



Australian Government
Australian Transport Safety Bureau

Safe Transport

RAIL SAFETY INVESTIGATION
2004/001

Near collision between stationary
Coal Train LD166
and an empty
Endeavour Passenger Train D743



Sandgate, New South Wales
25 February 2004



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EXECUTIVE SUMMARY

At 1303 on Wednesday 25 February 2004 an empty Endeavour passenger train D743 was placed on a collision course with a stationary loaded coal train LD166 at Sandgate. The crew of train D743 realised that number 157 points were in the wrong position and made an emergency brake application. Train D743 stopped about 75 metres short of train LD166.

Sandgate is located on the main northern railway corridor between Sydney and Brisbane about 170 kilometres from Central Railway Station, Sydney. The rail corridor contains four standard gauge tracks for non electric powered trains.

Train D743 was a relief train from Newcastle provided to render assistance to passenger train 604 which had broken down on the Up Main line at Beresfield station platform. The following two passenger trains 736 and 738 on the Up Main line were diverted to the Up Coal Road at Thornton to bypass train 604. Trains 736 and 738 were diverted back onto the Up Main line at Sandgate through number 157 points.

The wrong direction movement of train D743 via the Up Main line was controlled by a Special Proceed Authority (SPA) issued by the train controller at Broadmeadow and Yard Working authorised by the signaller. Train movements in the Sandgate area are controlled by a signaller located at Hanbury Junction signal box, 2.575 kilometres southeast from Sandgate station. Normal signal protection (unidirectional) could not be used for the wrong direction movement. The movement was manually controlled by the signaller. In addition to delayed trains and increased traffic movements, there were a number of factors competing for the signaller's attention.

The investigation concluded that the incident occurred because the signaller did not check the intended route for train D743 thoroughly or apply blocking facilities to the greatest effect to protect the route. Number 157 points were in the reverse position after the passage of train 738. Blocking facilities are physical devices used as memory aids for the signaller to prevent inappropriate issue of Proceed Authorities, or signalling or point equipment operation.

Findings

- The condition of the track and other infrastructure was not considered to be a directly contributing factor to the incident.
- No injuries were reported.
- No damage was reported.
- The medical condition or training status of Hanbury Junction signal box staff was not considered to be a contributing factor to the incident.

- The medical condition, training status, or fatigue levels of the crew of CityRail train D743 was not considered to be a contributing factor to the incident.
- The medical condition, training status, or fatigue levels of the crew of Pacific National train LD166 was not considered to be a contributing factor to the incident.
- The medical condition, training status, or fatigue level of the train controller at Broadmeadow Train Control Centre was not considered to be a contributing factor to the incident.
- The condition of CityRail train D743 was not considered to be a contributing factor to the incident.
- The condition (or operation) of Pacific National train LD166 was not considered to be a contributing factor to the incident.
- The train controller at Broadmeadow Train Control Centre was not breath tested.
- No adverse accreditation audit comments, which could be related to the incident, were noted by ITSRR or by the investigation.
- The flooding of the Coal Roads and earlier derailment at Broadmeadow, although not considered to be a directly contributing factor to the incident, increased the workload for all employees, particularly the local signallers.
- Train 738 was the last train movement through the section, leaving number 157 points in the reverse position allowing CityRail train D743 to be misrouted.
- General order number 7 was issued to cover the gap in training for signal operators but it does not adequately instruct and guide the signal operator on what signals, points, releases, and other interlocking to place blocking facilities.
- The RailCorp master roster, prima facie, did not sufficiently monitor and prevent roster induced fatigue.

Significant findings

- A number of design factors in the signalling/control system were identified as less than optimal such as position of rotary switches, sizing of points numbers, and the lack of positive indication for the signaller during manual working.
- Signal operator training, both initial and Safety Management System, does not adequately train the signaller on what signals, points, releases, and other interlocking to place blocking facilities to the greatest effect.
- The RailCorp Network Rules or procedures do not adequately instruct and guide the signal operator on what signals, points, releases, and other interlocking to place blocking facilities to the greatest effect.
- The observations of the crew of train D743, combined with train speed, were the last line of defence to prevent an accident.

- General order number 7 issued by the Train Operations Manager (Country) identified a speed limit of 25 km/h for trains travelling in the wrong running direction whilst in Yard Limits, but this was not issued to train crews leaving them unaware of the speed restriction.

Contributing factors in the incident

- The signaller had not completed a SPA in the field, relying heavily on guidance from the train controller. This may be indicative of a potential experience and recency issue.
- The signaller at Hanbury Junction signal box did not apply blocking facilities to all points, signals, and release buttons affected by the SPA.
- The signaller was distracted whilst checking the route for the intended movement of train D743 by additional train operations.
- The signaller did not check the intended route thoroughly, overlooking points 157 in the reverse position, allowing train D743 to be misrouted and placed on a collision course with train LD166.

Recommended safety actions

RailCorp (New South Wales)

- The Australian Transport Safety Bureau recommends that RailCorp review and reinforce the use of blocking facilities to the greatest effect through initial and SMS employee training.
- The Australian Transport Safety Bureau recommends that RailCorp consider random audits by supervisory staff to review and reinforce the use of blocking facilities to signal operators.
- The Australian Transport Safety Bureau recommends that RailCorp consider reviewing the application of blocking facilities to provide effective protection.
- The Australian Transport Safety Bureau recommends that RailCorp review and reinforce the use of Special Proceed Authority forms to the greatest effect through initial and SMS employee training.
- The Australian Transport Safety Bureau recommends that RailCorp consider revised training practices with regard to 'live action' Special Proceed Authority training for signal operators.
- The Australian Transport Safety Bureau recommends that RailCorp review the content of the Network Rules and procedures to ensure that the effective use of blocking facilities and SPAs are clearly defined.
- The Australian Transport Safety Bureau recommends that RailCorp review fatigue management principles to monitor and prevent roster-induced fatigue.
- The Australian Transport Safety Bureau recommends that RailCorp review the human interface design of signalling equipment at Hanbury Junction signal box.

- The Australian Transport Safety Bureau recommends that RailCorp review the maximum speed of trains whilst travelling in the wrong running direction without signals.

Independent Transport Safety and Reliability Regulator (New South Wales)

- The Australian Transport Safety Bureau recommends that the Independent Transport Safety and Reliability Regulator liaise with RailCorp on the effective implementation of these recommendations.

INTRODUCTION

At about 1124 on 25 February 2004 the scheduled passenger train service 604 left Maitland for Newcastle on the Up¹ Main line. At 1137 train 604 broke down and was declared 'a total failure' at Beresfield station platform. This effectively blocked the Up Main line between Thornton and Sandgate, a distance of about 11.5 km.

Two following passenger trains, 736 and 738, departed Maitland on scheduled services on the Up Main line about 10 and 20 minutes respectively after train 604. The two trains were delayed for about half an hour at Thornton before being diverted, at about five minute intervals, to the Up Coal Road bypassing train 604. Neither train 736 nor 738 could be used to assist train 604 as their couplings were incompatible. Trains 736 and 738 were crossed back onto the Up Main line at number 157 points at Sandgate at 1246 and 1250 respectively.

Earlier, arrangements were made by the train controller at Broadmeadow Train Control Centre for a relief train, D743, to be sent to Beresfield to haul the failed train to Broadmeadow Service Centre. The plan was for D743 to travel from Newcastle to Hanbury Junction. At Hanbury Junction D743 was to be crossed to the Up Main line, signalled via 127 points, and proceed in the wrong running direction to Beresfield where it would be coupled with the failed train for the haul back to Broadmeadow. The wrong running direction movement would be managed by a Yard Working and a Special Proceed Authority (SPA)² form, issued by the train controller at Broadmeadow Train Control Centre, because the movement was not permitted under the system of safeworking normally in operation.

Number 157 points (about 500 metres south of Sandgate station platform), which were in the reverse position, should have been set in the normal position in preparation for the wrong running direction movement. This was not done. Train D743 was consequently placed on a collision course with a Pacific National coal train LD166.

1 An Up line or train is a line or train heading towards Sydney.

2 See appendix 6.2.

1 OVERVIEW

1.1 Location

Sandgate is located on the main northern railway corridor between Sydney and Brisbane, 170.05 kilometres from Central Railway Station, Sydney. Sandgate is on the railway section³ between Broadmeadow and Maitland, prescribed as part of the Defined Interstate Rail Network (DIRN). The railway corridor contains four standard gauge lines, an Up and Down⁴ Coal Road, and an Up and Down Main line.

The Coal Roads predominately carry freight trains. The Main lines predominately carry passenger trains. Traffic, however, can be crossed between the various lines. Between Thornton and Hanbury, a distance of about 14 km, there are points that allow trains to cross between the main lines and the coal lines at Thornton, Sandgate and Warabrook.

Train movements in the Sandgate area are controlled by a signaller located at Hanbury Junction signal box, 2.575 kilometres southeast from Sandgate station. A train controller located at Broadmeadow Train Control Centre oversees all train movements in that area.

1.2 Track and other infrastructure

Within the main railway corridor between Hanbury Junction signal box and Sandgate there is no overhead wiring on any line, therefore only non electric powered trains can travel over the lines. The Up and Down Coal Roads are 60 kg/m head hardened rail anchored on concrete sleepers by elastic fasteners in a track bed of ballast. The Up Main line is 53 kg/m standard carbon steel rails anchored to timber sleepers by elastic fasteners. The Down Main line is a mixture of 60 kg/m head hardened rail anchored to concrete sleepers by elastic fasteners and 53 kg/m standard carbon rail anchored to timber sleepers by elastic fasteners.

The railway corridor, at the location of the incident, has a slight incline of 1 in 1461 in the down direction of travel and no recorded curvature.

The condition of the track and other infrastructure was not considered to be a directly contributing factor to the incident.

1.3 Sequence of events⁵

At 0500 on 25 February 2004 assistant signaller number 1 signed on for duty at Hanbury Junction signal box.

At 0600 the signaller signed on for duty at Hanbury Junction signal box.

