Nearly 95% of brake-related irregularities on passenger trains were associated with CityRail passenger trains, which provide the vast majority of the state's passenger train services. While the length of historical data was truncated due to changes in reporting, there was a decrease in the rate of notified braking system irregularities from 17.3 occurrences per million train km travelled in 2007–08 to 10.7 in 2010–11.

Faulty passenger train doors are of lower significance in terms of safety risk. However, they are a major contributor to fleet-related delays on the MRA. Past reports have described a range of measures undertaken by RailCorp to address the rate of door failures. The rate of door faults (per million train km travelled) has decreased over the period for which comparable data is available, falling from 38.5 in 2008 to 25.4 in 2010–11.

Freight train

Recent history shows that many freight train accidents in NSW such as derailments and fire are caused by rolling stock irregularities. While associated risks are generally lower due to reduced passenger exposure, almost one-quarter of the 723 freight train irregularities listed in Figure 43 occurred on the MRA.

There were 19 notifications of axle bearing-related irregularities on freight trains in 2010–11. Further, at least two of the four wheel/axle-related occurrences were also associated with a bearing irregularity. Most of these incidents were detected by trackside monitoring equipment. This equipment plays a critical role in the detection of bearing faults and prevention of derailments although false alarms are sometimes notified. The rate of bearing-related occurrences in 2010–11 (1.1 per million train km travelled) was comparable to the historical record excluding a period in 2007–08 affected by a suspected rise in false alarms. However, axle bearing failures remain a significant risk and appeared to be the cause of three running line freight train derailments in 2010–11 (see Table 7 for more information).

A total of 534 braking system irregularities were notified in 2010–11. While the vast majority of irregularities were associated with rolling stock defects, for example, sticking brakes, they did include crew and vandalism-related incidents such as interference with handbrakes. The consequence of incidents were generally limited to rail traffic delays while brakes were repaired or isolated. However there were several incidents in 2010–11 in which a brake-related irregularity led to another event such as thermal cracks in wheels, runaways or fires. Both the number and rate of freight train brake irregularities have increased over the past five years. The rate has risen from 19.9 per million train km travelled in 2006–07 to 29.7 occurrences per million train km travelled in 2010–11.

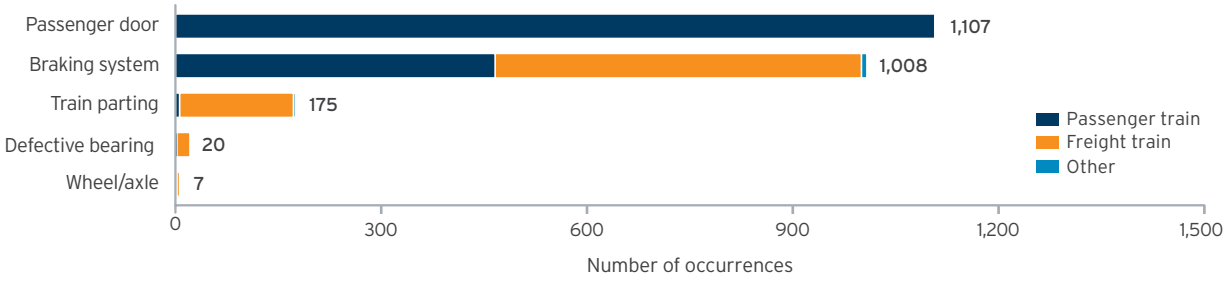


Figure 43: Rolling stock irregularity on the NSW rail network, 2010–11

Braking system includes occurrences with a top event of wheel scale or wheel flat (which are classified as *rolling stock other* under the national occurrence classification guideline).

Train partings comprise the unintentional separation of rolling stock. These are associated with a range of causes including coupler faults, track irregularities and vandalism. There were 166 train parting occurrences notified in 2010–11. They are typically lower risk occurrences because brakes automatically apply in such situations, preventing runaways. However, they result in delays and require crew to leave the train to inspect and protect trains, which in turn gives rise to other risks. Both the number (166) and rate (9.2 per train km travelled) of partings in 2010–11 was higher than the previous year (137 and 8.2 respectively), continuing the upward trend in incidents over the past five years. As noted previously[32] the increase was associated with the main southern interstate rail line between Sydney and the Victorian border and coincided with the development of a specific type of track irregularity referred to as a mud hole (this issue is discussed further in section 4.3).

Safety risks associated with rolling stock irregularities are a key focus of ITSR's compliance program. ITSR uses information from notifications as well as its knowledge of the nature and scale of operations to target higher risk freight operators. These include operators with comparatively poor performance, larger operations and/or running on networks shared with passenger services. In 2010–11 ITSR undertook more than 50 compliance inspections of specific freight operators to ensure safety risks associated with rolling stock irregularities were being appropriately managed and rolling stock complied with relevant engineering standards. In several cases ITSR undertook joint audits with rail regulators from other states for operators with multi-jurisdictional accreditation. In 2011-12 ITSR will focus on freight operators' use of asset management (see section 4.3) to increase the level of assurance that rolling stock assets are fit for purpose throughout their lifecycle.

