



Australian Government
Australian Transport Safety Bureau

Signal RS57 passed at danger, involving suburban passenger train 1W33

Roma Street Station, Brisbane, Queensland | 5 September 2017



Investigation

ATSB Transport Safety Report
Rail Occurrence Investigation
RO-2017-012
Final – 6 March 2018

Cover Photo: Queensland Rail

Released in accordance with section 26 of the *Transport Safety Investigation Act 2003*

Publishing information

Published by: Australian Transport Safety Bureau
Postal address: PO Box 967, Civic Square ACT 2608
Office: 62 Northbourne Avenue Canberra, Australian Capital Territory 2601
Telephone: 1800 020 616, from overseas +61 2 6257 4150 (24 hours)
Accident and incident notification: 1800 011 034 (24 hours)
Facsimile: 02 6247 3117, from overseas +61 2 6247 3117
Email: atsbinfo@atsb.gov.au
Internet: www.atsb.gov.au

© Commonwealth of Australia 2018



Ownership of intellectual property rights in this publication

Unless otherwise noted, copyright (and any other intellectual property rights, if any) in this publication is owned by the Commonwealth of Australia.

Creative Commons licence

With the exception of the Coat of Arms, ATSB logo, and photos and graphics in which a third party holds copyright, this publication is licensed under a Creative Commons Attribution 3.0 Australia licence.

Creative Commons Attribution 3.0 Australia Licence is a standard form license agreement that allows you to copy, distribute, transmit and adapt this publication provided that you attribute the work.

The ATSB's preference is that you attribute this publication (and any material sourced from it) using the following wording: *Source:* Australian Transport Safety Bureau

Copyright in material obtained from other agencies, private individuals or organisations, belongs to those agencies, individuals or organisations. Where you want to use their material you will need to contact them directly.

Addendum

Page	Change	Date

Safety summary

What happened

On the 5 September 2017, Queensland Rail suburban passenger train 1W33 was being transferred from Mayne Depot to Roma Street Station, Brisbane, Queensland, as a non-revenue operation. Nearing the Roma Street Station at 1628, train 1W33 passed signal RS57 at danger. Signal RS57 was displaying a stop indication (red aspect). Train 1W33 ran through points 226 and travelled east into platform 8. At the same time, another train (15X2) was approaching Roma Street Station on a converging route from the east.

As the train passed signal RS57 at danger, a 'signal passed at danger' (SPAD) alarm was generated in the Queensland Rail Management Centre. The Network Control Officer broadcast an emergency call to 1W33 and converging train 15X2. Both trains came to a stop approximately 550 m apart.

The rail infrastructure (points 226) was damaged by train 1W33. There were no reported injuries or damage to the rolling stock.

What the ATSB found

The ATSB found that the driver of 1W33 was distracted from his primary task of driving the train, including observing and reacting to signals, by personal emotional thoughts, when approaching signal RS57 displaying a stop indication.

What's been done as a result

Queensland Rail has initiated a number of strategies to manage the risk of SPADs, including administrative processes, human factors analysis, plus reviews and improvements to existing SPAD controls.

Longer term, Queensland Rail have sought expressions of interest from market leaders to partner with Queensland Rail to implement European Train Control System (ETCS) on sections of the Queensland Rail network. ETCS incorporates automatic train protection that provides for monitoring of train speed and limits of authority to ensure trains stay within designated speed limits and authorised safeworking limits.

Safety message

This incident highlights how distraction increases the risk of a SPAD event. Distractions can be external, but internal thoughts related to significant personal events or circumstances can take away a driver's attention from their primary task of safely managing the train.

The occurrence

At about 1623 Eastern Standard Time on 5 September 2017, the Queensland Rail (QR) suburban non-revenue passenger train 1W33, departed Mayne Depot and travelled on the Exhibition loop towards Roma Street Station, Brisbane, Queensland (Figure 1).