3 See appendix 6.1 for an area map.

4 A Down line or train is a line or train heading away from Sydney.

5 See appendix 6.3.

At 1043 the Down Coal Road at Hanbury Junction flooded as a result of rain causing the track circuiting⁶ to fail. The 'track failure' affected the movement of trains on the Down Coal Road and from Kooragang Island to the Down Coal Road. A Condition Affecting the Network (CAN) warning was broadcast by the signaller at Hanbury Junction signal box for the Down Coal Road.

At 1137 train 604 on the Up Main line at Beresfield station platform was declared a total failure by the driver. The following two trains, 736 and 738, were delayed behind train 604.

At 1219 the relief train D743 departed Newcastle for Beresfield travelling on the Down Main line. Train D743 remained stationary at Waratah from 1238 until 1246.

From 1232 to 1250 trains 736 and 738 travelled from Thornton to Hanbury Junction via the Up Coal Road, crossing back to the Up Main line through number 157 points.

The Special Proceed Authority (SPA)⁷ form was faxed to the signaller at Hanbury Junction by the train controller at 1240. The form was completed and authorised by the train controller at 1244.

At 1249 train D743 arrived adjacent to Hanbury Junction signal box. The driver was handed a copy of the completed SPA form number 33 by assistant signaller number one. The driver then shunted the train from the Down Main line to the Up Main line signalled via number 127 points near Hanbury Junction signal box.

At about 1250 the assistant signaller 2 signed on for duty and received a handover from assistant signaller number one at Hanbury Junction signal box.

At 1259:19 loaded coal train LD166 came to a stand about 25 metres on the approach side of signal C105.6 (Sandgate junction) on the Up Coal Road.

At about 1300 assistant signaller 1 signed off duty and left the premises.

At 1300 a clearance was given from the signaller at Hanbury Junction signal box for train D743 to proceed in the wrong running direction on the Up Main line to Beresfield station platform. Train D743 departed at 1301.

Train D743 accelerated to an instrument indicated speed of 60 km/h and continued to coast at this speed. As train D743 approached a group of points the driver noticed that a set of facing points (number 157) was in the reverse position.

At 1303:30 the driver made an emergency brake application. At 1303:48 train D743 came to a complete stop, about 75 metres short of the stationary coal train standing at signal C105.6 on the Up Coal Road. The driver contacted the signaller at Hanbury Junction signal box and notified him of the incident. The signaller authorised the driver to shunt back onto the Up Main line clear of 157 points (which were then set correctly) and resume the journey to Beresfield. The train crew of LD166 also called the signaller at Hanbury Junction signal box to notify him of the incident.

At 1309:54 train D743 departed number 157 points for Beresfield on the Up Main line arriving at 1317.

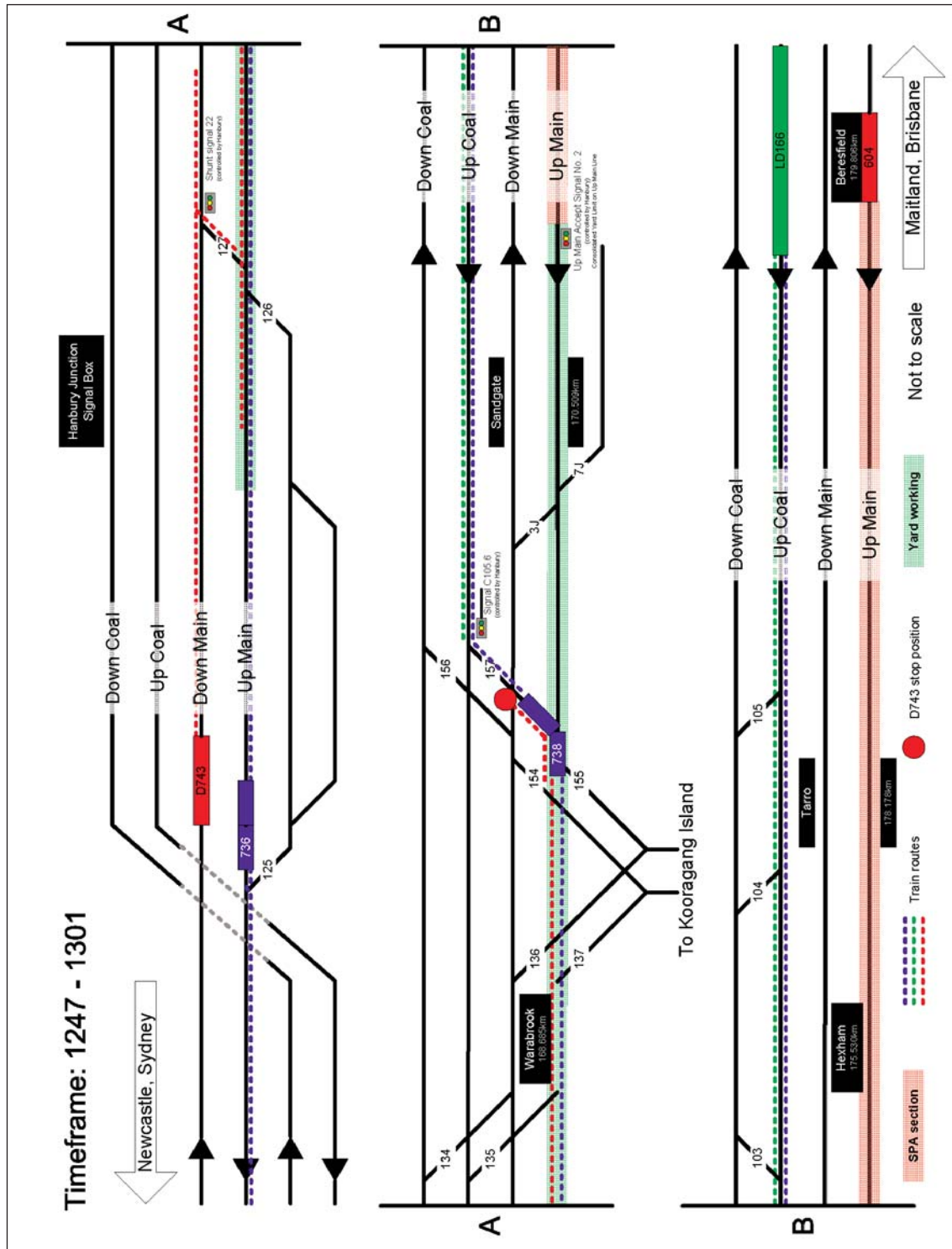
6 An electric circuit that uses the rails of a railway track as conductors such that a train electrically connects them via its axles. The absence or presence of this rail-to-rail connection indicates the absence or presence of a train or item of rollingstock.

7 See appendix 6.2 for a sample SPA form.

At 1312:49 train LD166 departed signal C105.6 for Port Waratah on the Up Coal road.

At 1350 train 604 departed Beresfield and was hauled by train D743 to the Broadmeadow service centre.

FIGURE 1: Local area from Hanbury Junction signal box to Beresfield station



1.4 Injuries

No injuries were reported.

1.5 Damage

No damage was reported.

1.6 Employee details

1.6.1 Hanbury Junction signal box

The signaller was employed by RailCorp and has worked in signal boxes since 1990. He has been working at Hanbury Junction signal box since January 2002 on a 'reducing time roster'. On the reducing time roster the signaller also works in signal boxes at Newcastle and Woodville. The signaller would work at Hanbury Junction signal box three shifts each fortnight. The remaining shifts would be divided between Newcastle signal box and Woodville signal box.

Assistant signallers are employed by RailCorp to record train movements in the Train Register Book (TRB), answer telephone calls, respond to two way radio calls, and manipulate signals under supervision of the signaller. Assistant signaller 1 was a train driver before moving into signal boxes in 1990. He has worked at Hanbury Junction signal box full time for several years. Assistant signaller 2 has been working within signal boxes for the last three years and recently started working at Hanbury Junction signal box.

Table 1: Hanbury Junction signal box staff details

<i>Hanbury Jct Box</i>	<i>Signaller</i>	<i>Assistant signaller 1</i>	<i>Assistant signaller 2</i>
Gender	Male	Male	Female
Classification	Signaller Grade 3	Signaller Grade 1	Signaller Grade 1
Medical status	Medically fit	Medically fit	Medically fit
Training	Current	Current	Current
Time on duty	7 hours 5 minutes	8 hours (ceased at 1300)	5 minutes

The medical condition or training status of Hanbury Junction signal box staff was not considered to be a contributing factor to the incident. However, the training curriculum surrounding the use of blocking facilities and SPA forms is discussed in section two. Issues of rostering and fatigue management are also discussed in section two.

1.6.2 CityRail Train D743

Train D743 was operated by CityRail (RailCorp). The driver had extensive experience with 27 years of driving trains. The guard also had extensive experience with 22 years service as a guard. Both guard and driver were based at Newcastle.

Table 2: Train D743 crew details

<i>D743</i>	<i>Driver</i>	<i>Guard</i>
Gender	Male	Male
Classification	Driver	Guard
Medical status	Medically fit	Medically fit
Training	Current	Current
Time on duty	3 hours 5 minutes	4 hours 45 minutes

The medical condition, training status, or fatigue levels of the crew of CityRail train D743 was not considered to be a contributing factor to the incident.

1.6.3 Pacific National Train LD166

Train LD166 was operated by Pacific National Pty Ltd. The 1st driver was driving the train at the time of the incident. He had extensive experience with 26 years of train driving. The 2nd driver was sitting in the observer's position at the time of the incident. He had 10 years of train driving experience. Both drivers were based in the Newcastle region.

Table 3: Train LD166 driver details

<i>LD166</i>	<i>1st Driver</i>	<i>2nd Driver</i>
Gender	Male	Male
Classification	Driver	Driver
Medical Status	Medically fit	Medically fit
Training	Current	Current
Time On Duty	8 hours 15 minutes	8 hours 15 minutes

The medical condition, training status, or fatigue levels of the crew of Pacific National train LD166 was not considered to be a contributing factor to the incident.