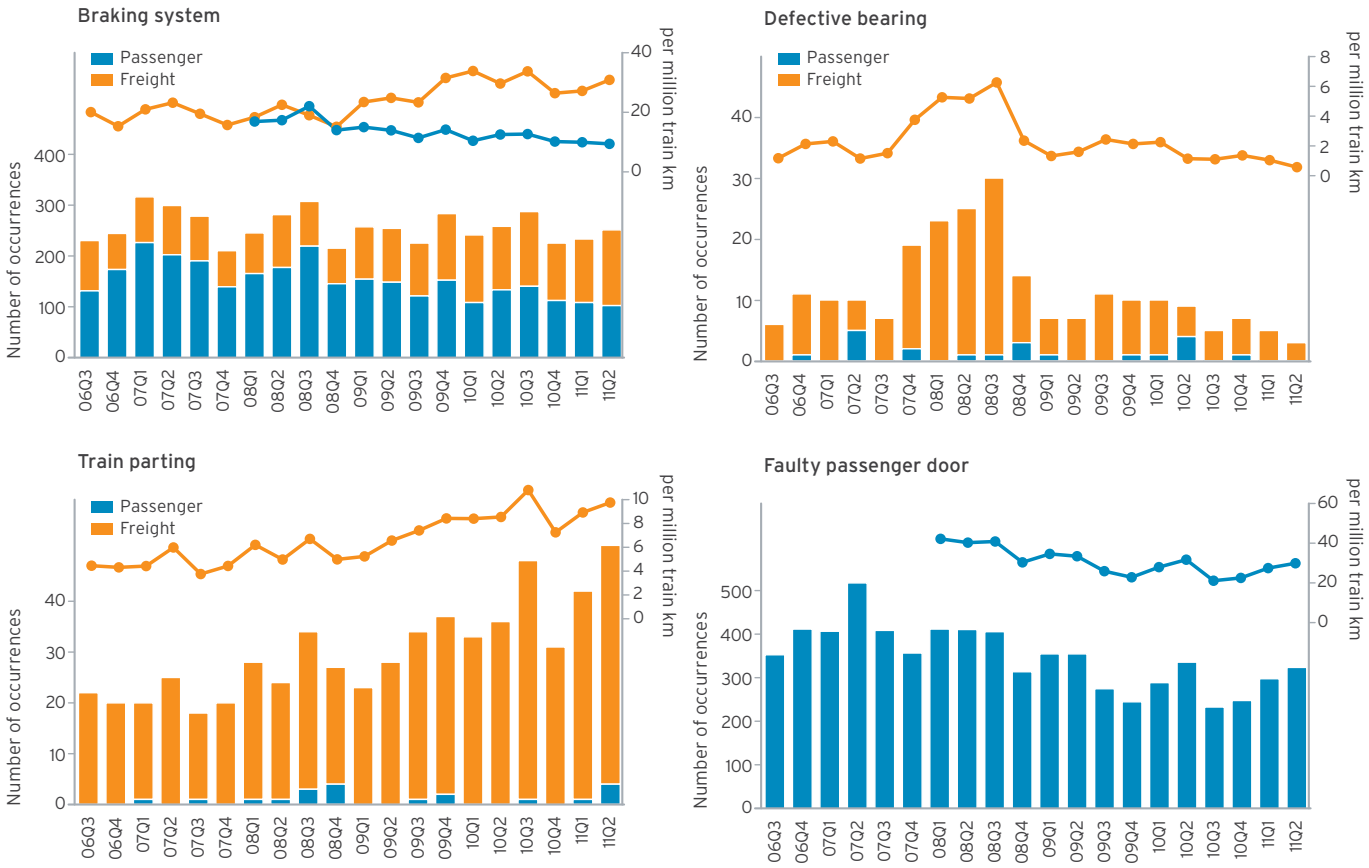


Figure 44: Rolling stock irregularity on the NSW rail network, 2006–07 to 2010–11

Vertical bar is quarterly occurrence count. Solid line is quarterly occurrence rate (per million train km travelled). *Braking system* includes occurrences with a top event of wheel scale or wheel flat (which are classified as *rolling stock other* under the national occurrence classification guideline). Passenger train rate for brake and door prior to 2008 excluded due to change in RailCorp's method of train km calculation. Passenger train rates for *defective bearing* and *train parting* are not shown due to low counts.

32 Independent Transport Safety Regulator, *Rail Industry Safety Report 2009–10*, ITSR, Sydney, January 2011

4.5 Load irregularity

Summary

- 195 load irregularities were notified in 2010–11. The rates of open door and load shift (per million train km travelled) have fallen over the past five years.
- There was a small rise in the number of incidents involving the uneven distribution of load within trains. This is thought to reflect, in part, a reporting change following the issue of an industry alert by ITSR in mid 2010.

Load irregularities are associated with freight trains and are precursors to a range of rail accidents. A load that shifts beyond the train envelope poses a collision hazard to other trains and railway infrastructure such as signals. The loss of materials such as coal from trains can obstruct tracks and derail trains.

A total of 195 load irregularities were notified for the period 2010–11 (Figure 45). More than half the load irregularities occurred on the DIRN & Hunter network, which carries most of the state's freight traffic. Another third occurred on the MRA where they present a risk to passengers on platforms and in trains.

The longer term patterns in both the number and rate of irregularities are presented in Figure 46. Significant changes in several categories of load irregularity are evident over the five-year period.

