RAIL SAFETY INVESTIGATION REPORT

WORKSITE PROTECTION INCIDENT

SYDNEY TRAINS FLEMINGTON MAINTENANCE CENTRE

2 AUGUST 2014

Released under the provisions of
Section 45C (2) of the Transport Administration Act 1988 and
Section 46BBA (1) of the Passenger Transport Act 1990

Investigation Reference 04651
THE OFFICE OF TRANSPORT SAFETY INVESTIGATIONS

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# CONTENTS

<table>
<thead>
<tr>
<th>TABLE OF FIGURES</th>
<th>ii</th>
</tr>
</thead>
<tbody>
<tr>
<td>TABLE OF PHOTGRAPHS</td>
<td>ii</td>
</tr>
<tr>
<td>EXECUTIVE SUMMARY</td>
<td>iii</td>
</tr>
<tr>
<td><strong>PART 1</strong></td>
<td>1</td>
</tr>
<tr>
<td>FACTUAL INFORMATION</td>
<td></td>
</tr>
<tr>
<td>Overview</td>
<td>1</td>
</tr>
<tr>
<td>Location</td>
<td>1</td>
</tr>
<tr>
<td>Environmental conditions</td>
<td>2</td>
</tr>
<tr>
<td>Train information</td>
<td>2</td>
</tr>
<tr>
<td>Train crew</td>
<td>3</td>
</tr>
<tr>
<td>Train movements at Flemington Maintenance Centre</td>
<td>3</td>
</tr>
<tr>
<td>Network management</td>
<td>4</td>
</tr>
<tr>
<td>Area controller</td>
<td>5</td>
</tr>
<tr>
<td>Possessions and configurations</td>
<td>6</td>
</tr>
<tr>
<td>Events leading up to the occurrence</td>
<td>8</td>
</tr>
<tr>
<td>The occurrence</td>
<td>12</td>
</tr>
<tr>
<td>Post occurrence</td>
<td>13</td>
</tr>
<tr>
<td><strong>PART 2</strong></td>
<td>15</td>
</tr>
<tr>
<td>ANALYSIS</td>
<td></td>
</tr>
<tr>
<td>Decision to modify the possession configuration</td>
<td>15</td>
</tr>
<tr>
<td>Organisational reform</td>
<td>18</td>
</tr>
<tr>
<td>Defining and protecting the parameters of the possession and overhead power isolation</td>
<td>22</td>
</tr>
<tr>
<td>Handover procedures and documentation control within Strathfield Box</td>
<td>26</td>
</tr>
<tr>
<td>Rosters and fatigue</td>
<td>28</td>
</tr>
<tr>
<td>Difficulties in identifying the strap as a hazard (Driver’s perspective)</td>
<td>31</td>
</tr>
<tr>
<td>Remedial actions</td>
<td>33</td>
</tr>
<tr>
<td><strong>PART 3</strong></td>
<td>35</td>
</tr>
<tr>
<td>FINDINGS</td>
<td></td>
</tr>
<tr>
<td>Causation</td>
<td>35</td>
</tr>
<tr>
<td>Contributing factors</td>
<td>35</td>
</tr>
<tr>
<td>Other findings</td>
<td>36</td>
</tr>
<tr>
<td><strong>PART 4</strong></td>
<td>38</td>
</tr>
<tr>
<td>RECOMMENDATIONS</td>
<td></td>
</tr>
<tr>
<td><strong>PART 5</strong></td>
<td>40</td>
</tr>
<tr>
<td>APPENDICES</td>
<td></td>
</tr>
<tr>
<td>Appendix 1: Authority for Removal of Supply from 1500 Volt Sections No: 629/14</td>
<td>40</td>
</tr>
<tr>
<td>Appendix 2: Table of documents associated with the possession and OHW isolation</td>
<td>42</td>
</tr>
<tr>
<td>Appendix 3: Sources and submissions</td>
<td>44</td>
</tr>
</tbody>
</table>
TABLE OF FIGURES

Figure 1: Location of Flemington Maintenance Centre ...........................................................2
Figure 2: Flemington Maintenance Centre – track diagram ...................................................12
Figure 3: Limits of possession, power isolation and route of S12A ........................................24

TABLE OF PHOTGRAPHS

Photograph 1: Route taken by S12A and portable rail connection locations .........................13
Photograph 2: View from forward facing CCTV camera on front of S12A .............................32
Photograph 3: Infrastructure at the entrance to Flemington Maintenance Centre .................32
EXECUTIVE SUMMARY

At approximately 1306\(^1\) on 2 August 2014, an empty passenger train collided with a portable rail connection as it exited Sydney Trains Flemington Maintenance Centre. The lead pantograph became entangled with the portable rail connection causing the train to lose power and the driver to bring it to a stand. Both the train and overhead wiring suffered minor damage. There were no reports of injuries.

An extensive maintenance possession and associated isolation of the overhead wiring was in progress at the time. The portable rail connection was installed in conjunction with this work. However, it was placed in the wrong location by a team unfamiliar with the area. The team had been brought in from Gosford due to personnel shortages at a time of restructuring and were not fully inducted into the site. The unit tasked with remotely monitoring the state of the power supply did not detect the error.

The area controller had not expected the train movement due to inadequacies in handover procedures and in the documentation at hand in relation to the possession. In setting the route for the train, he removed protection that would have prevented the train from entering the track fouled by the portable rail connection.

The possession was of a type characterised by very long lead times; extensive high level planning, coordination and resource allocation involving numerous Sydney Trains’ divisions and engineering disciplines; and development of optimal alternative customer transport services. The possession was modified at comparatively late notice to facilitate delivery of train services to a major sporting event at Olympic Park. Consequently, planning timeframes were significantly reduced.

Concerns about the impact of short notice changes were documented but, there was no mechanism for escalating such concerns to an appropriate level of management. Possession configurations were amended without sufficient quality checks and waivers were issued outside Safety Management System parameters.

The investigation found that several safety critical publications, including electrical documentation, directly affecting the planning and implementation of the work contained conflicting and incorrect information. Some documentation was released

\(^{1}\) All times referred to in this report are Australian Eastern Standard Time, Coordinated Universal Time (UTC) +10 Hours.
at shorter notice than provided for in Sydney Trains’ Safety Management System. Additionally, there were deficiencies in the control of safety documentation. Consequently, there was confusion over the limits of the possession and overhead wiring isolation at Flemington resulting in insufficient protection being emplaced.