1.6.4 Broadmeadow Train Control Centre

The train controller was employed by RailCorp and has extensive railway experience spanning over 40 years, 20 of those years as a train controller mainly at the Broadmeadow Train Control Centre.

Table 4: Train controller details

<i>Train Control</i>	<i>Train controller</i>
Gender	Male
Classification	Train Controller
Medical Status	Medically fit
Training	Current
Time On Duty	1 hour 50 minutes

The medical condition, training status, or fatigue level of the train controller at Broadmeadow Train Control Centre was not considered to be a contributing factor to the incident.

1.7 Train details

1.7.1 CityRail train information

CityRail train D743 was an empty two carriage (TE2851 – TE2801) diesel multiple unit (DMU) known as an Endeavour set (E1). The train was a push-pull self propelled type with a driver's cabin at either end of the train.

The train was fitted with a Fischer Industries data logger in each carriage. The data logger records information such as time, speed, throttle position, brake cylinder pressure, and brake pipe pressure. An analysis of that data indicates that the train was travelling at 59.1 km/h just prior to the driver making an emergency brake application at 1303:30. The train came to a complete stop at 1303:48, about 75 metres short of the leading locomotive of train LD166, halfway along number 157 crossover. An average deceleration of -0.93m/s^2 was achieved which is within the limits specified by RailCorp⁸.

Train D743 responded to the emergency brake application made by the driver. The average deceleration was better than the minimum requirement.

The condition of CityRail train D743 was not considered to be a contributing factor to the incident.

1.7.2 Pacific National train information

Pacific National train LD166 regularly travels between Liddell and Kooragang/Port Waratah. Train LD166 consisted of two '90' class diesel electric locomotives (9001, 9004) hauling 53 loaded wagons containing coke. The total train weight was 1,296.4 tonnes and a total length of 895.7 metres. The maximum permissible line speed of train LD166 was 80 km/h, limited by rollingstock type.

Locomotive data logs indicated that train LD166 was standing stationary at signal C105.6 on the Up Coal Road at Sandgate Junction from 1259:19 until 1312:49.

The condition (or operation) of Pacific National train LD166 was not considered to be a contributing factor to the incident.

1.8 Medical and toxicology

The signaller and assistant signaller 2 from Hanbury Junction signal box were breath tested at about 1400 on 25 February by a Network Operations Superintendent and both returned a zero reading. The signaller and both assistant signallers were up to date with their medical examinations and assessed as medically fit for duty.

The train controller at Broadmeadow Train Control Centre was not breath tested. The train controller had signed on fit for duty and was up to date with medical examinations.

The two drivers of the Pacific National train signed on fit for duty in accordance with the rules and procedures of their employer. The CityRail train crew (D743) were breath tested at about 1430 on 25 February by a Train Crew Inspector and

8 Endeavour emergency braking curve -0.9m/s^2 to -1.0m/s^2

both returned a zero reading. The train crews were up to date with their medical examinations and assessed as medically fit for duty by their respective organisations. The medical and toxicological condition of all staff was not considered to be a contributing factor to the incident.

1.9 Crew LD166 actions

The crew of train LD166 had noticed the unusual movement of train D743 on the Up Main line. The crew then realised that the points were in the incorrect position (reverse) and that train D743 did not appear to be slowing down. The crew became aware of the imminent collision and immediately evacuated the crew compartment of the leading locomotive 9001 of train LD166. As the crew were leaving the train they realised that train D743 was going to stop short of their train so they returned to the locomotive to contact Hanbury Junction signal box.

FIGURE 2: Representative driver's view from train LD166 (157 points in normal position)



1.10 Organisational context

RailCorp, officially formed on 1 January 2004, is a state-owned corporation that has as its main focus 'the provision of a safe, clean, secure and reliable passenger rail network throughout NSW'. RailCorp resulted from merging the State Rail Authority of NSW (State Rail) and the metropolitan functions of the Rail Infrastructure Corporation (RIC). Functions were progressively transferred to RailCorp from State Rail and RIC during the first six months of 2004.

RailCorp provides passenger rail transport throughout NSW via its CityRail and CountryLink services and is responsible for the safe operation, crewing and maintenance of passenger trains and stations. It also owns and maintains the metropolitan rail network and provides access to freight operators in the metropolitan area.

Accreditations are managed by the State regulatory body, the NSW Independent Transport Safety and Reliability Regulator (ITSRR). ITSRR audit reports for a period of 12 months prior to the incident were reviewed by the investigation team. No adverse accreditation audit comments, which could be related to the incident, were noted by ITSRR or by the investigation.

2 KEY ISSUES

The misrouting of train D743 occurred due to the signaller at Hanbury Junction signal box not checking the intended route for train D743 thoroughly or applying blocking facilities to the greatest effect to protect the route. Number 157 points were in the reverse position after the passage of train 738 allowing train D743 to be misrouted.

2.1 Environmental factors

The incident occurred on an overcast wet day with an ambient air temperature of 19 degrees Celsius⁹. At the time of the incident the sun was obscured by cloud cover creating a dead light effect. The relative humidity was 97 per cent with a 42 km/h wind gusting to 55 km/h from the southeast.

Up to the time of the incident approximately 95 mm of rain had fallen since 0900 on 24 February 2004 causing the adjacent swamp area to flood onto the railway corridor. The flooding affected train running operations on the Down Coal Road at 1043, then on the Up Coal Road at 1348. The flooding of the Coal Roads (and an earlier derailment at Broadmeadow), although not considered to be a directly contributing factor to the incident, increased the workload for all employees, particularly the local signallers.

2.2 Hanbury Junction signal box

The analysis led to a focus on the signalling equipment/apparatus that the signaller used at Hanbury Junction signal box. Analysis found it to be less than optimal for this critical safety function.

Hanbury Junction signal box was commissioned in 1970. The signal box is located 2.575 kilometres southeast from Sandgate station platform on the western side of the railway corridor. The signal box is a two storey full brick building with glass windows overlooking the railway corridor. It is operated 24 hours a day, seven days a week. Hanbury Junction Yard is defined as a 'Consolidated Yard'¹⁰ on the Up and Down Coal Roads and standard Yard Working on the Up and Down Main lines.

9 The Bureau of Meteorology has provided these figures from the Nobbys Head automated weather station.

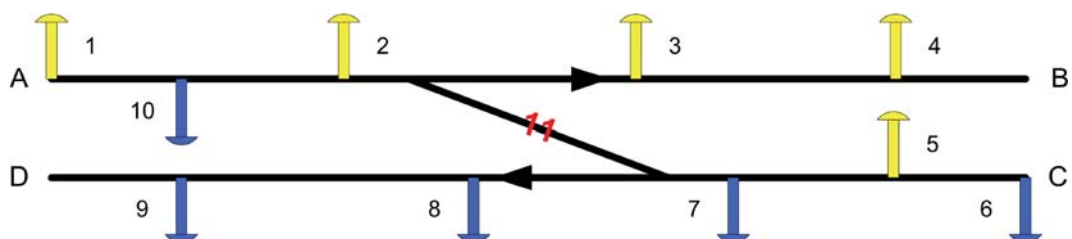
10 Consolidated Yard is an area in which interlockings controlled by one signalling location have intervening automatic signals.

FIGURE 3: Hanbury Junction signal box



The signal box contains a signalling panel used to manipulate signals and points within the area bounded by Waratah and Tarro, a section of 12.7 kilometres. The main signalling panel consists of an indication board¹¹ and manipulation¹² panel. A secondary panel for the Hexham area is a combination of both indication and manipulation functions. Both panels are operated by push/pull buttons (eNtrance-eXit [NX]). To set a route for a train the signaller would press the ‘start/entry’ button and then press a ‘finish/exit’ button to select a route. The selected route is illuminated by white lights on the indication board. The interlocking system proves the system to be safe, and if it is, the points move and signals indicate proceed for the selected route. For example in figure 4, if a train wanted to travel from A to B the signaller would select the route by pressing button 1 to start then press button 2 to finish, then likewise from buttons 2 and 3 then 3 and 4, until all the signals would indicate proceed. If the train wanted to travel from A to C the signaller would select the route by pressing buttons 1 and 2, then 2 and 5. The points numbered 11 would move to the reverse position and the protecting signal would indicate proceed.

FIGURE 4: Example of push button panel

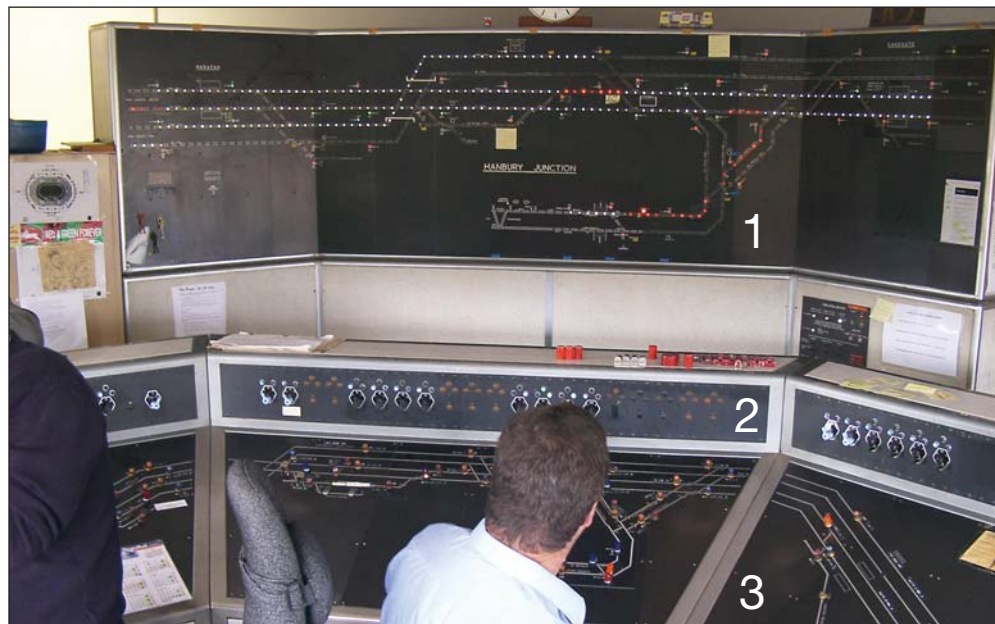


11 Indication board displays signal indications, train position, and route selected.

12 Manipulation panel has a track layout with push buttons and points switches.

The design of the signalling panel is such that it divides the attention of the signaller by up to three ways in emergency conditions (degraded working). Figure 5 shows the location and separation between the indication board (number 1 in the background) and the manipulation panel (number 3 in the foreground). Also contributing to the physical separation for the signaller, the clusters of rotary point switches¹³ (number 2) are located on the panel not in the vicinity of the corresponding points.