Figure 1: Train 1W33 route from Mayne depot to Roma Street Station, Brisbane, Queensland

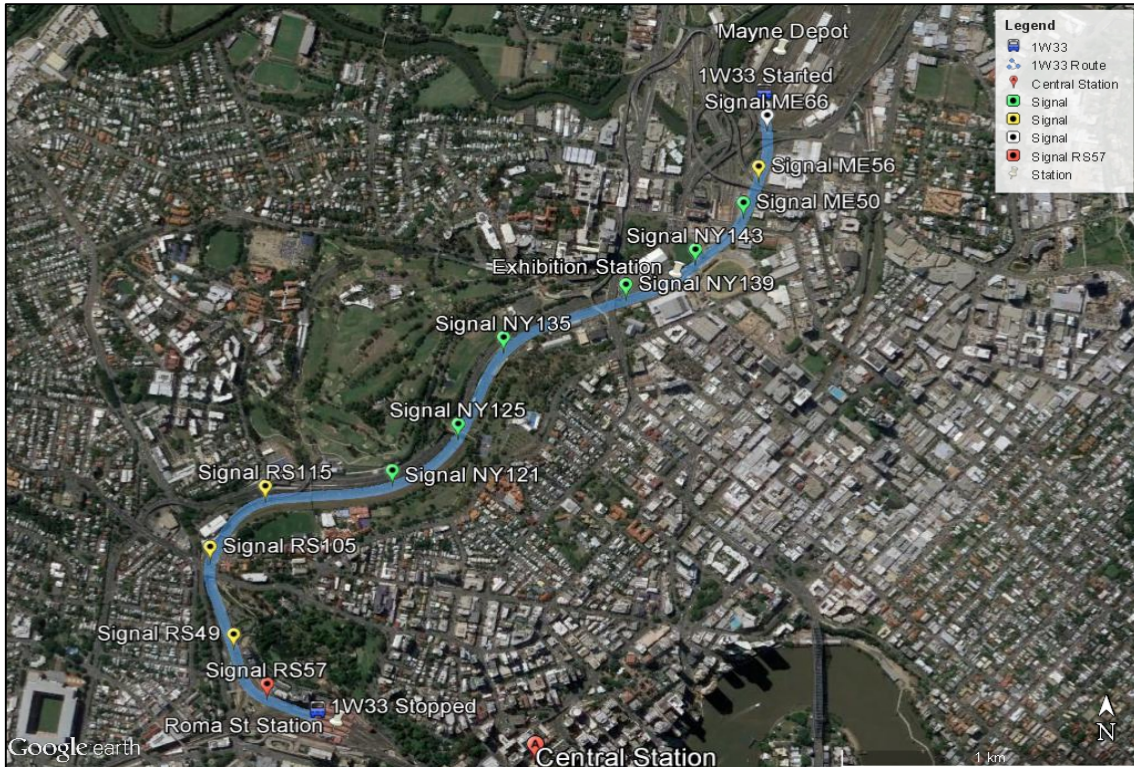


Image shows signal and station locations. Note that the colour of the signal markers denotes the aspect of the signal passed by 1W33. Source: Google Earth annotated by ATSB.

The penultimate signal prior to Roma Street Station (RS49) displayed a restricted indication (flashing yellow aspect¹) for the driver. As train 1W33 approached signal RS49, the driver slowed down in preparation for a 25 km/h speed board placed adjacent the signal. The driver recalled that the Automatic Warning System (AWS)² generated an in-cab alert of the restricted signal RS49 indication ahead and that he acknowledged the AWS alert. At about 1628, train 1W33 continued past signal RS49 towards signal RS57, just west of Roma Street Station. Signal RS57 was displaying a stop indication (red aspect) to allow other train movements to clear Roma Street Station before train 1W33 would be authorised to continue.

Meanwhile, passenger train 1K56 was preparing to depart Roma Street Station from platform 8 (Figure 2). At about 1628, train 1K56 departed Roma Street Station travelling west towards the Springfield line via points 226 set normal.³ About 11 seconds after train 1K56 cleared 226 points, train 1W33 proceeded past signal RS57 at danger. Train 1W33 ran through⁴ points 226 about 26 seconds after passing RS57 at danger and travelled east into platform 8.

¹ Special Caution indication advising the driver to proceed to the next stop signal at a speed not exceeding 40 km/h. Source: Queensland Rail Observance of Signals Manual.

² An advisory system that provides audible and visual warnings to the driver on the approach to signals.

³ The normal position of points generally refers to the position set to give optimum protection to other routes. The opposite position is referred to as points set reverse.

⁴ A movement through trailing points set in the wrong position. Damage to the point mechanism and switch rail usually results.