Sydney Trains engaged an external consultant to undertake an independent investigation into the incident. The consultant’s report made 19 recommendations, 17 of which were accepted. Implementation of these recommendations will adequately address many of the issues associated with Sydney Trains’ Safety Management System, possession planning, switching processes and documentation control.

Notwithstanding the action in hand, the following additional recommendations are made to Sydney Trains in relation to matters identified in the course of OTSI’s investigation:

- Identify and remove barriers to timely and accurate reporting of safety critical information to senior management and, where appropriate, the Executive Team.
- Revise the process related to modifications of possession configurations to ensure that sufficient lead times are available to deliver the required tasks safely and efficiently.
- Implement a more robust handover process which can reinforce the possession and electrical isolation limits, as applicable, with area controllers.
- Implement a more robust process in their Safety Management System to guard against a portable rail connection not being properly connected and power not being isolated in accordance with documented parameters.
- Improve the distribution process of safety critical documentation to and throughout Strathfield signal box.
- Audit rostering practices of signallers/area controllers from a systemic point of view and implement action to address any non-compliance with documented rostering principles.
PART 1  FACTUAL INFORMATION

Overview

1.1 At approximately 1306 on 2 August 2014, an empty Waratah passenger train designated S12A began its departure from the Flemington Maintenance Centre. During this movement, the train collided with a portable rail connection. The connection had been incorrectly installed on the overhead wire some seven hours earlier by an electrical switching team unfamiliar with the area. The lead pantograph of the train became entangled causing the train to lose power and the driver to bring it to a stand. Both the train and overhead wiring suffered minor damage. There were no reports of injuries.

Location

1.2 The incident involving S12A occurred at the entry/exit point for Flemington Maintenance Centre. The Centre is located adjacent to the main Western rail corridor approximately 15.049 km² by rail west of Central railway station (see Figure 1).

1.3 Within the maintenance facility there are 26 maintenance and storage roads, all with 1500 volt overhead wiring. Multiple points and crossovers exist to facilitate the throughput of rail traffic. These roads converge into four possible entry/exit tracks at the city (Sydney CBD) end:

- Arrival Road
- Departure Road³
- Transfer Road – unidirectional movements available
- Departure movements only via ‘A Road’, 647 points and 649 points.

1.4 At the time of the incident, S12A had left its stabling position in No.13 Road and was attempting a departure movement via the Transfer Road.

² All kilometragaes are measured from the buffer stop at No. 1 platform at Central railway station, Sydney Terminal. The kilometrage shown for Flemington Maintenance Centre is referenced from the Network Local Appendices (NLA) 116, up electric train STOP sign on No 13 Road. The train struck the portable rail connection at approximately 14.870 km.
³ This was also referred to as No 1 Departure Road (see Appendix 3: Table of documents associated with the possession and OHW isolation).
Environmental conditions

1.5 It was dry, cool and clear around Flemington Maintenance Centre at the time of the incident. The Bureau of Meteorology recorded a maximum temperature of 16.1°C at Sydney Olympic Park (Archery Centre), located approximately 3.4 km north-east from the facility. These conditions did not contribute to the incident.

Train information

1.6 The scheduled timetable for S12A was documented on Tables Telegram 194-14GM as departing the facility at 1300, travelling onto the Down Flemington Goods line and then forming run S12X to Olympic Park Station.
1.7 S12A consisted of eight Waratah double-deck suburban cars, belonging to two four-car ‘sets’; A80 (leading in direction of travel) and A34 (rear). The overall length was approximately 161 m and gross mass was 418.4 t.

1.8 Shortly before the train was due to depart, the sixth position car developed an electrical fault with the internal emergency door release (IEDR), which could not be rectified prior to departure. However, the investigation found that this IEDR defect had no impact on the events that contributed to the incident.

1.9 The pantograph of lead car D6480 was destroyed when it collided with the portable rail connection.

Train crew

1.10 There were two crew members on board the train. Both were qualified for their duty and current in required competencies. In addition to these two crew members, two Sydney Trains staff members were aboard the train attempting to rectify the IEDR defect.

1.11 After the pantograph was damaged, the train lost power and the driver reacted quickly to bring the train to a stand. The investigation found that there were no significant anomalies in the train’s operation, or interaction between these employees, that contributed to the incident.

Train movements at Flemington Maintenance Centre

1.12 Movements to, from and within the Flemington Maintenance Centre were the sole responsibility of Sydney Trains.

1.13 Within the facility, a Yard Supervisor had overall responsibility for coordinating any train movements and providing directions to shunters. Train drivers received authority to move via a combination of hand signals from shunters and signals controlled by the Strathfield signal complex.

1.14 The track speeds within Flemington Maintenance Centre ranged from 8 km/h on tracks within covered areas (sheds) up to 13 km/h in the yard (uncovered areas). The train was operated within the speed limits.
Network management

1.15 The departure route of S12A would have taken the train onto the Down Flemington Goods line. Both the Up and Down Flemington Goods lines at Flemington form part of the Sydney Metropolitan Rail Area Network (MRA). They form part of a shared corridor and run adjacent to the Sydney Trains controlled Up and Down Main lines between Homebush (12.669km) and Lidcombe (16.337km). Various interface, licencing and access agreements exist between RailCorp and Sydney Trains, which are both NSW State Government owned entities. Sydney Trains had effective control and management of the rail infrastructure including track maintenance, signalling, train control and incident management functions in this area of the corridor, as well as the network-wide Rail Management Centre (RMC).

1.16 Train movements in the area were controlled by a combination of automatic and controlled signals under RailCorp’s Network Rule NSY 500 Rail Vehicle Detection System. All signals and points were monitored remotely from the Strathfield signal complex. At the signal complex, area controllers (signallers) operated panels, each covering a defined portion of the total area controlled from Strathfield. The incident occurred in the area controlled from the Flemington panel.

1.17 This Flemington panel covered rail operations between Homebush and Lidcombe stations and had signalling control over the rail territory on:

- the Up and Down Main and Up and Down Suburban lines (broadly between Flemington and Lidcombe)
- the Up and Down Homebush Bay East Fork lines (Flemington to Olympic Park)
- the Up and Down Flemington Goods lines (Homebush to Flemington South Junction).