FIGURE 5: Hanbury Junction signal box signalling panel layout



During normal train operations, the signaller interprets information from panel 1 and analyses and scales the information to an action on panel 3. During times of heavy workload, such as emergency conditions or degraded operating conditions, the signaller analyses both sets of information from panels 1 and 3 and takes action by using the rotary point switches on panel 2 to set routes for trains.

The main signalling panel exhibits poor spatial compatibility between the three panels shown in figure 5. The Australian Standard SAA HB59-1994, Ergonomics – A human factor, states:

The display must be positively associated with its control in a manner which avoids any possibility of confusion as to which display is related to which control...

When designing, or evaluating the layout of displays, regardless of whether the display is a VDU, or a number of older-style pointer and dial instruments in a large control panel, it is of great importance that the layout of the displays reflect the sequence of operations in the process and that they be grouped according to their functions...

¹³ Rotary point switches allow the signaller to manually operate the point positions.

A number of design factors in the signalling/control system were identified as less than optimal. These were:

- Rotary switches for moving the points individually are physically separated from the position of the points on the diagram for the yard (i.e. the signal board).
- The numbers representing the points for manual operation are small in size and hence open to misreading, particularly under periods of high workload.
- When the signalling system is manually operated during degraded operating conditions (i.e., using rotary point switches) there is no visual indication of the route set as there is with the usual NX setting of the routes. Consequently there is little feedback to the signaller indicating whether the points have been set, or whether his actions are correct apart from the indicator lights at the rotary switches. When the NX panel is used, the display of white route lights and the change of a signal aspect to proceed, provides proof that the actions of the signaller and the interlocking are correct. Such confirmation that is absent when under manual operation during degraded operating conditions.

2.3 Train control/signalling

Train movements through the Sandgate area are monitored by a train controller on the Hunter Board¹⁴ within the Broadmeadow Train Control Centre¹⁵. Normal train operations are controlled by signallers through controlled fixed signals. Automatic signals are also used in areas between signaller controlled areas. Within defined Yard Limits¹⁶ the signaller may authorise the movement of trains by any means under the signaller's authority.

In this incident, train D743 was to be routed onto the Up Main line signalled via 127 points and travel in the wrong running direction to Beresfield station. The movement was therefore not able to be controlled by fixed signals. In such cases, train movements are controlled by Yard Working and the use of a SPA issued by the train controller to all signallers and train crew involved. Yard Working in the Sandgate area involves the signaller at Hanbury Junction signal box authorising the movement of trains by any means. As a control measure for movements within the consolidated yard area, a '*checklist for an unsignalled movement within consolidated yard limits*' form¹⁷ is used. Standard yard working movements do not require any forms to be used.

At the time the signaller was completing the SPA form and planning the intended route, he was engaged in a number of other tasks that may have potentially distracted him.

The investigation examined whether the signaller's actions were an error in individual action, an individual violation of procedures or whether there was a wider issue in the operational risk controls. A survey was designed to evaluate the

14 The Hunter Board covers an area bounded by Broadmeadow, Hamilton, Maitland, Singleton, and Mount Owen including branch lines.

15 Broadmeadow Train Control Centre is now managed by the Australian Rail Track Corporation (ARTC). At the time of the incident RailCorp managed the centre.

16 A portion of the running lines identified by yard limit signs or specified signals marking the entrance to the yard or movement within the yard.

17 See appendix 6.4

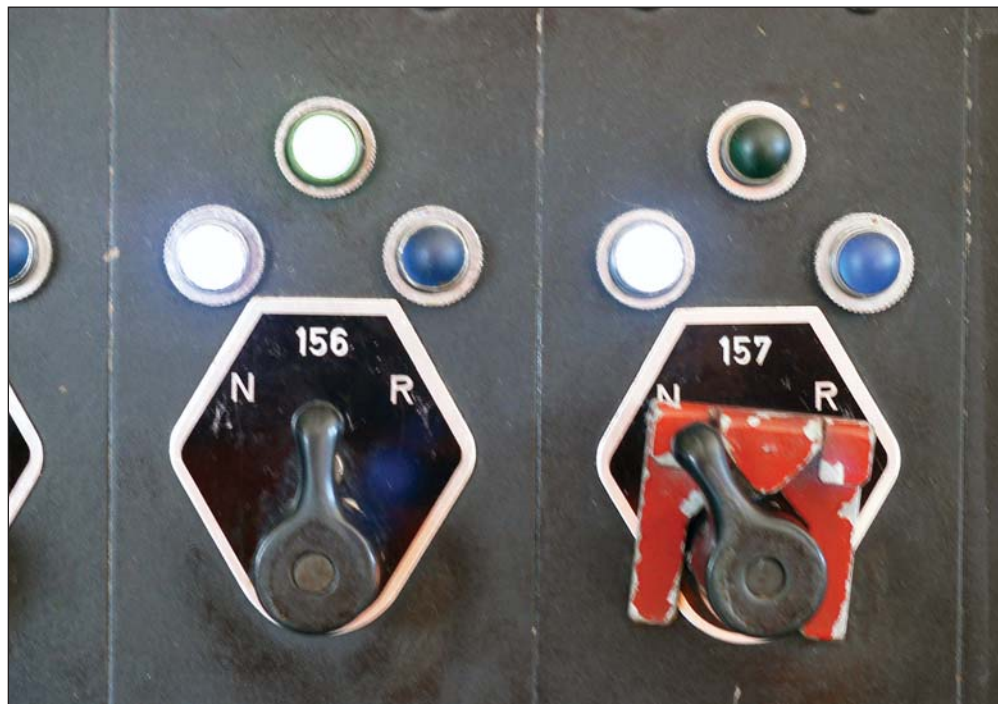
understanding of signal operators in general with respect to blocking facilities and SPA procedures.¹⁸

The ATSB distributed 575 questionnaires to signal operators in New South Wales of which 45 questionnaires (7.8 per cent) returned. The purpose of the questionnaire was to survey a representative sample of signallers on their understanding of blocking facilities and SPA forms. The key finding was that although 86.7 per cent of respondents indicated always using blocking facilities when required, only 48.9 per cent indicated that they placed blocking facilities on those signals and points most effective at protecting the section. This suggests that there may be some confusion about what is required and what signals and points need to have blocking facilities placed on them to ensure that an area is protected. Caution is necessary when interpreting results of the survey however as the response rate was low, reducing the likelihood that results were representative of the larger signal operator population.

2.3.1 Blocking facilities

Blocking facilities are physical devices used by the signaller on the control panel as memory aids to prevent inappropriate issue of Proceed Authorities, or signalling or point equipment operation. Blocking facilities act primarily as a visual reminder, a form of defence, to protect track sections. Irrespective of whether blocking facilities had been applied or not, the type of error may occur again predominantly due to the lack of defences to protect the system. The signaller applied blocking facilities to the signal entry and exit locations affected by the SPA, but did not block any points. If the signaller had applied blocking facilities to all signals and points systematically whilst checking the route it would have been visibly identifiable as to what had not been checked and protected.

FIGURE 6: Red blocking facility on rotary point switch



18 See appendix 6.6

Although the rules/procedures provide information regarding the removal, recording and storage of blocking facilities they do not specify what signals or points need to be blocked to ensure that the above conditions are met. Furthermore, the survey results indicated that 51.1 per cent of respondents did not place blocking facilities on those points and signals that protected the system to the greatest effect. This indicates that a potential defence for the system may not be used to the greatest effect.

The use of blocking facilities takes extra time and once placed should not be removed except where specified by the network rules. Under conditions of high workload and high task demands (i.e. when their role is potentially most critical) this additional task may not be done. It is not clear why the signaller did not use blocking facilities to the greatest effect (heavy workload – forgot, or routine practice) in the current incident. However, had they been used to the greatest effect the error may have been identified and rectified before the system became vulnerable.

Signal operators should use blocking facilities to the greatest effect to prevent conflicting train movements through inappropriate issue of Proceed Authorities, or signalling or point equipment operation, and unintended routes.

2.3.2 Special Proceed Authority (SPA)

A SPA is a safeworking form used to authorise rail traffic movements that are not otherwise permitted under the system of safeworking normally in operation. In this instance a SPA form was used because the rail movement extended beyond the control of the signaller at Hanbury Junction (yard limits).

Numerous communications took place between the signaller and the train controller. Once it was apparent that train D743 would travel in the wrong running direction on the Up Main line to Beresfield, the train controller prepared a SPA form. The train controller completed sections of the SPA form then sent it by facsimile at 1240 to the signaller to complete. From 1240 the signaller started completing the SPA form in consultation by telephone with the train controller. While compiling the form the train controller ‘double checked’ in his own mind that the signaller understood what was being communicated. The form was completed and the train controller authorised it at 1244, the signaller acknowledged it at 1244.

In relation to the movements of trains 736 and 738 from the Up Coal Road via number 157 points to the Up Main Line, the investigation team noted that information recorded on the train control graph was incorrect. The Hanbury Junction signal box Train Register Book (TRB) indicated that number 157 points were used, whereas the train control graph indicated that the movement was via Waratah about 4 km away.

In the current incident there were three key individuals that needed to have a clear and identical understanding of the SPA details: Hanbury signaller, train controller and the driver of D743. Information gathered through interview indicated that there was a high level of ambiguity concerning what items on the form meant (including the assurances). Subsequently, individuals were working under their own interpretation and not all operating with the same understanding.