Figure 2: Western end Roma Street Station layout, Brisbane, Queensland

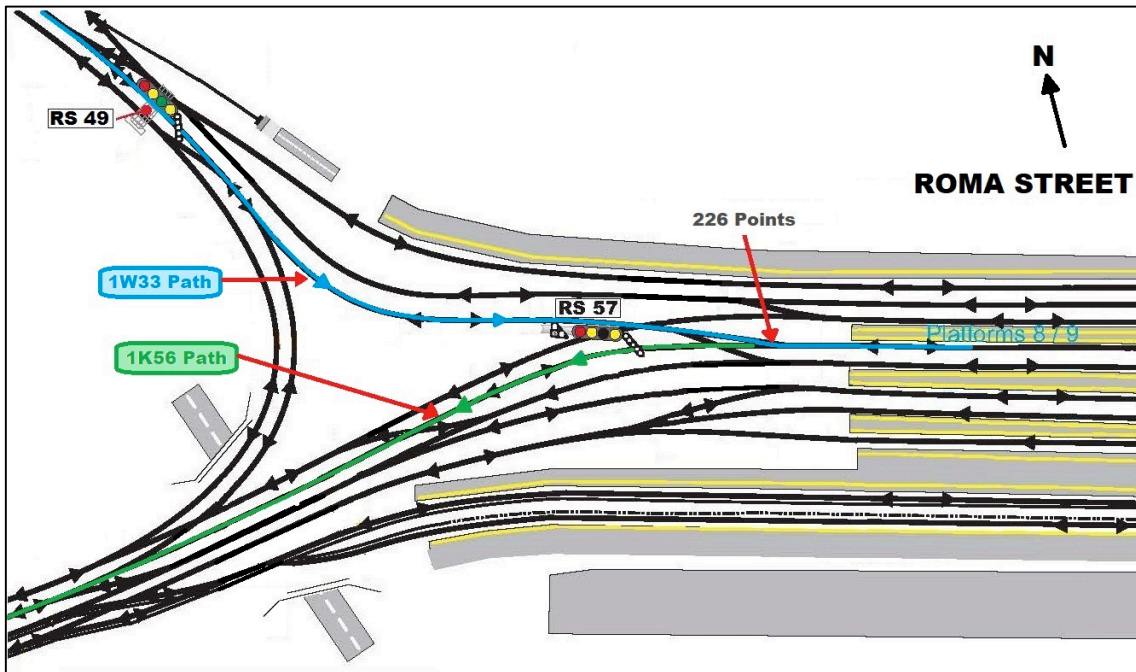


Image shows track infrastructure layout west of Roma Street Station with the directions of travel and path for trains 1W33 and 1K56. Source: Queensland Rail annotated by ATSB.

At approximately the same time, another train (15X2) had just departed Central Station and was travelling towards Roma Street Station on a converging route with train 1W33 from the east.

As train 1W33 passed signal RS57, an alarm activated at the QR Rail Management Centre. The Network Control Officer, broadcast an emergency radio message, calling for the driver of 1W33 and the driver of 15X2 to stop. At about 1630 the two drivers confirmed they had stopped.

Train 15X2 came to a stop approximately 25 m prior to signal RS102. Signal RS102 is the signal before the eastern entry signal (RS100) into platform 8 at Roma Street Station (Figure 3). Signal RS102 was displaying a single yellow caution⁵ indication at this time due to signal RS100 displaying a stop indication. The signal interlocking system had restored Signal RS100 to stop when train 1W33 entered platform 8 at Roma Street Station. The two converging trains stopped approximately 550 m from each other.

Figure 3: Train 15X2 route from Central Station towards eastern entry of Roma Street Station, Platform 8

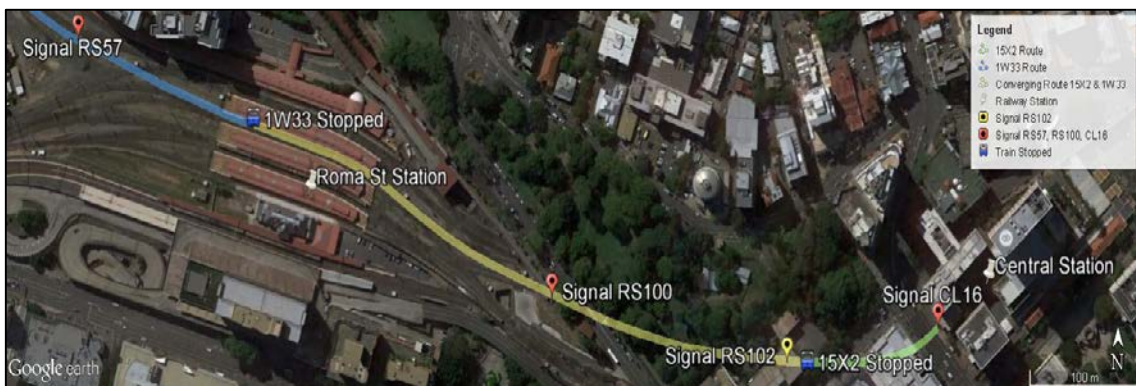


Image shows signal locations and stopping locations of train 1W33 and 15X2. Note that colour of the signal markers denote the aspects displayed after 1W33 entered the platform track circuit at Roma Street Station. Source: Google Earth annotated by ATSB.