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4 With effect 1 July 2013, RailCorp retained ownership of the MRA (including stations) and Sydney Trains (metropolitan train services) was formed. Sydney Trains became accredited as both a rail operator and infrastructure manager under the Rail Safety National Law (NSW) and inherited a number of staff, documents, systems, assets and responsibilities from RailCorp. All employees, roles and maintenance responsibilities for the MRA network and rolling stock referred to in this report were under the effective control and management of Sydney Trains.

5 The kilometrage shown for Homebush is referenced from NLA 114 and Lidcombe from NLA 120.
Area controller

1.18 Employment and training records showed that the area controller commenced training as a signaller/area controller in 1998 and had been working in the Strathfield signalling complex since 2004. He was deemed fully qualified and was certified in all relevant systems of safe working. He was also deemed competent to operate various signalling control panels at the signalling complex, including the Flemington panel.

1.19 At 0600 on 2 August 2014, the area controller signed on for duty to commence an 8-hour shift on the Flemington panel. Shortly after, he received a handover from the outgoing area controller. The handover included acknowledgment of the parameters of the planned possession and overhead power isolations. Local train running arrangements within his area of control and directly affected by the possession were also covered in the handover.

1.20 Later, when setting the route for S12A, the area controller removed a blocking facility on 644 points. This blocking facility had been placed there by the previous area controller as part of a range of blocking facilities protecting the limits of the possession. This permitted S12A to access the Transfer Road, contrary to the limits as specified on Special Train Notice STN 1130-2014.

1.21 Shortly after the incident, the area controller was placed under supervision of the shift supervisor at Strathfield signal complex until he was in turn relieved. He was then subjected to drug and alcohol testing both of which returned negative results.

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6 A possession is an arrangement whereby a section of rail line/s is/are closed to normal rail traffic to allow engineering staff to carry out works.

7 Blocking facilities: a facility or device used by a competent worker to prevent either the unintended issue of an occupancy authority, or the operation of points or signalling equipment. (Rail Industry Safety and Standards Board (RISSB) - National Guideline Glossary of Railway Terminology).

8 The Network Rules Glossary describes a ‘Special Train Notice (STN)’ as: ‘A published notice providing details of train operations or events that might affect train operations’. STNs are produced by the Sydney Trains Train Planning Unit. STN 1130-2014 was the main document showing the overall possession and power isolation limits.
Possessions and configurations

1.22 The possession protection method used was Local Possession Authority (LPA). LPA is used to close a defined portion of track for a specified period to allow work to be carried out safely in the danger zone within the boundaries of the possession. LPAs must be advertised in a Special Train Notice (STN) at least seven days in advance. Several STNs, VIDEs\(^9\) and SAFE Notices\(^10\) were issued advertising the possession and advising the altered train running information.

1.23 The procedures for the protection of track workers using LPA were prescribed under RailCorp Network Rule NWT 302 – Local Possession Authority. An LPA can only be authorised and issued by a train controller and is issued exclusively to a possession protection officer (PPO).

1.24 Sydney Trains Network Rule NWT 300 - Planning Work in the Rail Corridor states that LPAs are one of two preferred methods for working safely on track, the other being track occupancy authorities (TOAs). The LPA was chosen as the preferred method to protect the work area and it was adequate for and compatible with the type of engineering work to be performed.

1.25 Large LPAs and track possessions are also known as Configurations. Configurations are closures of a group of tracks for an agreed time (usually a weekend, or extended closedown period) over an extensive area and are often repeated a few times a year. These configurations allow a large number of internal and external work teams to access the rail network to deliver major works and planned maintenance. An underpinning efficiency of the configuration process was that of standardisation, such that worksite parameters, signalling requirements and assessed risks would remain relatively constant. Recurrent planning could then be replicated with only minor variations.

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\(^9\) VIDE (also known as ‘GM Wire’) is a term that refers to the amendment of or alteration to an STN and is issued by the Train Planning Unit as a ‘Tables Telegram’. This can be transmitted by e-mail and is also posted online.

\(^10\) A Safe Notice is issued to give immediate notice of changes or exemptions to RailCorp/Sydney Trains Network information publications. Where there is insufficient time available to permit the printing and distribution of a Safe Notice, a Safe Telegram is issued.
1.26 Standard LPAs (and configurations in general) had other inherent advantages in safety and efficiency over other methods of worksite protection, including TOAs. A key advantage was a long lead time approval process undertaken by Sydney Trains for LPA possessions. This allowed high levels of planning, coordination and resource allocation amongst the various divisions and engineering disciplines, and development of an optimal alternative customer transport option.

1.27 In accordance with Sydney Trains safety management system (SMS), STNs were to be issued more than seven days in advance of the work to be carried out. This provided ample time for operations and engineering personnel to absorb the content and for downstream rail stakeholders, many who dealt directly with customers, to plan for the possession at their local level. Overall, these processes aimed to find the right balance between communicating safety critical information, maximising efficiency of the possession period and minimising the overall impact to rail customers.

1.28 The standard configuration for the weekend of 2-3 August 2014 was referred to as a Configuration 3, with an area defined by:
- Sydney Yard to Clyde (Main lines)
- Wells Street (near Central) to Homebush (Suburban lines)
- Flemington Sidings and Junction, and Olympic Park Loop.

1.29 Planning and management for a standardised Configuration 3 process took place over several months. Then, on 8 July 2014, at the request of the Operations Directorate, the standard Configuration 3 was modified to accommodate train movements in and out of Flemington Maintenance Centre and on the Olympic Park Loop. Subsequently, not all safety critical documentation was issued, or finalised, within the timeframes documented in the SMS. Moreover, some documentation contained errors or omissions.
Events leading up to the occurrence

1.30 On Wednesday 30 July 2014 (three days prior to the start of the possession), a field copy of the Authority for Removal of Supply from 1500 Volt Sections No 629/14 (the ‘Authority’) arrived at the Clyde Network Base for checking by the local electrical engineer. Shortly after, Tables Telegram 0144-14V was issued amending the power outage shown on STN 1130-2014. In the meantime, a pre-possession meeting was held involving numerous stakeholders, including the nominated switching coordinator, during which final coordination and planning details were confirmed.