Analysis of the survey found the SPA form to be clear (46.7 per cent marked always), and easy (44.4 per cent marked always), to use. However 24.4 per cent had never completed a SPA in the field and a further 51.1 per cent reported to have only sometimes had experience. Consequently, a large proportion of respondents had either nil or limited experience and may not know how useful the form was when applied in the work environment. Analysis of the assurance section in particular indicates that clarity may be an issue. The observation that few signal operators had extensive experience with SPAs may explain the result that 75.0 per cent of signal operators relied on train control, to varying degrees, to tell them what assurances they needed.

2.4 The signaller (individual actions)

The signaller's level of knowledge and skills was investigated as a possible contributing factor. The signaller was unsure how to compile a SPA form. The signaller relied heavily on the train controller for direction and guidance. In terms of the SPA, there is potentially an experience and recency issue as the signaller had not completed a SPA in the field, although he had compiled a SPA form in a controlled training environment during ongoing Safety Management System (SMS) training in January 2004, a month before the incident.

The signaller was not required to compile the '*checklist for an unsignalled movement within consolidated yard limits*' form. As part of RailCorp's initial risk assessment, potential hazards associated with unsignalled movements were identified as a risk that needed to be managed. The risk strategy identified wrong direction movements in consolidated yards as posing a risk, greater than normal yard working, that could be reduced by the use of a checklist. In normal yard working, where a signaller has full control over all signals, the overall control was seen as acceptable in terms of managing the risk. However, a checklist for normal yard working would have reduced the risk of further human error, and in this case would have aided the signaller. RailCorp had indicated that in August 2005 the rules and procedures will be re-written such that the checklist form will be compulsory for all unsignalled moves.

There were three primary factors affecting the network between Newcastle and Sandgate on the morning of 25 February 2004. Firstly, there had been a derailment at Broadmeadow two days earlier that was continuing to influence traffic flow. Secondly, due to heavy rains, the down-coal line was flooded at 1030 returning affected signals to stop. Trains were operating under CAN warning conditions (i.e., Down Coal still operational) however due to reduced speed, delays were incurred for trains leaving Port Waratah and Kooragang Island. Finally, the failed train at Beresfield occurred at approximately 1137 that day. Trains on the Up Main line therefore needed to be diverted onto the Up Coal Road until such time they could be returned to the Up Main line. All three factors resulted in disruptions to traffic flow in Hanbury Junction yard consequently requiring additional movements that may not otherwise have been necessary. In addition to delayed trains and increased train operations, there were a number of factors competing for the signaller's attention.

At the time the signaller was setting the route for D743 he was also engaged in a number of other tasks. In the 17 minutes preceding the incident, the signaller was

involved in 12 telephone conversations, three of which lasted more than one and a half minutes. He was filling out the SPA form and executing the assurances. Also, there were a number of potential distractions in the box at this time. The signaller reported that there was a high level of noise in the signal box that shift, coming from the radios, phones and discussions inside the box. There was an unusual amount of radio traffic due to flooding on the Down Coal Road and the necessity for radio communication for CAN warnings, and the consequent traffic delays. The disabled train at Beresfield required coordination between the signaller, train control and the driver of the relief train.

The SPA was required because the train was going to extend beyond Hanbury Junction Yard Limits and the movement was not permitted under the system of safeworking normally in operation. There are two factors concerning the SPA that may have influenced the signaller's workload. Firstly, the SPA was an unfamiliar task as the signaller had never been issued one in the operational environment. Consequently, a greater amount of attention was required to not only fill out the form, but also in its execution. Secondly, the process of filling out the SPA form occurred at a critical time in route setting when the signaller's attention was needed to set the route and verify its accuracy.

The SPA itself was a separate task from the setting of the route for the unsignalled movement. The timing of the SPA form completion therefore occurred at a time when the signaller's attention was critical to setting the unsignalled movement.

The results of the ATSB signal operator survey provided a peer group assessment of the signaller's response to the situation he faced. The actions of the signaller, based on survey results, are fairly indicative of those actions made by other respondent signallers and area controllers currently working on the network. In this situation the movement was unsignalled, therefore there was no interlocking in place to verify that the route set was correct nor prevent other conflicting movements (i.e., no signals). Nor was a checklist required to assist the signaller when setting the route for the unsignalled movement. Like many complex activities, there is invariably more than one factor involved contributing towards the development of an incident sequence.

During the time the train D743 shunted across number 127 points and the time it was misrouted through number 157 points, there had also been a changeover shift of the signaller assistants. It was not clear to the investigation whether or how this handover or changeover influenced the activities of the signaller.

2.5 Driver D743 actions

The driver was travelling under normal operating conditions until arriving at Hanbury Junction signal box to receive the completed SPA form. The train shunted across to the Up Main line, the crew changing ends on each direction change. The driver checked the SPA form and train D743 left Hanbury Junction signal box travelling in the down direction on the Up Main line at 1301. The driver (and guard) visually inspected the position of points and when they noticed number 157 points in the incorrect position, the driver made an emergency brake application stopping short of the leading locomotive of train LD166.

If the crew of train D743 had not noticed the points in the reverse position or if train D743 was travelling in excess of 70 km/h, a collision would have occurred. Essentially the crews' observations, combined with train speed, were the last line of defence to prevent an accident.

General Order number 7 issued by the Train Operations Manager (country) to 'all staff, train operations country' on 22 August 2003 page 9 states that 'when a driver is required to carry out an unsignalled wrong direction movement within yard limits, the driver ensure that the speed of the train does not exceed 25 km/h'. General Order number 7 was not issued to train crew, leaving the train crew unaware of the speed restriction.

2.6 Training and qualifications

All RailCorp staff are required to undergo initial training in the relevant safeworking rules applicable to their position requirements. Training courses are tailored to each group of employees i.e. train controllers, drivers, signallers.

Additionally, ongoing training called Safety Management System (SMS) training is provided to employees. SMS training is recertification training designed to ensure rail safety workers are capable of working safely in a high risk operational environment and are competent to safely manage the activities they are assigned, including emergency situations. The State Rail (RailCorp) Policy and Procedures for the issue of State Rail (RailCorp) Rail Safety Worker Certificates submitted to and accepted by the NSW regulator, require rail safety workers to have attended a minimum of six SMS training interventions every two years for recertification. Part of this ongoing training includes revision of safeworking rules with scenario exercises in a controlled environment.

An analysis of the training records for the signaller from Hanbury Junction and the train controller from Broadmeadow indicated that both employees had passed their initial training and were up to date with SMS recertification training. Both training curriculum's include practical exercises with SPA forms in a controlled environment. The training curriculum for blocking facilities outlines the types of uses for blocking facilities but does not identify how to use the blocking facilities to the greatest effect i.e. placing blocking facilities on all signals, points, releases, and conflicting routes.

The RailCorp network rules and procedures were analysed to determine how blocking facilities should be used by the signaller to the greatest effect. A number of sections were analysed, including Network Rules section 'NSG 614 Blocking Facilities'¹⁹. No instructions could be found to indicate to the signal operator on what signals, points, releases, and other interlocking must have blocking facilities applied.

Page four of General Order number 7 issued by the Train Operations Manager (country) on 22 August 2003 identifies issues with employee training. The author describes in greater detail the responsibilities of the signaller and how to operate a signal box including the use of blocking facilities, but no instructions could be found to instruct the signal operator on what signals, points, releases, and other interlocking blocking facilities must be applied. The investigation was advised that

19 See appendix 6.5

generally trainee signallers will be taught the 'finer details' of being a signaller during their induction training at a signal box by a senior signaller on duty.

Results from the Signal Operator Survey indicated that although 86.7 per cent of respondents used blocking facilities when required, 51.1 per cent did not place blocks on all points and signals that protected the system to the greatest effect. Although caution is required when interpreting survey results due to the low response rate, this information provides a useful indicator that blocking facility training may require attention, particularly given that the majority (i.e. 86.7 per cent) of respondents had over five years experience as a signal operator.

It seems that there is a population of signal operators with nil or limited experience in fulfilling the requirements of a SPA. Furthermore, one signal operator indicated that they had never been trained in SPA requirements.

2.7 Rostering and fatigue management

At the time of the incident RailCorp operated a 24-hour four-week cyclic master roster including morning, afternoon, and nightshift for signallers. The master roster was amended on an 'as needed' basis to reflect the actual roster to be worked to meet operational requirements. The work days tended to be grouped together and normally each shift is eight hours in duration. The signallers' roster displayed a number of signallers who have a break of eight hours between rostered shifts, i.e. 1500–2300 and return the next day 0700–1500. The master roster is gradually being improved to incorporate fatigue management principles.

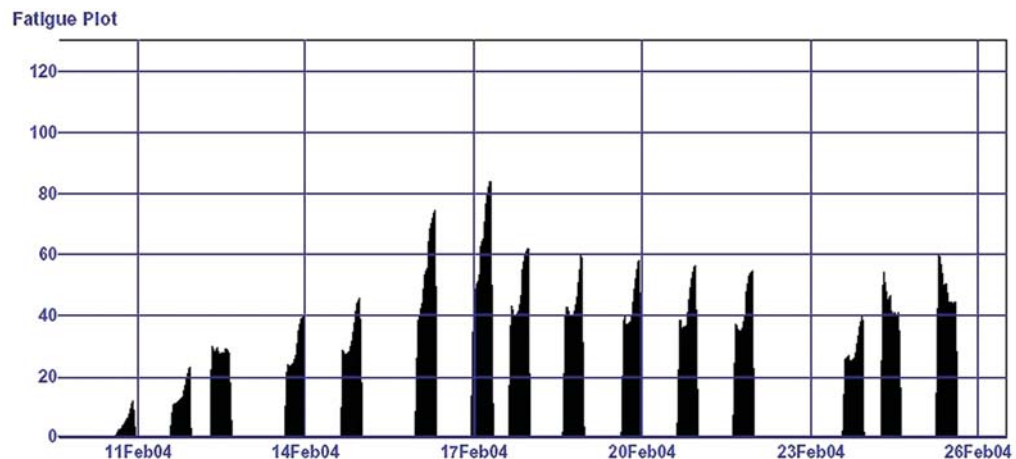
Fatigue may be described as a reduction in physical and/or mental capability as a result of physical or emotional exertion which may impair nearly all physical abilities including strength, speed, reaction time, coordination and decision making. Fatigue may be described as acute or chronic. Acute fatigue occurs in a matter of hours as the result of excessive mental or physical activity and may be cured by a period of rest or sleep. A state of chronic fatigue is reached when the 'normal' period of rest or sleep is insufficient to restore an individual's working performance to its usual level. Chronic fatigue is insidious and usually happens over a period of time. Individuals suffering from chronic fatigue always perform below their personal best but are often unaware that their performance has been significantly degraded. In the worst case, chronic fatigue can drive an individual to sleep while at work often in the form of a momentary event or 'micro-sleep' which may last a few seconds or several minutes.