The number of open doors (including hatches and gates) in 2010–11 (62) was higher than for the previous year (49). However there is a longer term decreasing trend in both the number and rate of open door incidents over the five-year period. The rate has fallen from 5.2 per million train km travelled in 2006–07 to 3.5 in 2010–11. Open freight container doors have been the subject of past compliance activity by ITSR due to the collision risk they pose. Freight operators have taken steps to reduce these occurrences, for example wagon and door modifications. This is likely to have been a contributing factor to the reduction in occurrences over time.

Load shifts and out of gauge loads are classified separately under the national occurrence classification guideline. However, there is often insufficient information provided in a notification to distinguish between them so counts for the two are combined. There were 48 occurrences classified as either *load shift* or *out of gauge* in 2010–11 which is less than that for 2009–10 (53). Both the number and rate of these types of incidents have decreased over the five-year period. The rate has fallen from 4.0 per million train km travelled in 2006–07 to 2.7 per million train km travelled in 2010–11.

The category *uneven distribution of load* encompasses two main types of incident including loads distributed unevenly within an individual wagon which can cause a wagon to lean, and an uneven distribution of load between wagons within a train consist. The latter was a contributing factor to at least two derailments in 2009–10 and one yard derailment in 2010–11. A sharp increase in the number of these types of occurrences is apparent in 2010–11 (Figure 46). The rise occurred soon after ITSR issued a rail industry safety notice in June 2010 highlighting the derailment risk[33]. The rise is therefore likely to be due, at least in part, to heightened awareness of this issue and a resultant increase in monitoring and reporting.

Load fastening irregularities are one of the most frequent, but lowest risk types of load irregularity. They include dragging chains, loose ropes and flapping tarpaulins. There were 65 occurrences reported in 2010–11 at a rate of 3.6 occurrences per million train km travelled. This remains consistent with the rate of 3.8 (per million train km travelled) observed over the previous four years (Figure 46). While the risk associated with these types of occurrences are minor, they can pose a threat to passing trains – in October 2010 a loose strap on a wagon smashed the window of passing passenger train (Table 9).

33 Independent Transport Safety and Reliability Regulator, *Operation of less than safely loaded wagons*, ITSRR, Sydney, June 2010

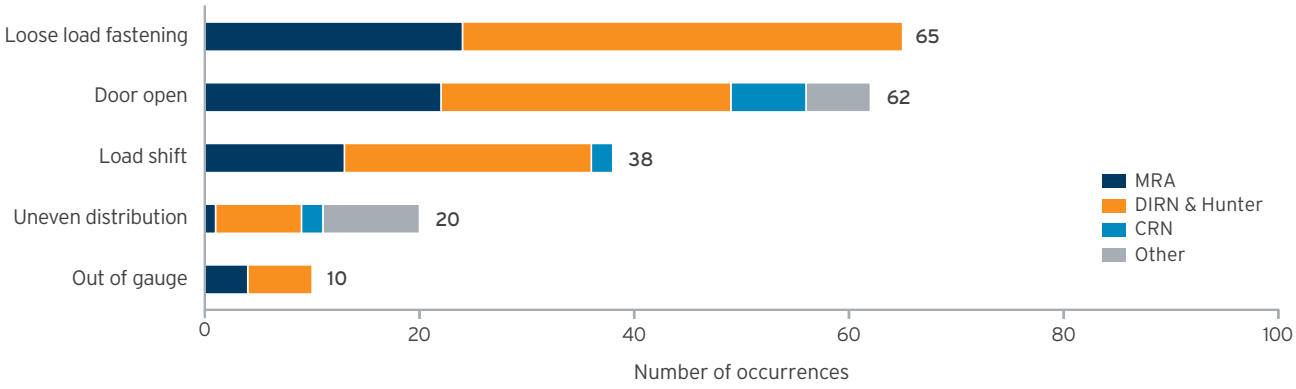


Figure 45: Load irregularity on the NSW rail network, 2010–11

Door open includes incidents where load is lost from a freight train via an open door. Such incidents are classified as top event *load shift* under the national occurrence classification guideline.