1.31 On Thursday 31 July 2014, the switching coordinator, as part of his role, helped coordinate 29 on-site inspections or ‘walk-throughs’ of the site with various stakeholders. This was so they could get a better understanding of the electrical parameters (limits) and risks from the ‘field’ perspective. As no problems were identified with the Authority at that stage, the switching coordinator then got the stakeholders to review the relevant Electrical Permit to Work in preparation for when they returned the next morning to start work. At the end of that day, the switching coordinator was booked off until Friday night, in the lead up to the start of the possession.

1.32 Subsequently, it became apparent to the electrical engineer that the Authority required alteration to the original switching requirement. The Authority was eventually amended sometime on Friday 1 August 2014.

1.33 At 2300 on Friday 1 August 2014, the switching coordinator signed on at Clyde Network Base. He then commenced final preparations and planning for the removal of the electrical supply from various 1500 volt overhead sections, electrical support and permit issuing and other activities.

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11 RailCorp SMS document SMS-06-EN-0567 Part 3 (d) prescribes a requirement for this Authority to be issued a minimum seven days prior to the commencement of the work. Whilst this procedure prescribes for no alterations within this period (Part 3g), to enable adequate planning and allocation of resources, changes can be made, but require holders to be re-instructed, Authorities to be re-issued and a number of other alternatives and contingencies.

12 RailCorp SMS document SMS-06-FM-0602.

13 Sydney Trains SMS document NMD-PR-194 defines a switching coordinator as: “A person that is responsible for the completion of an isolation, restoration, holding the Authorities and WHVI’s and issuing of permits”. Majority of these tasks occur within a week from the start of the possession. Reference to WHVI means Working High Voltage Instruction. This document details the role of a ‘Senior Electrical Engineer’, who is responsible for ensuring the: “Authorities and WHVIs checked, approved and forwarded to the Switching Coordinator” by two weeks prior to the start of the possession.
associated with the possession. The possession was scheduled to commence at 0200 on Saturday.

1.34 Due to the size of the task and workload, the switching coordinator was assigned an assistant who signed on at the same time. The assistant had not yet obtained the suite of electrical competencies to undertake the full switching coordination role.

1.35 The switching coordinator noted the amended Authority. However, several anomalies still existed which complicated the pre-possession activities and included:

- notification from the Electrical Operating Centre\(^ {14} \) (EOC) that the Authority 629/14 required further alteration due to missing section data
- lack of information related to attending mains personnel, their equipment levels and their experience in the possession area.

He realised he would need to resolve the problems, re-issue forms and Authorities and undertake part of the local switching function, in order to reduce the delays to the start of the possession. To do this he had to leave Clyde Network Base and travel to Flemington Maintenance Centre and Strathfield Box.

1.36 The switching coordinator was concerned that he may be held personally responsible for delays to the start of the possession this process would have incurred. As it was now close to the start of the possession, the situation became more urgent. Consequently, the switching coordinator left the Base without providing a sufficiently detailed handover to the assistant.

1.37 In the meantime, at 2200 on 1 August 2014, team members of the Gosford Electrical Switching Group signed on duty at their Gosford depot. They then made their way to Clyde Network Base, arriving after the departure of the switching coordinator. They were to undertake the switching and isolation of the overhead wiring in the area around Flemington, including installation of the portable rail connection within the Maintenance Centre.

\(^ {14} \) The EOC is responsible for the management of the electrical power distribution for both Sydney Trains and NSW Trains networks, as well as coordination of responses to asset failures and operational incidents and remote monitoring and surveillance to all operational networks, the electrical high voltage network, systems, switching and applications. The EOC forms part of Infrastructure Control (ICON).
They had never been to that location before and were not given a detailed induction, task briefing, copies of relevant diagrams, or location information. Shortly after, an escort was provided to assist the Gosford team to find their way to Flemington.

1.38 In the lead up to the start of the possession, the train controller was trying to coordinate with various stakeholders to rectify the problem with the Authority and minimise the delays to the start of the possession. Eventually, he concluded it was more practical to stage the overall implementation of the Configuration; firstly by granting possession of the tracks, then concentrating on the removal of the overhead power (subject to receipt of a corrected and reissued Authority).

1.39 To facilitate possession of the tracks, the train controller sought a number of assurances from relevant signallers and area controllers controlling the rail territory between Central and Lidcombe. He sought and received affirmation from them all that they had the correct documentation, relevant limits were understood and blocking facilities were applied (albeit he did not specify every individual STN, Tables Telegram or other document). At 0306, having received affirmation from all the area controllers, the train controller declared the limits of the track possession as being in force.

1.40 At 0358, the clearance was given for the removal of the overhead wiring power on the reissued Authority and all switching was completed by 0615 (over four hours after the scheduled start of the possession).

1.41 At 0600, the area controller signed on duty at the Strathfield Signal Complex to commence his shift on the Flemington panel. Shortly after, he received a handover from the outgoing area controller who had placed all the blocking facilities to protect the track possession and overhead wiring isolation. The outgoing area controller routinely highlighted the limits of the various track possessions and overhead wiring isolations in his area of control. This handover included acknowledging STN 1130-2014 (showing the main possession and power isolation limits) and Tables Telegram 0144-
14V (amending STN 1130-2014).\textsuperscript{15} Significantly, STN 1130-2014 showed possession of, but no power out over, the Transfer Road.

1.42 The train register book (TRB) for the Flemington panel showed only one notation by the incoming area controller relevant to the possession; acknowledging STN 1130-2014. Unbeknown to the incoming area controller, the handover had not included specific mention or a copy of Tables Telegram 194-14GM, which detailed the timetable for run S12A later in the day.

1.43 At approximately 1301, the area controller on the Flemington panel received a two-way radio call from a shunter at Flemington Maintenance Centre. The shunter stated that run S12A on Tables Telegram 194-14GM was ready to depart from the facility.

1.44 The area controller was not prepared for the departure of the train, as he was not advised during handover and could not immediately locate a copy of the particular tables telegram. Anxious to avoid being deemed responsible for incurring a delay to the train, he immediately went to search for the telegram amongst the documents on other panels. No copy of the telegram could be found, so the area controller eventually downloaded a copy from the Sydney Trains’ Train Planning Unit intranet site.

1.45 By 1304, now with a copy of Tables Telegram 194-14GM, the area controller returned to his panel and commenced setting up the route for the departure of S12A.\textsuperscript{16} In setting the route for the train, the area controller removed blocking facilities on 644 points and set them into the reverse position.\textsuperscript{17} This meant that S12A would be routed out of No.13 Road, through the Transfer Road and onto the Down Flemington Goods line (refer to Figure 2). In doing so, this route would take the train past signal 320, 651 points, signal 318, 650 points, Transfer Road, signal 306, 644 points and onto the Down Flemington Goods line, clear of signal ST301DG.