The signaller's work and rest routine was analysed using Fatigue Audit InterDyne (FAID) software developed in conjunction with the Centre for Sleep Research at the University of South Australia. Research by the Centre for Sleep Research suggests that a fatigue score of 40–80 is moderate, 80–100 is high, and 100–120 is very high. High fatigue scores of 80–100 have been shown to produce individual performance impairment equivalent to a blood alcohol concentration over 0.05 per cent. The FAID software enables the quantitative assessment of an individual's level of fatigue at a point in time based on work hours for a previous number of days. It cannot measure the emotional or other psychological causes of fatigue, neither can it differentiate in terms of the level of physical exertion. The resultant individual

fatigue 'score' may be used as a guide to indicate what effect fatigue may have had on an individual's performance.

The FAID software was used to analyse the signaller's rostered work hours from 10 February 2004 to the time of the incident on 25 February. The FAID program gave a maximum fatigue score of 84.1 at 0700 on 17 February 2004. The signaller's fatigue score at the time of the incident was 43.6.

FIGURE 7: FAID results for Hanbury Junction Signaller based on the master roster



Based on work hours, and the assumption that the individual's time off duty included an appropriate period of recuperative sleep, the signaller was in the low range fatigue at the time of the incident. However, he told the investigation team that he was also experiencing abnormal sleep patterns.

Whatever the fatigue level of the signaller, based on the FAID rostering principles, the RailCorp master work roster was not considered to be a causal factor in this incident. However, a maximum score of 84.1 on 17 February 2004 is indicative that the RailCorp master roster, prima facie, did not sufficiently monitor and prevent roster-induced fatigue.

3 CONCLUSIONS

3.1 Findings

1. The condition of the track and other infrastructure was not considered to be a directly contributing factor to the incident.
2. No injuries were reported.
3. No damage was reported.
4. The medical condition or training status of Hanbury Junction signal box staff was not considered to be a contributing factor to the incident.
5. The medical condition, training status, or fatigue levels of the crew of CityRail train D743 was not considered to be a contributing factor to the incident.
6. The medical condition, training status, or fatigue levels of the crew of Pacific National train LD166 was not considered to be a contributing factor to the incident.
7. The medical condition, training status, or fatigue level of the train controller at Broadmeadow Train Control Centre was not considered to be a contributing factor to the incident.
8. The condition of CityRail train D743 was not considered to be a contributing factor to the incident.
9. The condition (or operation) of Pacific National train LD166 was not considered to be a contributing factor to the incident.
10. The train controller at Broadmeadow Train Control Centre was not breath tested.
11. No adverse accreditation audit comments, which could be related to the incident, were noted by ITSRR or by the investigation.
12. The flooding of the Coal Roads and earlier derailment at Broadmeadow, although not considered to be a directly contributing factor to the incident, increased the workload for all employees, particularly the local signallers.
13. Train 738 was the last train movement through the section, leaving number 157 points in the reverse position allowing CityRail train D743 to be misrouted.
14. General Order number 7 was issued to cover the gap in training for signal operators but it does not adequately instruct and guide the signal operator on what signals, points, releases, and other interlocking to place blocking facilities.
15. The RailCorp master roster, prima facie, does not sufficiently monitor and prevent roster-induced fatigue.

3.2 Significant findings

1. A number of design factors in the signalling/control system were identified as less than optimal, such as position of rotary switches, sizing of points numbers, and the lack of positive indication for the signaller during manual working.
2. Signal operator training, both initial and SMS, does not adequately train the signaller on what signals, points, releases, and other interlocking to place blocking facilities to the greatest effect.
3. The RailCorp Network Rules or procedures do not adequately instruct and guide the signal operator on what signals, points, releases, and other interlocking to place blocking facilities to the greatest effect.
4. The observations of the crew of train D743, combined with train speed, were the last line of defence to prevent an accident.
5. General order number 7 issued by the Train Operations Manager (Country) identified a speed limit of 25 km/h for trains travelling in the wrong running direction whilst in Yard Limits, but this was not issued to train crews, leaving them unaware of the speed restriction.

3.3 Contributing factors in the incident

1. The signaller had not completed a SPA in the field, relying heavily on guidance from the train controller. This may be indicative of a potential experience and recency issue.
2. The signaller at Hanbury Junction signal box did not apply blocking facilities to all points, signals, and release buttons affected by the SPA.
3. The signaller was distracted whilst checking the route for the intended movement of train D743 by additional train operations.
4. The signaller did not check the intended route thoroughly, overlooking points 157 in the reverse position, allowing train D743 to be misrouted and placed on a collision course with train LD166.

4 RECOMMENDED SAFETY ACTIONS AND SAFETY ACTIONS INITIATED

4.1 Recommended safety actions

4.1.1 RailCorp (New South Wales)

RR20050022

The Australian Transport Safety Bureau recommends that RailCorp review and reinforce the use of blocking facilities to the greatest effect through initial and SMS employee training.

RR20050023

The Australian Transport Safety Bureau recommends that RailCorp consider random audits by supervisory staff to review and reinforce the use of blocking facilities to signal operators.

RR20050024

The Australian Transport Safety Bureau recommends that RailCorp consider reviewing the application of blocking facilities to provide effective protection.

RR20050025

The Australian Transport Safety Bureau recommends that RailCorp review and reinforce the use of Special Proceed Authority forms to the greatest effect through initial and SMS employee training.

RR20050026

The Australian Transport Safety Bureau recommends that RailCorp consider revised training practices with regard to 'live action' Special Proceed Authority training for signal operators.

RR20050027

The Australian Transport Safety Bureau recommends that RailCorp review the content of the Network Rules and procedures so that the effective use of blocking facilities and SPAs are better defined.

RR20050028

The Australian Transport Safety Bureau recommends that RailCorp review fatigue management principles to monitor and prevent roster-induced fatigue.

RR20050029

The Australian Transport Safety Bureau recommends that RailCorp review the human interface design of signalling equipment at Hanbury Junction signal box.

RR20050030

The Australian Transport Safety Bureau recommends that RailCorp review the maximum speed of trains whilst travelling in the wrong running direction without signals.

4.1.2 Independent Transport Safety and Reliability Regulator (New South Wales)**RR20050031**

The Australian Transport Safety Bureau recommends that the Independent Transport Safety and Reliability Regulator liaise with RailCorp on the effective implementation of these recommendations.

4.2 Safety actions already initiated**4.2.1 RailCorp**

RailCorp had indicated that in August 2005 the rules and procedures will be re-written such that the 'checklist for an unsignalled movement within consolidated yard limits' form will be compulsory for all unsignalled moves.

5 SUBMISSIONS

5.1 The Office of Transport Safety Investigation (New South Wales)

The Office of Transport Safety Investigation made a number of comments and observations on the draft report issued to directly involved parties. The comments and observations have largely been incorporated into the body of the report.

5.2 Independent Transport Safety and Reliability Regulator (New South Wales)

The Independent Transport Safety and Reliability Regulator made a number of comments and observations on the draft report issued to directly involved parties. The comments and observations have largely been incorporated into the body of the report.

5.3 Pacific National

Pacific National made several comments and observations on the draft report issued to directly involved parties. The comments and observations have been incorporated into the body of the report.

5.4 RailCorp (New South Wales)

The nominated RailCorp representative at the time of the incident made several comments and observations on the draft report issued to directly involved parties. The comments and observations have largely been incorporated into the body of the report.