⁵ A Caution indication, advises drivers that they must expect the next signal to be at Stop. Drivers can proceed towards the next signal being prepared to stop prior to the next signal. Source: Queensland Rail Observance of Signals Manual.

Safety analysis

The ATSB explored the following aspects which have been known as contributing factors in other signal passed at danger incidents.

Environmental conditions

A review of the CCTV⁶ images from the time of the incident and driver comments indicated that the weather conditions were fine and clear. Further to this, no rainfall had been recorded for Brisbane on the day of the incident by the Bureau of Meteorology. The ATSB found that environmental conditions did not contribute to this incident.

Human performance

The ATSB reviewed the health assessment records, drugs and alcohol test results, rosters (with respect to fatigue) and competency records related to the driver of train 1W33. In conjunction with the driver comments, the ATSB found that these human performance factors did not contribute to this incident.

Rolling stock

Train 1W33 consisted of two coupled Suburban Multiple Units (SMU's), with SMU 261 leading and SMU 279 trailing. Train 1W33 weighed approximately 256 tonnes and had a length of approximately 150 m.

As permitted by the Queensland Rail standard for operational integrity of trains, event recorders⁷ for suburban multiple units SMU 261 and SMU 279 had both been temporarily removed for repairs and therefore did not record rolling stock inputs in relation to this incident (refer to ATSB comment below). However, driver comments and examination of available CCTV footage did not suggest any degradation of braking performance of train 1W33.

Visibility of signal RS57

Signal RS57 was a 4-aspect⁸ main line signal fitted with a junction indicator and low speed shunt signal (Figure 4). Signal RS57 authorised train movements towards signals RS83 or RS85 located at the eastern end of Roma Street Station (platforms 8 and 7).

⁶ Abbreviation for Closed Circuit Television.

⁷ A device / system designed to resist tampering, with crash-protected non-volatile memory, that records event data to support accident or incident analysis. *Source: Queensland Rail Event recorders for rolling stock specification.*

⁸ Although RS57 was fitted with a 4 aspect signal head, only 3 aspects are in use, with the signal not configured to display a green aspect.

Figure 4: Signal configuration of RS57, at Roma Street Station, Brisbane



Source: Queensland Rail.

Signal RS57 was located at the end of a left hand curve adjacent to Roma Street Station on the right hand side of the track in the direction of travel. Due to the curvature of the track and the placement of the overhead catenary masts, RS57 signal sighting was limited to approximately 103 m.

Queensland Rail managed the limited signal sighting with the application of a 25 km/h speed restriction from signal RS49 leading up to signal RS57 and LED signal lamps had recently been installed. In addition, other controls have been considered and implemented as part of Queensland Rail's ongoing signal sighting reviews.

The ATSB found that the configuration and sighting of signal RS57 did not contribute to this incident.

Signal SPAD history

The ATSB found that signal RS57 had been passed at danger on six occasions since 2007. Queensland Rail records for these SPAD events noted varying sources of driver distraction as the causal factor for each event.