\textsuperscript{15} Sydney Trains OSP21 Signal Box Management states that signallers must: ‘acknowledge Safeworking and safety documentation affecting their area in the system provided…..record all information concerning the movement of trains in the Train Register Book’. Train Register Book (TRB) records confirm the incoming area controller only notated STN 1130-2014 when signing on.

\textsuperscript{16} Instead of being called S12A, signal data logging entries confirm the train was entered into this system as ‘S12X’.

\textsuperscript{17} Blocking facilities on 644 points was one way to prevent access by unauthorised rail traffic to the Transfer Road and there were other options that could have been utilised by the area controllers.
The occurrence

1.46 At approximately 1306, the train moved off from its stabling position in Flemington Maintenance Centres No.13 Road and travelled down through the yard past 651 points (refer to Photograph 1). Shortly afterwards, the driver became aware of problems when the power was lost to the train, so he applied the brakes to bring the train to a stand on the Transfer Road. At the same time, a work group located in a safe place near the boundary fence observed sparks emanating from the pantograph area of lead car D6480. Reacting to this, the protection officer with the work group walked towards the train and raised both his hands in the air, hoping the driver of S12A would see him and recognise this as a commonly used STOP hand signal.

1.47 Neither the location of the nearby work group nor any actions on their part contributed to the incident.
Photograph 1: Route taken by S12A and portable rail connection locations

Post occurrence

1.48 Following the incident the driver contacted the shunter, who in turn notified the area controller. Shortly after, the driver was advised by the area controller to remain with the train until such times as incident responders could attend and declare the area and train safe.

1.49 In the meantime, the train controller initiated incident management procedures. Shortly afterwards, he received assurances from the site that:

- all staff on the train and in that area of the facility were safe
- only the train pantograph and overhead wiring had suffered damage.

1.50 After discussion between the RMC’s train controller and shift manager and the shift supervisor in Strathfield signal complex, the area controller was placed under immediate supervision of a Tableman until the shift

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Tableman positions exist at major signalling complexes including Strathfield. Tablemen are managed by the shift supervisor and their roles include assisting with risk mitigation in overload, fatigue and staff failure/shortage situations; area controller relief; and assisting supervisors with administrative functions, including the management of safety critical documentation such as Safe Notices, STNs and Tables Telegrams.
supervisor could arrange a relief. Later, the area controller was subjected to drug and alcohol testing, the results of which were negative. Before the area controller ceased duty, the RMC shift manager deemed that no other person needed to undergo post-incident drug or alcohol testing.

1.51 By 1435 the Incident Rail Commander had determined that the portable rail connection was not located in the correct location. He became concerned that this posed an unacceptable level of risk to those involved with removing the damaged pantograph and any ongoing electrical work in the possession. Consequently, he directed that all work in that area cease until:

- the damaged train pantograph and portable rail connection were removed
- a new portable rail connection could be installed in the correct location
- damage to the overhead wiring was rectified
- the area was declared safe and appropriate documentation and protections were in place to protect the work for the remainder of the possession.

1.52 At 1544 an Emergency Authority E49/14 was granted to the local Electrical representative on site to facilitate the remedial emergency works.

1.53 At 1709 all emergency electrical work was completed and Emergency Authority E49/14 was fulfilled and cancelled.
PART 2 ANALYSIS

Decision to modify the possession configuration

2.1 In the NSW rail environment, rail infrastructure owners and operators are constantly competing for track access and coordinating and planning for the impact of track possessions, alternative transport arrangements and special events. All these needs have the potential to significantly affect track access, service levels and resources. They also have the potential to impact on their organisation’s reputation. All factors have to be considered and catered for, and key decisions are usually made during the early stages of the planning processes. By their nature, configurations like the Flemington Configuration, require extensive lead times, planning and coordination.

2.2 Within Sydney Trains, there were a number of areas across the Operations and Maintenance Directorates responsible for coordinating possession arrangements, resources, STN publications, alternative transport and special events, and ensuring the organisation was in a state of ‘readiness’ for the impact. Some examples of these include:

- Various divisions and units within the Maintenance Directorate which existed to liaise with external parties, plan, schedule, coordinate and deliver the Sydney Trains asset maintenance program. Up to 79 individual scopes of work were planned for the initial ‘intact’ Configuration. This number was subsequently reduced to 63 prior to commencement of the modified Configuration.

- Various divisions and units within the Operations Directorate including:
  - The Train Planning Unit which was responsible for production, validation and distribution of STNs. Ideally STNs were validated and finalised at least two weeks before the start of the work and were distributed and received by stakeholders at least one week out.
An Operational Readiness and Events team who were responsible for coordinating operational readiness activities associated with major closedowns, selected high-risk possessions and rail asset enhancement projects. Within this team other units were involved in planning for the Configuration and included:

- An Alternative Transport Unit which was responsible for the coordination of alternative transport arrangements, such as large bussing operations. This team was responsible for identifying requirements, liaising with external authorities, the procurement of vehicles and management of bussing operations.

- An Events Transport Team who were responsible for the planning and coordination of special events. This involved liaison with event promoters, government agencies and operational personnel.

2.3 Notably, significant stakeholder effort and resources were involved throughout the organisation in the lead up to a Configuration. Having to blend the schedule of planned future trackwork with known and proposed special events, that may have an impact on their services and infrastructure, posed a regular challenge for Sydney Trains. Consequently, it was important that any event ‘briefs’ and readiness plans effectively monitored the scheduling of major public events that were likely to involve the use of rail transport to move large numbers of people to a venue. The majority of these events, such as the Royal Easter Show and the Rugby League Grand Final, had their date and venue known well in advance. Therefore, rail maintenance and construction could be planned and scheduled so as to avoid or minimise disruption to the travelling public.

2.4 There were, however, other events of similar magnitude which had a known date but for which the venue was not known until shortly before the event. One such event was the 2014 Super Rugby Final. In this case, the Operations Directorate became concerned about the ability of the
organisation to rely solely on alternative transport arrangements to meet passenger needs for that sporting event. Consequently, on 8 July (25 days prior to the start of the possession), they sought modification to the standard Configuration 3 to accommodate direct passenger transport to the venue (Olympic Park).