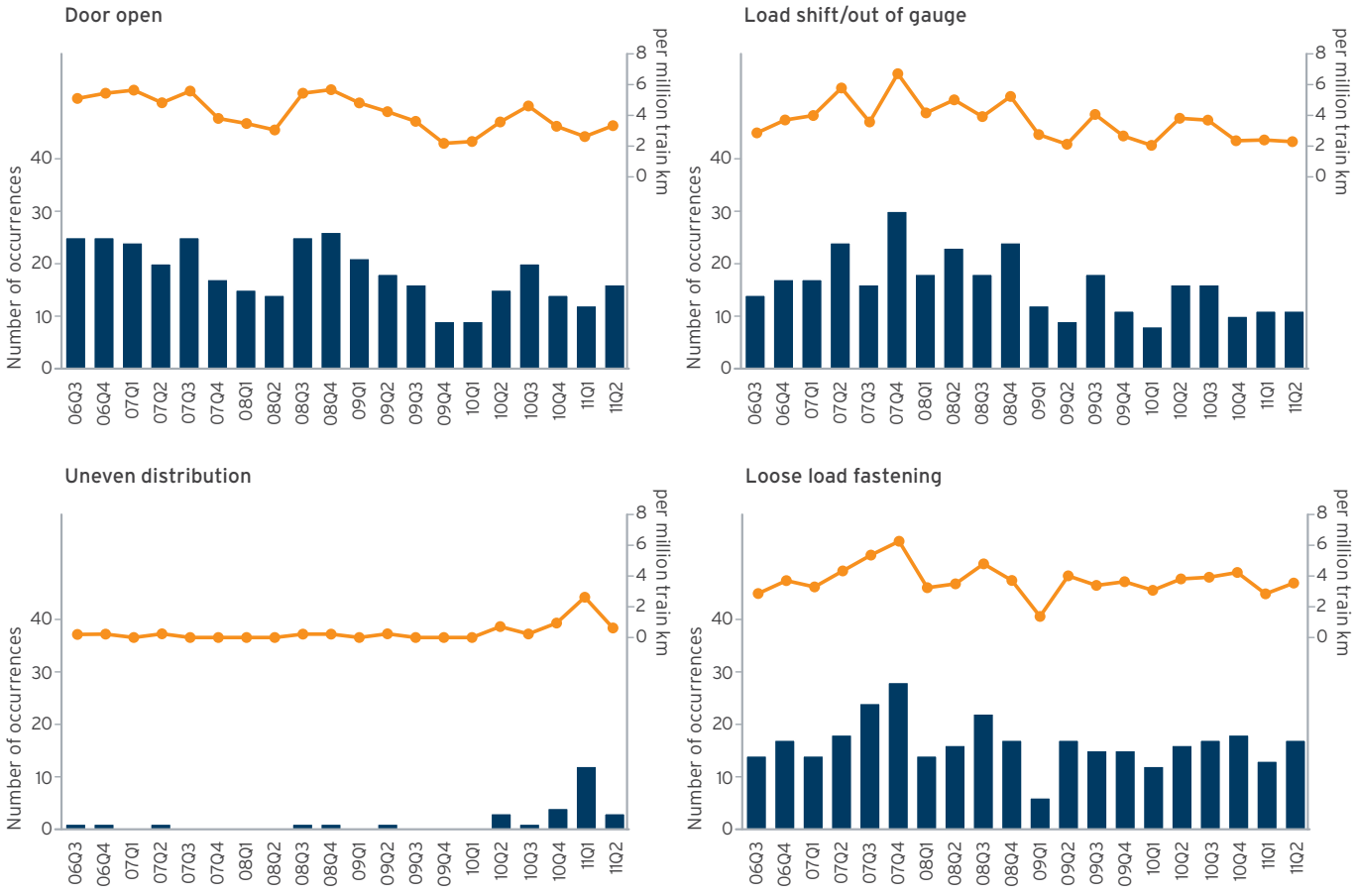


Figure 46: Load irregularity on the NSW rail network, 2006–07 to 2010–11

Vertical bar is quarterly occurrence count. Solid line is quarterly occurrence rate (count per million train km travelled).

5. Fitness for duty

The human contribution to rail safety occurrences may be immediate and direct, for example, the incorrect setting of points or the breach of a safeworking rule. In other cases the human contribution may be removed from the occurrence, for example, an error in an inspection or maintenance procedure that subsequently led to a rolling stock irregularity.

The importance of human performance in operational safety is recognised in the national guideline on safety management systems for rail transport operators[34]. Effective safety management systems must consider the range of factors that influence worker performance, from organisational factors such as safety culture through to local workplace conditions and personal factors such as physical health.

NSW's rail safety legislation is consistent with the national guideline requirements for safety management systems. However, it specifies additional requirements in three key areas of safety management concerning rail safety worker performance – drug and alcohol management, human fatigue and health and fitness.

5.1 Drug and alcohol management

Summary

- Almost 18,900 drug and 132,300 alcohol tests were conducted by rail transport operators in 2010–11. The amount of testing in 2010–11 was the highest on record.
- The rate of alcohol detection for freight operators as a whole has risen in recent years while the rate of drug and alcohol detection for infrastructure maintainers has fallen.
- ITSR initiated six prosecutions against rail safety workers for offences under the drug and alcohol provisions of the NSW rail safety legislation in 2010–11.

The requirement for rail transport operators to conduct drug and alcohol testing of rail safety workers was introduced in the *Rail Safety Act 2002* and further developed under the *Rail Safety (Drug and Alcohol Testing) Regulation 2003* and the *Rail Safety (Drug & Alcohol Testing) Regulation 2008*.

The *Rail Safety Act 2008* requires all rail transport operators to have formal drug and alcohol programs in place that comply with the Regulation. Since 2006 it has been mandatory for every operator (excluding heritage operators) to have a random testing program that tests 25% or more of its rail safety workers every year[35]. In addition, testing may also include targeted and post-incident testing.

All operators are required to notify ITSR of positive test results as well as any instance where an employee refused to undergo testing. Commercial rail transport operators are also required to submit quarterly summaries of testing activity to ITSR. These extra reporting requirements do not apply to heritage operators.

Program activity

Quarterly summaries show that almost 18,900 drug and 132,300 alcohol tests of rail safety workers were conducted during 2010–11. The number of drug tests in 2010–11 was more than 30% higher than the final figures for 2009–10 (14,280). The number of alcohol tests in 2010–11 was nearly double that of the previous year (71,996). However, one operator was primarily responsible for the increase in alcohol tests in 2010–11, recording more than a ten-fold rise in the number of tests conducted. After exclusion of the results for this operator[36], the increase in alcohol testing in 2010–11 was in the order of 5% on the 2009–10 figure.