6 APPENDICES

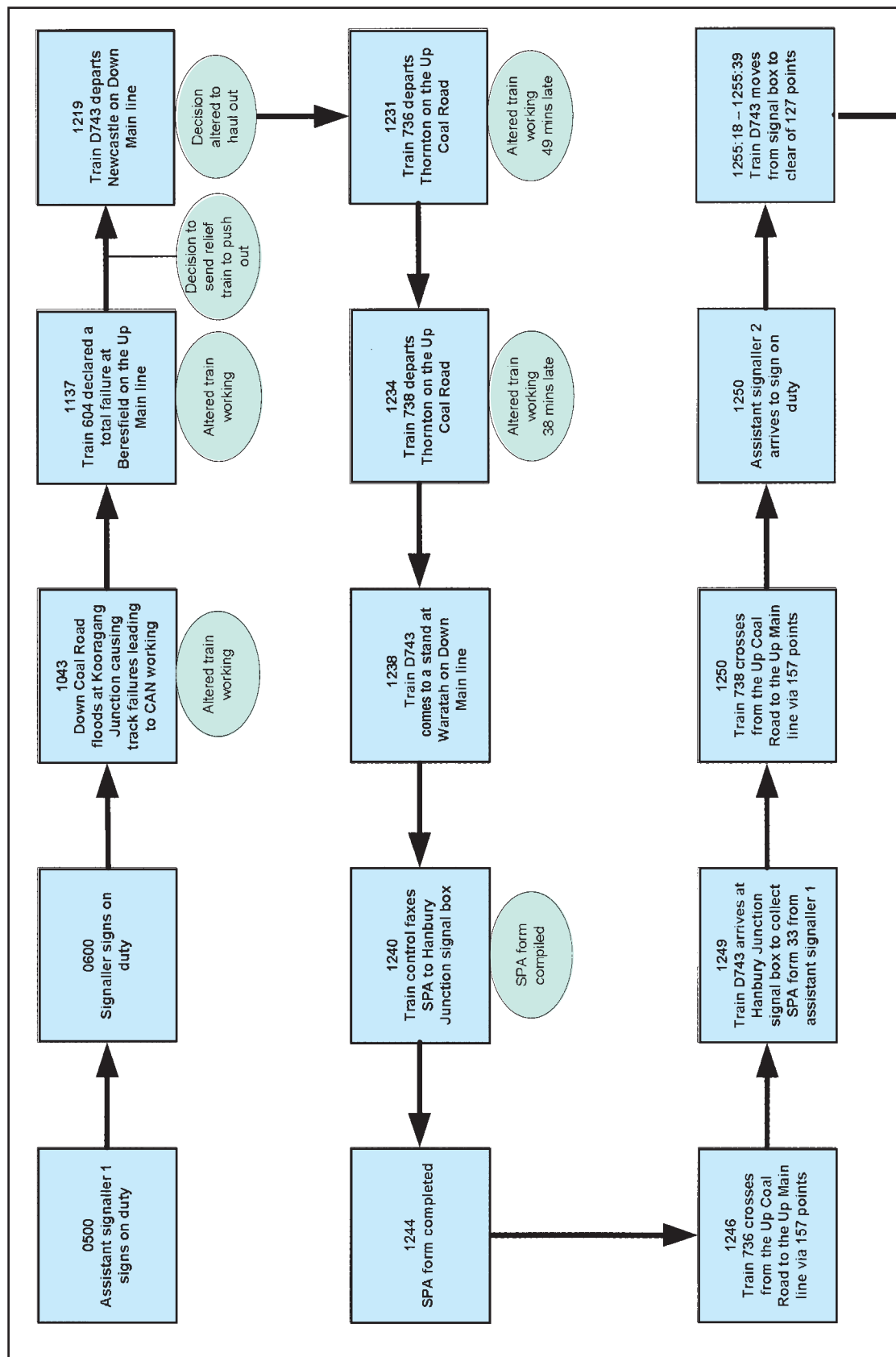
6.1 Area Map

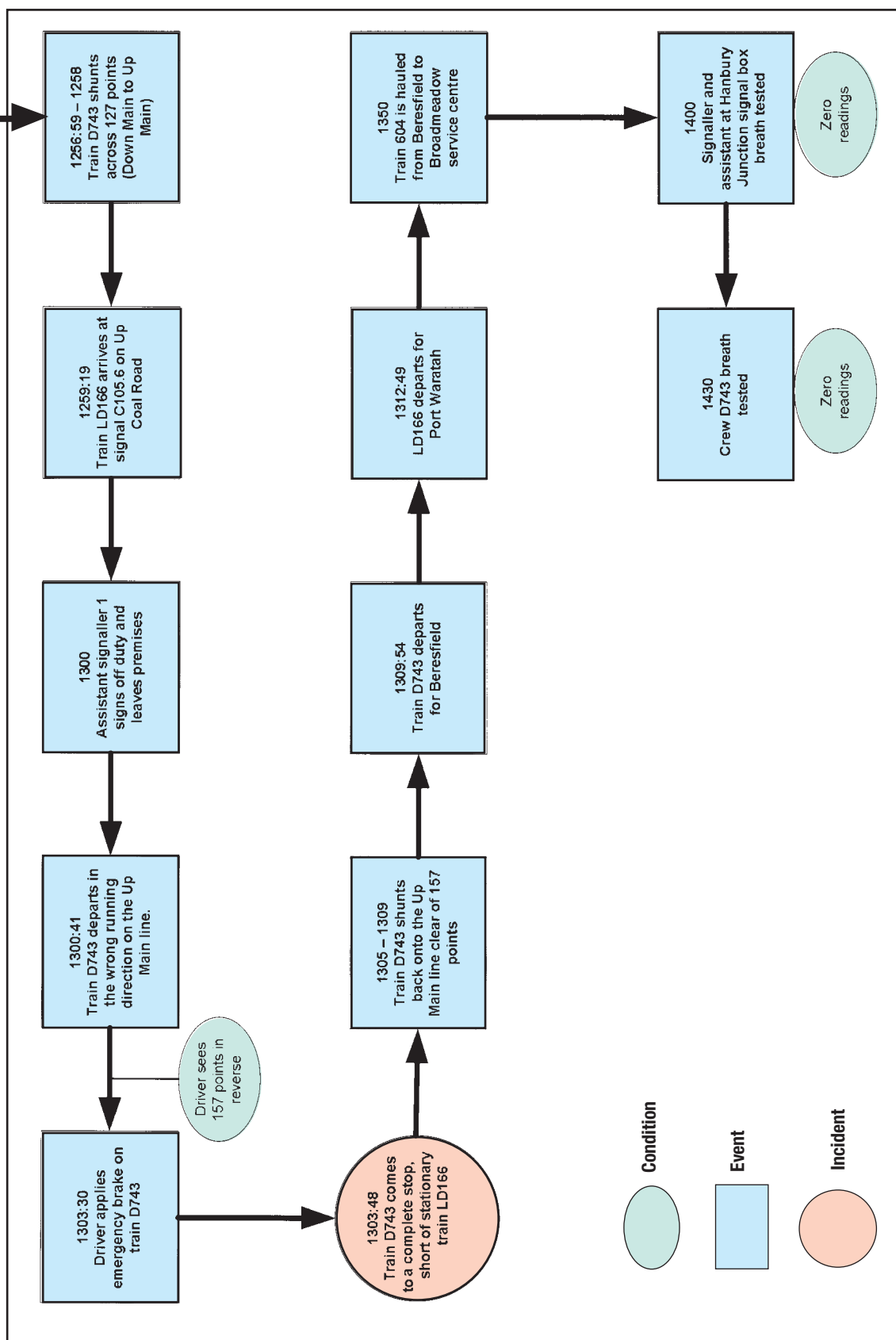


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	Name	Location/train no.	Time	Date
1	Number			
2	As a result of			
3	Authority is given to the Driver of train no.		to travel	
	from		to	
		specified limit		specified limit
	on the		line	
4	You are instructed to			
5	Automatic road or pedestrian level crossings are within the limits of this Authority. Observe level crossing precautions, as warning equipment may not be operating correctly.			
6	Assurances			
	Mark each check box in this section either Y(Yes) or N(No) as appropriate.			
	<input type="checkbox"/> The line between the limits is not occupied			
	<input type="checkbox"/> Blocking facilities have been applied to prevent conflicting movements			
	<input type="checkbox"/> Rail traffic that can enter the limits of this Authority has been restrained			
	<input type="checkbox"/> Facing points have been locked at			
		location/km	location/km	
	<input type="checkbox"/> Facing points have not been locked (Follow the instructions in Item 4)			
	<input type="checkbox"/> Worksites are located at			
		location/km	location/km	
	<input type="checkbox"/> Detonator protection has been placed at			
		location/km	location/km	
7	Authorised by			
		name	designation	
			Time	Date
		location	hours	/ /20
8	Issued to			

6.3 Timeline diagram






6.4 Checklist for an unsignalled movement within consolidated yard limits

RAIL INFRASTRUCTURE CORPORATION	Checklist for an unsignalled movement within consolidated yard limits
1	Number <input type="text"/>
2	An unsignalled movement within consolidated yard limits is required because
3	The unsignalled movement is authorised from <input type="text"/> to <input type="text"/> <small>signal no./location/km</small> <small>signal no./location/km</small>
4	Assurances Mark each box Y (Yes) when the assurance has been given: <input type="checkbox"/> If the movement affects more than one Signaller, the affected Signallers have conferred and agreed about how the movement will be managed <input type="checkbox"/> The portion of line for the movement is unoccupied <input type="checkbox"/> Blocking facilities have been applied to prevent other rail traffic entering the affected portion of line <input type="checkbox"/> Points have been set and secured for the movement <input type="checkbox"/> Drivers or track vehicle operators controlling potentially conflicting movements have been stopped and instructed not to proceed <input type="checkbox"/> Current Work on Track authorities in the affected portion of the yard are cancelled or fulfilled, or protected against the movement <input type="checkbox"/> Effective communication is established and maintained with all affected parties <input type="checkbox"/> If necessary, level crossings are managed in accordance with <i>NGE 216 Level crossings</i> and <i>NGE 218 Type F level crossing management</i> <input type="checkbox"/> Obstructions are protected <input type="checkbox"/> The Driver or track vehicle operator in charge of the unsignalled movement has been instructed that the movement is to take place at restricted speed
5	Movement authorised by Signaller <input type="text"/> <small>name</small> <input type="text"/> Time <input type="text"/> hours Date <input type="text"/> / <input type="text"/> /20 <small>location</small>
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6.5 Network Rule NSG 614 - Blocking Facilities



NSG 614

signals and signs

Blocking facilities

Purpose

To prescribe the rules for using *blocking facilities* in the *Rail Infrastructure Corporation (RIC) Network*.


Principle

Blocking facilities are facilities or devices used by *Qualified Workers* to prevent:

- unintended *issue* of *Proceed Authorities*, or
- signalling or *point* equipment operation.

Unless allowed in these rules:

- equipment with blocking facilities applied *must* not be operated, and
- *Train Controllers* must not issue *Proceed Authorities* for *sections* that *Train Control diagrams* show as blocked out of use.



WARNING

Unless you are assured by the *Network Control Officer*, do not assume that:

- signals have been set at STOP, or
- points have been correctly set, or
- blocking facilities have been applied.

RIC NETWORK RULES DECEMBER 2002 V 1.0

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PAGE 1 OF 4

signals and
signs**Blocking facilities****Management
of blocking
facilities**

Before applying blocking facilities to signals or points, *Signallers* must make sure that affected points are in the correct positions.