Figure 5: Signal RS57 10 year SPAD history

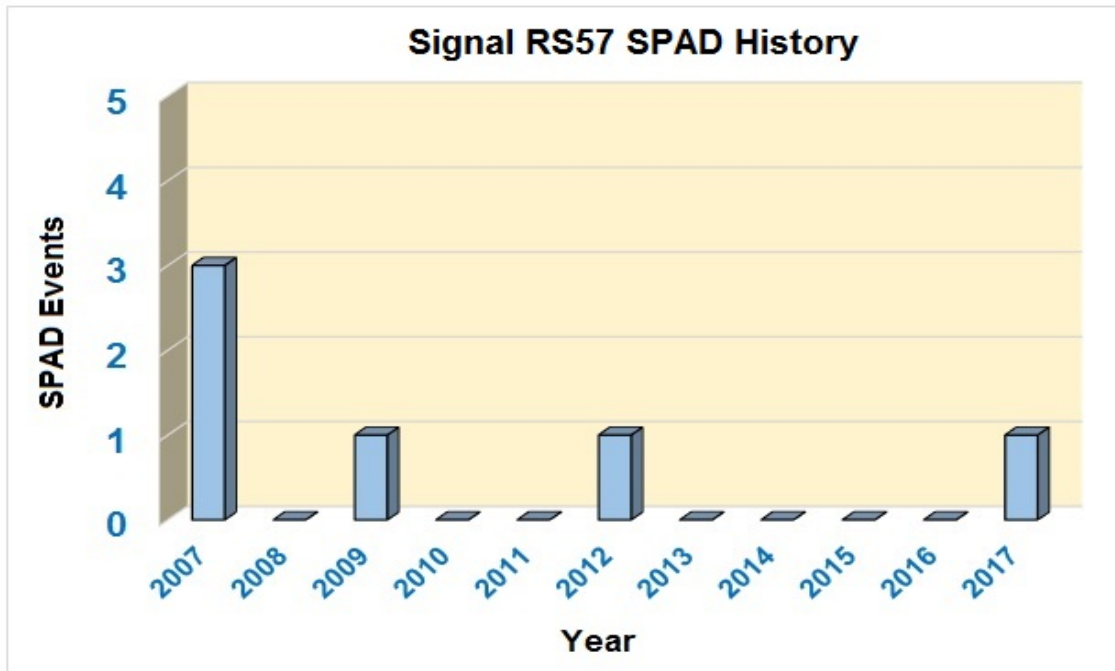


Image shows that in 2007 three reports for signals passed at danger for RS57 were recorded, plus three more each in 2009, 2012, and this event in 2017.

Source: Queensland Rail records graphed by ATSB.

Following the three SPAD’s in 2007, Queensland Rail identified RS57 as a multi-SPAD signal and had undertaken SPAD risk studies and regular reviews of the signal sighting. These risk studies and reviews led to the identification and, where accepted, the implementation of additional controls. This incident is the first time RS57 had been passed at danger in five years.

Driver distraction

Driver distraction can be understood as a type of inattention and has been defined as ‘the diversion of attention away from activities critical for safe driving toward a competing activity (occurring) voluntarily or involuntarily’.⁹ A physical source of distraction common in today’s society is the use of mobile phones. In this case, the driver reported he was not using his phone and there was evidence showing that his phone was not used at the time of the incident. Similarly, the driver reported no distractions from any radio chatter or noticing anything external to the train.

While the source of distraction can often be physical, it can also be non-physical. For example, a situation where task-irrelevant thoughts interfere with task-relevant thoughts can also contribute to distraction and decrease task performance.

A contributor to irrelevant thoughts is emotional mood states which have been described as providing a third processing layer on top of cognitive and physiological levels. ‘Emotions play an important role in motivating people to initiate and maintain a task in the first place, but they may also interfere with cognitive processing. In particular, under time pressure or threatening conditions, the regulation of our emotions is critical for efficient task performance’.¹⁰

A research study into the effects of emotional mood states on irrelevant thoughts and cognitive task performance concluded that ‘people produce more irrelevant thoughts during emotional mood

⁹ Regan, M.A., Hallett, C. & Gordon, C.P. (2011). Driver distraction and driver inattention: Definition, relationship and taxonomy. *Accident Analysis and Prevention*, 43, 1771-1781.

¹⁰ Gaillard, A.W.K. (2001). Stress, workload and fatigue as three bio-behavioural states: A general overview. In P.A. Hancock, & P.A. Desmond (Eds.), *Stress, workload, and fatigue*. Mahwah, NJ: L. Erlbaum.

states, and when the proportion of irrelevant thoughts to relevant thoughts increases, performance suffers.¹¹

In relation to this incident, the driver advised that prior to commencing work he recalled a significant past personal event that resulted in an emotional response. It is likely this contributed to an increase in task-irrelevant thoughts that led to the driver being distracted from observing and reacting appropriately when approaching signal RS57 displaying a stop indication.

ATSB comment

The function of a safety investigation is to identify and reduce safety-related risk, by gathering information and evidence to form conclusions based on the facts.

The ATSB noted that the Queensland Rail standard for operational integrity of trains permitted trains into service on their network without an operational event recorder. In this case, the ATSB relied on CCTV footage and the driver's recollection for identifying the sequence of events. The absence of recorded data prevented further verification of the driver's performance against operational practice.