A breakdown of random testing activity by industry sector (Figure 46) shows the average rate of testing in 2010–11 for each sector, as a whole, exceeded the minimum required under the Regulation (a minimum of 25% of an operator's rail safety workers tested per year). The increased rate of drug testing observed in 2010–11 was across all four sectors, with passenger operators and rolling stock maintainers contributing the largest rate increases.

ITSR also undertook drug and alcohol testing of rail safety workers on four separate occasions in 2010–11. This resulted in 32 random drug and 89 random alcohol tests. The testing focused on a range of small and large rail transport operators.

34 National Transport Commission, *National Rail Safety Guideline, Preparation of a rail safety management system*, NTC Canberra, 2008
35 Under the proposed National Law this mandatory requirement will be removed
36 The operator represents 1% of the total 2010–11 workforce and undertook almost 45% of all alcohol tests with no positives recorded

Table 11: NSW rail industry drug and alcohol testing results, 2010–11

Statistics are based on rail transport operators that were accredited and required to submit quarterly returns for at least part of 2010–11. Excludes refusal to be tested (n=15). Includes all testing reasons, for example, for-cause, random, post-incident and 'other'. Excludes the heritage sector which has different testing and reporting requirements.

Description	Drug	Alcohol
Number of rail transport operators testing	34	38
Approximate random component (% of all tests)	95.8	99.0
Overall detection rate (% of all tests)[1]	1.05	0.05[2]
Median rail transport operator detection rate (% of all tests)[3]	0.00	0.00
Number of rail transport operators reporting no positive results	22	25
Number of rail transport operators reporting exactly one positive result	5	6
Number of rail transport operators reporting more than one positive result	9	9

1 Total positive tests (all rail transport operators) divided by total tests (all rail transport operators) multiplied by 100 (excludes refusal to be tested).
2 One infrastructure maintainer recorded a large increase in testing which strongly influenced alcohol results for 2010–11 (operator represented less than 1% of the workforce but over 40% of the total tests). Without this operator, the alcohol detection rate in 2010–11 was 0.09% and comparable with 2009–10.
3 Rail transport operator detection rate is rail transport operator's total positive tests divided by rail transport operator's total tests multiplied by 100 (excludes refusal to be tested). Median is the middle ranked value of all rail transport operator detection rates.

Program results

Table 11 presents summary statistics for 2010–11 based on all forms of testing.

Drug testing covers a range of drug classes including amphetamines (for example, 'speed'), opiates (for example, 'heroin') and cannabiniods (derived from cannabis). The overall detection rate for drugs in 2010–11 (1.05%) was slightly higher than that for 2009–10 (0.95%) but remained consistent with the average over the past few years. As in previous years, cannabis was the most common drug associated with positive drug tests.

The overall detection rate for alcohol in 2010–11 (0.05%) was influenced by the unusual testing activity of one operator, as noted previously. Exclusion of this operator's results from the analysis yielded an alcohol detection rate in 2010–11 of 0.09% which was equal to that for 2009–10.

The overall detection rate is sensitive to the influence of larger operators (who conduct the majority of tests) and operators reporting anomalous testing activity or results. For this reason, Table 11 also includes a summary of detection rates on an operator basis. It shows about two-thirds of rail transport operators testing for drugs and alcohol did not return a positive result in 2010–11. The rail transport operators reporting the higher number of positives tended to be those with larger numbers of workers.

Another limitation of the overall detection rate is that it is influenced by the results of non-random testing. Non-random testing comprises a range of test types that may yield rates of detection that are unrepresentative (higher or lower) of the general railway safety worker population. For example, it includes for-cause testing – testing that targets individuals because there is reason to believe they could be affected by drugs or alcohol.

A breakdown of random test results by industry sector over five years is shown in Figure 47. Significant differences are apparent between sectors. Freight operator detection rates have been low compared to other sectors in the past. However the rate of alcohol detection for the freight sector has increased for two successive years. The drug detection rate for the freight sector also appears to have increased in 2010–11 from previous years, but this may be an artefact of chance variation between samples of workers tested.

Rolling stock maintainers have historically recorded comparatively high rates of detection for both drugs and alcohol. The rate of drug detection in recent years remains high compared to all other sectors. However, alcohol detection rates appear to have improved in recent years although the comparatively low testing rate means estimates of detection are less reliable and subject to considerable volatility between years.

Infrastructure maintainers have also recorded comparatively high rates of drug and alcohol detection in the past compared to other sectors. A marked drop in the rate of both drug and alcohol detection for this sector was first noted in 2009–10. The rate of detection for both drugs and alcohol in 2010–11 was at least half of that observed over the first three years of testing.