2.5 Whilst the date of the Final (Saturday 2 August 2014) was known for many months in advance, the venue was not confirmed until 26 July 2014, shortly after the two competing teams were confirmed publicly. There was already some contingency planning around an expectation Olympic Park would be the venue, as evidenced by the development of STN 1523–2014 (refer to the Table in Appendix 2: Table of documents associated with the possession and OHW isolation). However, this STN only catered for some altered train running. It did not encompass other operational or engineering considerations, which had to evolve, modify, or in some cases recommence in the remainder of the time in the lead up to the modified possession.

2.6 Sydney Trains Level 3 Investigation Final Report into this incident found that some stakeholders documented their concerns about the intended possession strategy and switching, earthing and livening-up risks. These included a union and an internal stakeholder involved with the possession planning process, who forecast his concerns: “... almost one month prior to the event ... to a number of managers and peer stakeholders”. However, these safety concerns appeared to be largely outweighed by the competing interest of providing train services to the event. Regardless, the modifications were approved and went ahead.

2.7 Fortunately, such events are likely to be rare. However, where it can be identified that there is a reasonable possibility for such an event to take place at a venue serviced by rail transport, it would seem prudent for Sydney Trains to proactively provide for this contingency by planning its trackwork schedule on the basis that rail transport would be available. In other words, plan and schedule resources for a modified Configuration, rather than for a full Configuration, which may be altered closer to the date. If this is not done, there will be a significant possibility of disruption either to
the travelling public, or to the work schedule, should it be necessary to make late changes.

2.8 These issues also highlight the importance of ensuring change management incorporates an appropriate reassessment of risk. Where there were ongoing concerns about safety, the organisation should have had mechanisms in place such that safety concerns could be escalated to senior management and, in some cases, the Sydney Trains Executive Team. The Executive Team should ensure that there are appropriate governance structures in place to ensure timely and accurate reporting of safety critical information to them and take steps to verify that they are being properly informed. By doing this, the Executive Team would be in a position to make informed decisions that ensure safety is not compromised by the organisation in the pursuit of commercial objectives, or when challenged by competing internal priorities.

2.9 In summary, this Configuration was a standard possession, modified at relatively short notice to accommodate passenger transport to the event at Olympic Park. Concerns were documented about the intended possession strategy and switching, earthing and livening-up risks, but those concerns appeared to be largely overshadowed by the competing interest of providing train services to the event. The organisation did not have effective mechanisms in place such that those concerns could be escalated to an appropriate level.

Organisational reform

2.10 Significant organisational reform had taken place in the preceding year which saw efficiency measures implemented across all Sydney Trains Directorates. Within the Maintenance Directorate, transitional arrangements led to the departure of a number of key personnel with electrical and assurance expertise. Further, the reform included the transition of dispersed electrical work depots into Network Bases and the previously disparate disciplines of Electrical Distribution and Electrical Mains groups brought together.
2.11 The Clyde Network Base was opened only three days prior to the commencement of the possession. The Base was tasked with the oversight of routine maintenance within its defined territory (which included the Flemington and Olympic Park precincts) as well as the electrical switching function for the area included in the Configuration. Unable to provide all the switching personnel locally, the Clyde Network Base sought non-local personnel for the switching function at Flemington. The task was ultimately undertaken by a switching team from Gosford despite their not being familiar with the Flemington area. This absence of familiarity placed more emphasis and stress on other aspects of the organisation, including the quality, timeliness and reliability of critical documentation made available to these personnel.

2.12 A suite of electrical safety documents called the Electrical Network Safety Rules (ENSR) exist to provide electrical work instructions for persons authorised to work on, or near, electrical supply assets (such as the 1500 volt overhead power). Some prescribe a requirement for a minimum ‘frozen’ status to be exercised on electrical authorities to enable safe and efficient planning and allocation of resources. That is, no alterations may be made within a stated timeframe in advance of the work, unless documents are reissued and certain planning processes recommence.

2.13 The investigation found that there were a number of anomalies with key ENSR documents and waivers granted to compensate for known weaknesses in network maintenance planning and resources. One such document, *General requirements for Electrical Work*, provided for exceptions from working to the SMS and stated: ‘Any procedure for electrical work that differs from those documented in the SMS or the ENSR, may be adopted provided that it …’ complied with five stated conditions, none of which were adopted.

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19 Sydney Trains advised that the ENSR are a subset of documents that reside within their SMS and can be found on the RailSafe website. Content of the ENSR is managed by their Engineering and System Integrity Unit.

20 SMS document SMS-06-EN-0552
2.14 Another document, 1500 Volt Authority (3d),\textsuperscript{21} stated: ‘A minimum of seven (7) days prior to the commencement of work, the Issuing Officer will issue the Authority to the work group originating the request, the Electrical System Operator and the Train Controller’. On 23 July 2014, 10 days prior to the possession, conditional approval was sought and granted to waive this seven day requirement: ‘… for future isolations until systemic improvements can be actioned to resolve this issue’ and, as such, this waiver was extended to 20 October 2014.

2.15 This Authority\textsuperscript{22} was eventually issued on Thursday 31 July 2014 (two days prior to the possession). However, it contained errors and omissions only some of which were identified and resolved the following day (the day before the possession).

2.16 Significantly, the Authority contained a ‘Special Instruction’ that related to the switching activity at Flemington which, in part, required supply to be maintained to subsection FA/2 through the closure of 1500V switch 350/1B & FA/2 at F14+946. This meant that, if the listed switches were not closed, supply would not be maintained to subsection FA/2 and power would not be available for train movements in and out of the maintenance facility. A number of qualified individuals progressively modified the Authority over time. An unintended consequence was that this instruction was not placed within the allocated area within the Authority form itself. Additionally, the instruction was not highlighted or communicated directly to local switching personnel or the EOC, who were remotely monitoring the state of the high voltage power supply. Therefore, none of the parties involved with the switching function were aware of it.

2.17 The failure to close 1500V switch 350/1B & FA/2 proved critical in the switching process. As part of the process the switching team were required to place the portable rail connection to a suitable structure within the yard. This was to provide an additional control and safety measure for those working on or near the overhead wiring. However, in the absence of supply

\textsuperscript{21} SMS document SMS-06-EN-0567. This document described the procedures required for the issuing and cancellation of an Authority for Removal of Supply from 1500 Volt Sections (known as an ‘Authority’).