Temporary removal

Blocking facilities *may* be temporarily removed from controls:

- to set a different *route* using the same controls, or
- after safe arrangements have been made, to clear a signal to permit a movement over the blocked route, or
- for maintenance and testing of the signalling equipment, or
- with the agreement of the *Possession Protection Officer* or *Protection Officer* to allow a *work train* or *track vehicle* to enter or exit the limits of a *Local Possession Authority* (LPA) or a *Track Occupancy Authority* (TOA).

Blocking facilities must be restored to controls as soon as the activity, that required their temporary removal, has been completed.

Permanent removal

Blocking facilities must be removed from controls when the conditions that required their application no longer exist.

Blocking facilities

Management of blocking facilities cont.

Recording

Network Control Officers must record, in *permanent form*, the removal and application of blocking facilities:

- for maintenance and testing of signalling equipment, or
- to allow entry to the limits of an LPA or a TOA.

Unattended locations

Qualified Workers at *unattended locations* must:

- record, in permanent form, application and removal of blocking facilities, and
- tell the Train Controller that blocking facilities have been applied or removed.

Emergency covers

In *token systems of Safeworking*, only the Train Controller may:

- direct Qualified Workers to apply or remove *emergency covers*, and
- record, in permanent form, application and removal of emergency covers.

If a *staff* cannot be returned to an Electric Staff instrument, the staff must be placed in the satchel attached to the emergency cover.

Storage

Blocking facilities must be stored ready for use.

.....



signals and
signs

Blocking facilities

RIC Network Procedures	Nil
Effective date	1 December 2002

6.6 Signal Operator Survey

Instructions

Only fill out this survey if you operate a signal box as either a signaller or area controller (this includes employees who work in this role on an as needs basis).

There are no right or wrong responses to this survey. Please read each question carefully before answering and choose the response that best describes your experiences at work. We realise that some may wish to discuss the survey with co-workers, this is natural, please complete the survey first so we can obtain individual responses.

There are four types of questions in the survey. The first asks you to choose one response to the question by circling the number that best describes your experiences at work. For example see below. This scale will appear at the top of each page. On some questions the scale is slightly different and will be presented directly below the item. Please read the questions carefully.

1	2	3	4	5	N
Always	Often	Usually	Sometimes	Never	Not aware or do not know

The second type involves a written response. You may write more than one comment to these questions if you choose. If there isn't enough space please write on a separate page.

The third type asks you to select from a number of options the one that best describes your experiences. The fourth type asks for a 'Yes' or 'No' response.

The survey is separated into three sections. The first asks for information about where you fit in the rail network and the remaining two contain the questions themselves. Please ensure for items requiring only one response that you circle only one number or letter. If you decide to change a response, cross it out and either circle your new choice (using the scale) or write down another response (in the case of written responses).

As employees working in the role of signal operator your responses will provide us a more accurate picture of what factors are influencing rail safety. Thank you again for providing this information.

Section 1

1. Please indicate which line you most often work:
 - a) Broadmeadow to Brisbane
 - b) Broadmeadow to Sydney
 - c) Maitland to Werris Creek
 - d) Sydney to Dubbo
 - e) Broadmeadow to Newcastle
2. Please indicate which employment category you belong to:
 - a) Full time Signaller
 - b) Full time Area Controller
 - c) Safeworking Qualified Employee, Other (those employed in another role but fulfil the role of signaller when necessary)
 - d) Trainee signaller
3. Please indicate number of years fulfilling the position of signal operator:
 - a) Less than 12 months
 - b) 1-4 years
 - c) 5-9 years
 - d) 10 or more years

- ## Section 2: Blocking Facilities

1. In your opinion, what is the principal function of a blocking facility (e.g., reminder that a section/route is protected; physically lock-out or prevent movement of signal/point; etc)?

i. Do blocks currently achieve this?

	1	2	3	4	5	N
2. Are blocking facilities always available?						

- i. If not, what do you use (e.g., rely on memory, post-it note)?

ii. If not, why are there insufficient blocking facilities?

iii.	Are all the blocking facilities for points (e.g., collars) the same in your signal box (when more than one type of control panel at your signal box, are blocking facilities the same for each control panel type)?	No	Yes
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- | | | | |
|-----|---|----|-----|
| iv. | Are all the blocking facilities for signals (e.g., sleeves) the same in your signal box (when more than one type of control panel at your signal box, are blocking facilities the same for each control panel type)? | No | Yes |
|-----|---|----|-----|

- v. If there are more than one type / shape of blocking facility at your signal box, does this become a problem at any time during your shift (e.g., when things get busy)?

	1	2	3	4	5	N
3. Do blocks remind you that a route is being protected?						

- | | | | | | | | |
|-----|--|---|---|---|---|---|---|
| i. | Have you ever forgotten what they were on for? | 1 | 2 | 3 | 4 | 5 | N |
| ii. | Have you ever removed them accidentally? | 1 | 2 | 3 | 4 | 5 | N |

	1 Always	2 Often	3 Usually	4 Sometimes	5 Never	N Not aware or do not know
<p>4. When there are multiple points and signals across an area that requires protection, what do you put blocking facilities on: <i>(Please choose only <u>one</u> option)</i></p> <p>a. Entry signal/s of the route/block/section</p> <p>b. All points across the route</p> <p>c. All points and signals across the route including those on conflicting routes</p> <p>d. Only those points and signals that need to be operated for the movement</p> <p>e. Other. Please specify</p>						
<p>5. If for example you did not apply all required blocks (on signals/routes/points) what would a reason for this be (e.g., high workload, shortcut, unnecessary, error, etc)?</p> <p>.....</p> <p>.....</p>						
6. Are requirements clear when blocking facilities are needed and when they are not?	1	2	3	4	5	N
7. When you are required to use blocking facilities for signal safeworking, how often do you use them?	1	2	3	4	5	N
8. Are blocking facilities a useful strategy for ensuring safety?	1	2	3	4	5	N
<p>i. How could they be improved?</p> <p>.....</p> <p>.....</p>						
9. Have there been times you have forgotten to use them?	1	2	3	4	5	N
<p>i. If so, what contributed to this (e.g., distraction)?</p> <p>.....</p> <p>.....</p>						
10. Do other signal operators <u>not</u> use blocking facilities when they are required?	1	2	3	4	5	N
<p>i. Why do you think someone might <u>not</u> use blocking facilities?</p> <p>.....</p> <p>.....</p>						
11. Do you use blocking facilities when a Condition Affecting the Network (CAN) is in place?	1	2	3	4	5	N
12. When you start your shift, do you receive all information from the previous signaller about situations impacting the network that (already) have blocking facilities applied?	1	2	3	4	5	N
<p>3</p> <p>P.T.O</p>						

1 Always	2 Often	3 Usually	4 Sometimes	5 Never	N Not aware or do not know
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13. When you start your shift, are you informed of what up and coming situations will require blocking facilities (e.g., handover, block register, safe notice, etc)?
- | | | | | | |
|---|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 | N |
|---|---|---|---|---|---|

Section 3: Special Proceed Authorities (SPA)

1. How often have you been issued or been directly involved in the process of issuing a Special Proceed Authority (SPA)?
- | | | | | | |
|---|------------|--------------|----------------|--|-------------------------------|
| 1
Always (at least once every shift) | 2
Often | 3
Usually | 4
Sometimes | 5
Never (have never been issued or been involved in the process of a SPA) | N
Not aware or do not know |
|---|------------|--------------|----------------|--|-------------------------------|

2. Do the forms for a SPA indicate clearly what needs to be done?
- | | | | | | |
|---|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 | N |
|---|---|---|---|---|---|

3. Are the forms easy to use?
- | | | | | | |
|---|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 | N |
|---|---|---|---|---|---|

i. If improvements could be made, what would they be?

4. Do you have difficulty filling out the form for a SPA?
- | | | | | | |
|---|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 | N |
|---|---|---|---|---|---|

i. If so, what do you find difficult (e.g., is a particular section difficult)?

5. Do you have difficulty completing the requirements of a SPA (i.e., the assurances)?
- | | | | | | |
|---|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 | N |
|---|---|---|---|---|---|

i. If so, what do you find difficult?

6. What things or under what conditions do SPA's become difficult or demanding (bad weather, delayed train movements, etc)?

7. Do other signallers have difficulty using a SPA?
- | | | | | | |
|---|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 | N |
|---|---|---|---|---|---|

8. Why do you think someone might have difficulty with a SPA?

1 Always	2 Often	3 Usually	4 Sometimes	5 Never	N Not aware or do not know
-------------	------------	--------------	----------------	------------	-------------------------------

9. When a SPA is in force, do you block trains that would cross-over or conflict with the track protected by the SPA (i.e., those that cross but do not go onto the track under the SPA itself)?

1 2 3 4 5 N

10. After working with train control to complete a SPA form (including assurances) are you left with any doubts as to every requirement or action required?

1 2 3 4 5 N

11. After working with train control to complete a SPA form, do you understand why particular assurances are needed?

1 2 3 4 5 N

12. When you place blocking facilities along a section of track affected by a SPA, what do you place them on:
(Please choose only one option)

- Entry signal/s of the route/block/section
- All points across the route
- All points and signals across the route including those on conflicting routes
- Only those points and signals that need to be operated for the movement
- Other. Please specify

13. If for example you did not apply all required blocks (on signals/routes/points) for a SPA, what would a reason for this be (e.g., high workload, unnecessary, shortcut, error, etc)?

.....

14. Do you rely on train control to tell you what assurances you need when issuing/receiving a SPA?

1 2 3 4 5 N

15. Do you feel confident carrying out the actions required of a SPA?

1 2 3 4 5 N

16. How informative / useful was training concerning the use of SPA's?

1 2 3 4 5 N
Very useful Satisfactory Neither good nor bad Unsatisfactory Not Useful Have NOT been trained

i. Can you suggest how training may be improved? (e.g., more practice filling out the form)?

.....

Thank you for your time

17. Are there any other comments you wish to make?

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**Near collision between stationary
Coal Train LD166 and an empty Endeavour Passenger Train D743
Sandgate, New South Wales, 25 February 2004**

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