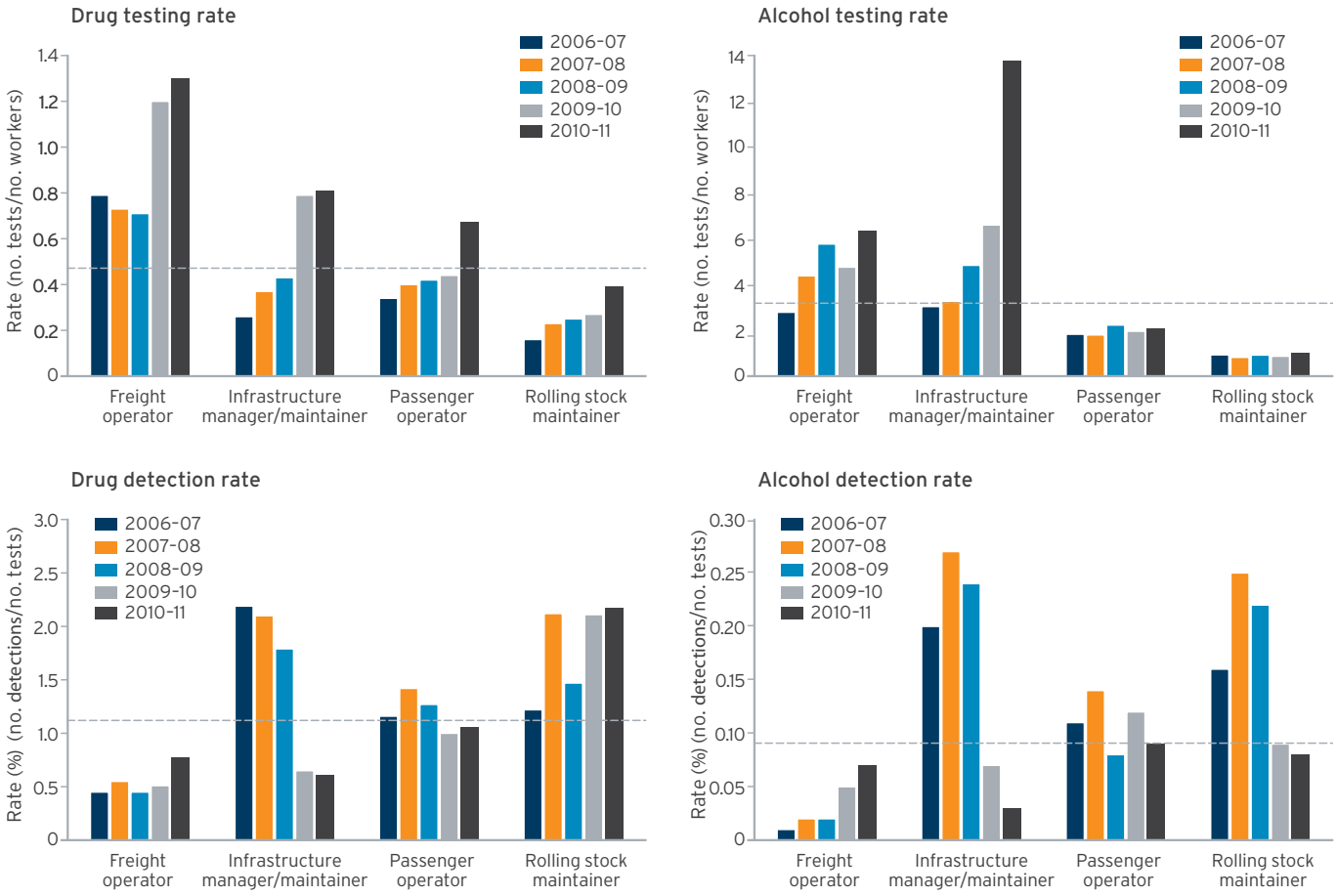


Figure 47: NSW rail industry random drug and alcohol testing activity by sector

Dotted line is industry average over five years 2006–07 to 2010–11. Excludes refusals to be tested. Excludes the heritage sector which has different testing and reporting requirements. All rates are averages for the sector as a whole, whereby an individual rail transport operator's contribution to a sector rate is proportional to the operator's size.

ITSR continues to monitor testing activity of rail transport operators and investigate incidents of concern and breaches of legislation. Seventeen compliance investigations were undertaken in 2010–11 for drug and alcohol breaches. ITSR also commenced six prosecutions of rail safety workers for offences under the *Rail Safety (Drug and Alcohol Testing) Regulation 2008*. Four matters involved instances of exceeding the prescribed concentration of alcohol (PCA) and two matters related to the failure to supply a sample. With the exception of two PCA matters, all occurred on separate occasions at various locations across NSW.

5.2 Other fitness for duty programs

Fatigue management

Fatigue is a human condition primarily caused by prolonged wakefulness and/or insufficient sleep. A worker's reasoning and concentration is impaired by fatigue and this can lead to operational errors. As such, fatigue is recognised as a causal factor in accidents and incidents on railway systems.

The national guideline for preparation of safety management systems states rail transport operators must develop and implement a program for management of fatigue amongst rail safety workers. Such programs should be developed in accordance with separate national guidance on fatigue management[37].

The fatigue management requirements for rail transport operators in NSW are consistent with those specified in the national guidance. The *Rail Safety Act 2008 and Rail Safety (General) Regulation 2008* require rail transport operators to have a fatigue management program, which is part of their safety management system. However, the Act and Regulation also list a number of specific requirements for rail transport operators in their management of fatigue including:

- minimum standards for certain rail safety workers, for example, maximum shift length for freight train drivers
- specific matters to be considered in preparing a fatigue management program, for example, the need for education and training of rail safety workers to identify and manage fatigue
- specific matters which must be addressed or included in a fatigue management program, for example, provide for safe hours of work and periods of time between shifts.