\textsuperscript{22} SMS document SMS-06-FM-0602 Authority For Removal of Supply From 1500 Volt Sections No 629/14 (refer to Appendix 1).
to FA/2; when the crew tested the overhead for the presence of electrical power, none was present (i.e. it tested as electrically ‘dead’). This gave them a false confirmation that the strap was connected at the right location. The eventual location chosen by the switching team for the portable rail connection increased risk as it:

- was outside the confines of the overhead wiring isolation
- increased the likelihood of entanglement with an electric train pantograph.

2.18 Significantly, procedural defences and controls for switching and isolating the power failed to detect:

- that the portable rail connection was not in the correct location
- that the power had not been isolated in accordance with the documented parameters and this rendered FA/2 electrically ‘dead’.

Sydney Trains contended that unique environmental and human circumstances combined such that the location of the portable rail connection was contrary to the requirement for these connections to be placed: “…as close as possible to the points of isolation”. Furthermore, these anomalies existed without alerts being generated to the switching personnel, other workers, or the EOC. The Level 3 investigation report did not address these issues in its recommendations.

2.19 In articulating the overall impact of these anomalies and waivers, Sydney Trains investigation report found that waivers to their ENSRs were granted to compensate for known weaknesses in planning and resources. Specifically: “The investigation considered that this request and subsequent waiving action demonstrated a genuine stress within the maintenance organisation at the time. In acknowledging the need for ‘systematic improvements’, the organisation effectively bypassed its professed safety requirements in the interests of production”.

2.20 Therefore, very real conflicts emerged between:

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23 SMS document SMS-06-EN-0570: 1500 Volt Operating Procedures, 8.1.1 Adjacent Live Sections or Subsections.
• meeting the policy objectives of maintaining the frequency of possession configurations - requiring long lead times, careful planning and appropriate controls
• a modified Configuration and significantly reduced planning timeframes
• implementing significant organisational reform - requiring a large injection of non-local personnel for some tasks.

Defining and protecting the parameters of the possession and overhead power isolation

2.21 LPAs have no forms, but rely on safety critical information (such as the limits, alterations to train pathing, etc.) being pre-validated and embedded on the Authorities and STNs which in turn are to be distributed, received, communicated, read back and understood by downstream stakeholders. Unless advertised in a network local appendix (NLA), the intention to take a LPA must be advertised in a STN at least seven days in advance.

2.22 Ultimately several STNs, Safe Notices, Authorities and Tables Telegrams were issued in association with the possession, overhead power isolation, and altered train running arrangements. These are detailed in the table in Appendix 2: Table of documents associated with the possession and power isolation.

2.23 Three key documents were issued within seven days of the start of the possession. These related to the activation of the modified STN, amendments to limits of OHW isolations at Flemington and inclusion of additional train movements which included the timetable of S12A.

2.24 There was an acceptance by the Train Planning Unit that any errors, omissions or changes to final STNs could be documented in a VIDE, Safe Notice, or Safe Telegram, depending on how close it was to the start of the work. Notably, changes made within the seven days were not centred around a risk assessment to better understand the impact of non-receipt, or

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24 Ideally, STNs were validated and finalised at least two weeks from the start of the work and were to be distributed and received by stakeholders by one week out. Any changes needed to the STN after finalisation up until three days out from the start of the work were documented on VIDEs. Changes within the three days prior to the start could be documented on Safe Telegrams.
incorrect interpretation by affected downstream stakeholders (such as train controllers, area controllers, PPOs and operational personnel). Consequently, when stakeholders eventually received the changes, they had to undertake careful reading to appreciate any subtle implications and significance of any changes to the limits, or their own completed planning.

2.25 A number of parties were involved in implementing and protecting the limits of the LPA. They included the train controller, area controllers and PPO. Train controllers had an overarching responsibility to declare a LPA in force and authorise the power to be removed from the overhead wiring according to the information and limits on the STNs. Prior to granting possession, the train controller initially sought specific assurances from the other parties that they had the required documents, understood the parameters and had placed the necessary protections in place. Generally, this was a routine process carried out at the commencement of the possession and repeated when a party was subsequently relieved.

2.26 In order to protect the limits of the LPA, area controllers and PPOs jointly arranged for protection to prevent unauthorised entry of rail traffic into the limits of the LPA and/or isolation. Area controllers implemented the primary level of defence. They achieved this by remotely and manually placing blocking facilities on points, signals, or nominated fixed rail infrastructure. PPOs implemented the secondary level of defence. They arranged for additional possession protection ‘in the field’, usually consisting of a combination of railway track signals, red flags/lights, point clips and signage. Neither party had visibility of the protection arrangements implemented by any other party. All assurances (affirmations) were obtained verbally.

2.27 The investigation found that the possession protection arrangements were determined several months in advance of the work and were based on a complete shutdown of the area, including all access to and from the maintenance facility. These protection arrangements were routinely replicated into an internal database known as a Possession Protection.

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Constraints Register which detailed specific locations for the placement of the secondary possession protection in the field. However, when the possession scope evolved to allow access to and from Flemington Maintenance Centre, unforeseen errors and omissions resulted in all references to the Transfer Road being removed. Thus, no additional or secondary possession protection was provided to prevent unauthorised movements onto the Transfer Road. This left any primary protection facilities implemented by the area controllers as the only defences.

2.28 Further complicating this situation, the limits of the possession, as defined by the STN, did not always match the limits of the power isolation. Similarly, neither of these directly matched the individual, nor combination, of infrastructure assets options that could be chosen to be 'blocked' by an area controller. An example was the Transfer Road, which was under possession, but did not have the overhead power removed. This meant that the overhead on subsection FA/2, encompassing the Transfer Road, was meant to be ‘live’ (refer to Figure 3).

Notably, STN 1130-2014 contained the following warning in conjunction with all the power outages associated with the Configuration: ‘WARNING! The advertised Power Outage extends outside the perimeter of the Track Possession area as identified by the power outage schedule above’. It was routine for outage areas not to correlate with possession parameters. Ultimately, area controllers had responsibility to identify what assets needed
to be blocked to prevent access. This required them to carefully correlate the power outage requirements between a STN and *1500 Volt Sectioning Diagrams* and then identify how best to protect the overall limits of possession and outage from the available assets within their area of control.