¹¹ Pennie S. Seibert and Henry C. Ellis, (1991), *Memory & Cognition* Irrelevant thoughts, emotional mood states, and cognitive task performance, 507-513.

Findings

From the evidence available, the following findings are made with respect to train 1W33 passing signal RS57 at danger near Roma St Station, Brisbane, Queensland, on 5 September 2017. These findings should not be read as apportioning blame or liability to any particular organisation or individual.

Contributing factors

- The driver of 1W33 was distracted by personal emotional thoughts from his task of observing and reacting appropriately when approaching signal RS57 displaying a stop indication.

Other findings

- A SPAD alarm activated at the QR Rail Management Centre prompting the network control officer to broadcast an emergency radio message stopping all affected trains.

Safety action

Whether or not the ATSB identifies safety issues in the course of an investigation, relevant organisations may proactively initiate safety action in order to reduce their safety risk. The ATSB has been advised of the following proactive safety action in response to this occurrence.

As a result of this occurrence, Queensland Rail has advised the ATSB they are taking the following safety actions:

- A qualitative analysis of the SPAD scenarios at RS57 using a bowtie model.
- Present a health and wellbeing strategic plan to the Executive Leadership Team which includes an organisational resilience and psychological wellbeing education and awareness program.
- Human factors review of driver response to AWS audible indications and reaction times for green and restricted signals.
- Facilitate the decrease in volume of the AWS audible indication at a proceed signal (green) and increase the volume of an AWS audible indication at a restricted signal (double yellow, yellow, and red).
- Queensland Rail have sought expressions of interest from market leaders to partner with Queensland Rail to implement ETCS (European Train Control System) on sections of the Queensland Rail network. ETCS incorporates automatic train protection that provides for monitoring of train speed and limits of authority to ensure trains stay within designated speed limits and authorised safeworking limits.

General details

Occurrence details

Date and time:	5 September 2017	
Occurrence category:	Incident	
Primary occurrence type:	Signal passed at danger	
Location:	Roma Street Station, Brisbane Qld	
	Latitude: 27° 27.881' S	Longitude: 153° 1.145' E

Train details

Train operator:	Queensland Rail	
Registration:	1W33	
Type of operation:	Suburban Passenger	
Persons on board:	Crew – 2	Passengers – nil
Injuries:	Crew – nil	Passengers – nil
Damage:	Nil	

Sources and submissions

Sources of information

The sources of information during the investigation included the:

- Queensland Rail (QR)
- Train driver involved in incident
- Recorded data
- Rail Industry Safety and Standards Board (RISSB)
- Bureau of Meteorology.

References

Queensland Rail *Observance of Signals Manual* (MD-10-109).

Queensland Rail *Event recorders for rolling stock specification* (MD-10-217).

Queensland Rail *Operational Integrity Of Trains standard* (MD-10-106)

Rail Industry and Safety Standards Board, 2010, *National Guideline Glossary of Railway Terminology*

Pennie S. Seibert and Henry C. Ellis, (1991), *Memory & Cognition Irrelevant thoughts, emotional mood states, and cognitive task performance*, 507-513

Regan, M.A., Hallett, C. & Gordon, C.P. (2011). Driver distraction and driver inattention: Definition, relationship and taxonomy. *Accident Analysis and Prevention*, 43, 1771-1781.

Gaillard, A.W.K. (2001). Stress, workload and fatigue as three bio-behavioural states: A general overview. In P.A. Hancock, & P.A. Desmond (Eds.), *Stress, workload, and fatigue*. Mahwah, NJ: L. Erlbaum.

Submissions

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

A draft of this report was provided to Queensland Rail, the driver of train 1W33, and the Office of the National Rail Safety Regulator.

Any submissions from those parties will be reviewed and where considered appropriate, the text of the draft report will be amended accordingly.

Australian Transport Safety Bureau

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

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

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

Purpose of safety investigations

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

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

Developing safety action

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

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

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

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

Australian Transport Safety Bureau

Enquiries 1800 020 616

Notifications 1800 011 034

REPCON 1800 020 505

Web www.atsb.gov.au

Twitter @ATSBinfo

Email atsbinfo@atsb.gov.au

Facebook [atsbgovau](https://www.facebook.com/atsbgovau)

Investigation

ATSB Transport Safety Report Rail Occurrence Investigation

Signal RS57 passed at danger, involving suburban passenger train 1W33

RO-2017-012

Final – 6 March 2018