Health and fitness management

Rail safety workers must be of sufficient good health and fitness to perform their duties. The national guideline for preparation of safety management systems states rail transport operators must put in place a health and fitness program to ensure that worker ill-health does not jeopardise rail safety.

A separate national standard[38] has been developed to help guide rail transport operators in their development of a health and fitness program. The standard describes the elements of an effective program including management systems and responsibilities, assessment procedures and medical criteria to ensure rail safety workers maintain an appropriate level of health.

The NSW legislation is consistent with the national guidance in requiring rail transport operators to have in place health and fitness management programs. However, whereas national guidance indicates operators' health and fitness programs must comply with the national standard so far as is reasonably practicable, the NSW legislation specifies that program's compliance with the national standard must be absolute.

37 National Transport Commission, *National Rail Safety Guideline, Management of Fatigue in Rail Safety Workers*, NTC, Canberra, 2008
38 National Transport Commission, *National Standard for Health Assessment of Rail Safety Workers*, NTC, Canberra, 2004

6. Glossary of rail-related terms

Source of definitions

Most definitions have been sourced from the national occurrence classification guideline and the *Glossary for the National Codes of Practice* (Australasian Railway Association <http://www.ara.net.au>). Level crossing definitions are from the NSW Staysafe Committee[39]. Some descriptions may differ from definitions contained in the legislation – for compliance purposes readers should refer to section 4 (Interpretation) of the *Rail Safety Act 2008*.

Accreditation requirements are outlined in the *Rail Safety Act 2008*. NSW rail transport operators must be accredited by ITSR or exempt from the requirement to be accredited under the Act. The granting of accreditation indicates that a rail transport operator has demonstrated it has the competence and capacity to manage the risks to safety associated with the railway operations for which it is accredited.

Ballast refers to material, usually stone, that surrounds the sleepers to hold them properly in place.

Balloon loop is track forming a loop usually at the end of a railway line where empty wagons are loaded from overhead bins, or full wagons are emptied through hopper doors in to under-track grates, all while the train is moving at low speed. The loop enables the train to effectively do a 'U' turn.

Buffer stop is a structure erected across and at the end of a track at main line terminals or dead end sidings which is intended to stop rolling stock.

Foul is where an object is in a position to obstruct rail traffic on an adjacent line.

Freight trains are designed and used for carrying goods such as coal and minerals, grain, fuel, livestock and containers.

Infrastructure generally includes the track and its components, for example, rails, sleepers, bridges, ballast, and signalling equipment. Generally the term does not include stations or terminals.

Interlocking is an arrangement of signal equipment that prevents conflicting movements of trains through junctions or crossings. It is designed so that it is impossible to give clear signals to trains unless the route to be used is proved to be safe.

Level crossing is any crossing of a railway at grade, providing for both vehicular traffic and other road users including pedestrians. The control of railway crossings is classified as either active or passive according to the following criteria:

- **active control** – control for the movement of vehicular or pedestrian traffic across a railway crossing by devices such as flashing signals, gates or barriers, or a combination of these, where the device is activated prior to and during the passage of a train through the crossing
- **passive control** – control for the movement of vehicular or pedestrian traffic across a railway crossing by signs and devices, none of which are activated during the approach or passage of a train and which rely on the road user, including pedestrians, detecting the approach or presence of a train by direct observation.

In addition to actively and passively controlled crossings there are also *occupational* or *accommodation* crossings between private property and public roads, maintenance crossings and illegal crossings.

Light locomotive/s means one or more locomotives coupled together without any vehicles attached.

Near miss is any occurrence where the driver of a moving train takes emergency action, or would have if there was sufficient time, to avoid impact with a person, vehicle or other obstruction and no collision occurred. Emergency action includes continuous audible warning and/or brake application.

Network rules are rules issued to mandate the requirements for safe operation on a rail network.

Passenger journeys in urban areas measures the number of point to point journeys for each passenger, irrespective of the number of vehicles or mode used for the trip. For non-urban areas, it measures the number of point to point journeys for each passenger, but each change of vehicle along the route is a separate journey.

39 NSW Staysafe Committee, *Report on updating progress on railway level crossing safety*, rep. no. 254/09, Staysafe Committee, Parliament of NSW, June 2009

Passenger trains are trains designed and used for carrying passengers.

Rail infrastructure manager is the person who has effective management and control of rail infrastructure of a railway, whether or not the person owns the rail infrastructure or has a statutory or contractual right to use the rail infrastructure or to control, or provide, access to it.

Rail safety worker is a person who has carried out, is carrying out or is about to carry out rail safety work. Classes of rail safety work are defined under section 7 of the *Rail Safety Act 2008*.

Rail transport operator is a rail infrastructure manager, a rolling stock operator, or both.

Rail vehicle detection track is a portion of track formed into an electric circuit where current is carried through the rails and used to detect the presence of trains. Track circuits are used in the operation and control of points and signalling equipment.

Risk is the likelihood that a harmful consequence might occur. In a safety context, risk is expressed in terms of likelihood of an adverse event and the consequences of that event.

Rolling stock means any vehicle that operates on or uses railway track.

Rolling stock operator is a person who has effective management and control of the operation or movement of rolling stock on rail infrastructure for a particular railway, but does not include a person merely because the person drives the rolling stock or controls the network or the network signals.

Running line is railway track used primarily for the through movement of trains.

Safeworking system is an integrated system of operating procedures and technology for the safe operation of trains and the protection of people and property on or in the vicinity of the railway.

Shunt is to move trains or vehicles on lines for purposes other than through movement.

Siding is a portion of railway track, connected by points to a running line or another siding, on which rolling stock can be placed clear of the running line.

Staff is a metal rod which represents the authority for rail traffic to proceed into a section.

Staff and ticket is a system of safeworking involving the use of a staff or the issue of a written authority to proceed into a section after the driver has seen the staff for the section.

Superfreighter is a high-priority intermodal freight train.

Terminals are places where freight is loaded onto or unloaded from trains. A passenger terminal is a place where passenger trains commence or terminate for passengers to board or alight.

Track machines are specialised pieces of rolling stock used on the rails to maintain infrastructure.

Train km refers to the total kilometres travelled in NSW by a rolling stock operator's trains.

Train order is an instruction, on a prescribed form, issued by a train controller to direct the movement of traffic.

Wheel flat is the loss of roundness of the tread of a wheel caused by wheelslip or wheel slide.

Wheel scale is the build up of metallic material on a wheel tread's surface.

Wrong side failure refers to a failure in the signalling system which results in the signal displaying a less restrictive aspect than required, for example, showing a proceed indication when the correct indication should be stop.

Yard is a network of railway tracks and sidings for marshalling, storage, and/or maintenance of locomotives, engines or wagons.

7. List of notifiable occurrences

Under the *Rail Safety Act 2008* (section 63), rail transport operators are required to report to ITSR, or another authority specified by ITSR, all notifiable occurrences that happen on, or in relation to, the operator's railway premises or railway operations. Under the *Rail Safety (General) Regulation 2008* (clause 27) notifiable occurrences are defined as follows:

Category A[40]

(a) an accident or incident that has caused death, serious injury or significant property damage

(b) a running line derailment

(c) a running line collision between rolling stock

(d) a collision at a road or pedestrian level crossing between rolling stock and either a motor vehicle or a person

(e) a fire or explosion on or in rail infrastructure or rolling stock that affects the safety of railway operations or that endangers one or more people

(f) a suspected terrorist attack

(g) any accident or incident involving a significant failure of a safety management system that could have caused death, serious injury or significant property damage

(h) the theft of or from rolling stock or railway premises of a rail transport operator of security sensitive dangerous goods (within the meaning of the *Australian Dangerous Goods Code* prepared by the National Transport Commission as in force on the commencement of this regulation) or the tampering with any such goods on rolling stock or railway premises of a rail transport operator

(i) any other accident or incident that is likely to generate intense public interest or concern.

Category B

(a) a derailment, other than a running line derailment

(b) a collision involving rolling stock

(c) any accident or incident at a road or pedestrian level crossing arising from a failure of rail infrastructure or that caused a risk to safety or damage to a person or property

(d) the passing of a stop signal, or a signal with no indication, by rolling stock without authority

(e) any accident or incident where rolling stock exceeds the limits of authorised movement given in a proceed authority

(f) any failure of a signalling or communications system that endangers, or that has the potential to endanger, the safe operation of trains or the safety of people, or that causes or could cause damage to adjoining property

(g) any slip, trip or fall by a person on, to or from a train, railway track, railway bridge, station, platform, escalator, lift or stairs, or any person being caught in the door of any rolling stock

(h) any situation where a load affects, or could affect, the safe passage of trains or the safety of people, or causes or could cause damage to adjoining property

(i) any accident or incident involving dangerous goods that affects, or could affect, the safety of railway operations or the safety of people, or that causes or could cause damage to adjoining property

(j) any breach of a safe working system or procedure, or the detection of any irregularity or deficiency in such a system or procedure

(k) any irregularity in any rail infrastructure (including electrical infrastructure and any obstruction on a running line) that could affect the safety of railway operations or the safety of people

(l) any irregularity in any rolling stock that could affect the safe operation of the train or the safety of people, or cause damage to the rolling stock

(m) any fire or explosion that causes damage to rail infrastructure or rolling stock, or both, or that causes the disruption or closure of a railway (even if the closure is only a precautionary measure)

(n) any accident or incident on railway premises where a person inflicts, or is alleged to have inflicted, an injury on another person

(o) a suspected attempt to suicide

(p) if a rail safety worker employed by a rail transport operator has returned a result to a test designed to determine the concentration of alcohol or other drugs in a sample of blood or urine that suggests that the worker was in breach of a relevant safety requirement concerning the use of alcohol or other drugs at a relevant time

(q) the infliction of any wilful or unlawful damage to, or the defacement of, any rail infrastructure or rolling stock that could affect the safety of railway operations or the safety of people

(r) any accident or incident in a rail corridor that indicates that the security of the corridor is compromised and that affects, or may affect, the safety of railway operations.

40 Category A occurrences are more serious than Category B occurrences and therefore must also be notified to OTSI as soon as practicable after the operator becomes aware of the occurrence.

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