2.30 *Track Possession No. 7 on STN 1130-2014* stipulated that possession of the Transfer Road at the maintenance facility was to be ‘clear of No. 644 catchpoints’ (refer to Figure 3). These catchpoints were located at the Sydney, or entry, end of the Transfer Road and a blocking facility was in place to prevent their operation. However, it was still possible to enter the limits of the possession from the Country, or yard, end of the Transfer Road. This was possible via a route through Nos 651 and 650 points, yet these were not detailed on the STN, nor ‘blocked’ by area controllers, or protected by PPOs.

2.31 During interview, the area controller admitted that, whilst the movement of S12A was scheduled, he was not expecting it due to not having *Tables Telegram 194-14GM*. When confronted with the situation where he had to set a route for S12A and minimise delay, he did not consider seeking clarification from the shift supervisor, or train controller. Instead, he manually removed the blocking facilities for 644 points. Doing so was contrary to the protection arrangements that were already in place for the Transfer Road. In hindsight, he indicated that other protection arrangements could have been implemented which would have provided additional protection even in the event of removing the block on 644 points. These included, but were not limited to, blocking facilities on conflicting routes on signal ST320 and 651 points (primary protection) and placing secondary protection on 651 points and both ends of the Transfer Road.

2.32 In summary, several safety critical publications, produced by separate entities within Sydney Trains, were made available to operational personnel (end users such as train controllers, PPOs and area controllers). These

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26 1500 Volt Sectioning Diagrams, or Electrical Operating Diagrams, detail the existing electrical (overhead wiring) and associated infrastructure and its condition. The Metropolitan rail network is broken up into a series of diagrams, of which *Diagram 17 (Issue D6)* covered the area between Flemington, Lidcombe and Olympic Park, which included Flemington Maintenance Centre.
publications detailed the limits of the possession and power outages, as well as alterations to train services. Upon receipt of these documents, the responsibility rested with the end user to carefully correlate the information to their area of responsibility. This was a challenge to the end users as it was not a normal configuration and many associated documents contained errors and required amendments within the week leading up to the start of work. These anomalies resulted in confusion over the limits of the possession and insufficient protection being placed to prevent unauthorised movements onto the Transfer Road.

**Handover procedures and documentation control within Strathfield Box**

2.33 An effective handover between area controllers at the Strathfield signalling complex relied on accurate communication of key information on the current state of operations and what was known and could be reasonably expected to occur in the short to medium term. There was no formal procedure. It relied heavily on the local knowledge and experience of the individuals. The information exchange between incoming and outgoing area controllers was brief, verbal and limited in detail. No specific reference was made to all the associated STNs and Tables Telegrams, particularly *Tables Telegram 194-14GM*, which included the timetable of S12A. In effect, this gave the incoming area controller an incomplete picture of the limits of the LPA around Flemington Maintenance Centre and safeworking documents relevant to the parameters of the possession and overhead wiring isolation.

2.34 An incoming area controller was not expected to undertake or receive a detailed review of all aspects of STNs. Sydney Trains’ expectation was that this process should have already been carried out initially by a ‘Tableman’ once STNs were received (at least seven days prior to the start), then again by the rostered area controllers (on the actual day of implementation). Evidence suggests that, on Wednesday 30 July 2014 (three days prior to the start of the possession), the *Tables Telegram 194-14GM* was emailed from the Train Planning Unit to a large number of recipients, including Strathfield signal box. However, there was no notation of its existence in
the TRB. This supported the incoming area controllers’ assertion that the document was not manually distributed to the Flemington panel for checking and notation by all area controllers.

2.35 The area controller stated that, when contacted by the shunter, he initially became concerned about the whereabouts of the document and the ramifications for him for any delays to the train. He searched the allocated folder and adjacent signalling panels for copies, but was unsuccessful. Eventually, he obtained the title of the document from the electronic timetable, and then accessed the Train Planning Unit intranet site, where he was able to download a copy. It was then that he returned to his panel and, conscious that the scheduled departure time had passed and anxious to expedite the departure, lifted the blocks on 644 points and set the departure route via the Transfer Road.

2.36 Consideration of the operational implications of STNs rested with the end user. This was made difficult by multiple STN drafts released for review and related STNs being issued in isolation without being cross-referenced. This was the case with a number of Configuration-related STNs and documents. Further, STNs contained no instructions as to where to direct any enquiries about perceived errors or anomalies. Draft copies distributed for review provided little more than advance notice of the content of the final document.

2.37 Significantly, there was no login/logout process for the panel signalling system or any of the systems and equipment on the panel. Additionally, there was no specified requirement to notify the train controller of a changeover of area controllers. Therefore, the train controller was not alerted to the change of area controllers. Consequently, the opportunity for train controllers to reinforce the possession and OHW isolation limits with incoming area controllers and PPOs was lost.

2.38 Sydney Trains confirmed that the Strathfield signalling complex had processes in place to receive and review STNs. However, no explanation was forthcoming as to why in this case neither incoming nor outgoing area
controllers detected any incomplete documentation until the departure of S12A.

2.39 The area controller’s shift started some four hours after the scheduled start of the possession. It would be reasonable for him to expect that all necessary documents would have been collated by the tableman, when documents were received and again by subsequent area controllers. Also, that blocking facilities would have been in place and implemented effectively by previous area controllers.

2.40 Notably, the non-receipt of *Tables Telegram 194-14GM* at the start of the possession was a local condition that had a significant influence on the area controller’s actions and decision making when setting the departure route for S12A.

2.41 In summary, procedures within the signal box to capture and distribute *Tables Telegram 194-14GM* were inadequate. No formal handover procedure existed to ensure accurate and complete information about possession limits and current activities was passed onto subsequent area controllers. The area controllers’ handovers were informal, key information was exchanged verbally, and there was no requirement to login/logout or advise a train controller of a staff changeover.

**Rosters and fatigue**

2.42 Factors that may have affected the performance of key personnel were considered. Fatigue is one area which is focussed on in investigations as it can have a range of influences on performance, such as: “… increased anxiety, decreased short term memory, slowed reaction time, decreased work efficiency, reduced motivational drive, decreased vigilance, increased variability in work performance, increased errors of omission …”.

2.43 The work rosters for the area controller, switching coordinator, crew of S12A, shunter and protection officer in charge of the work group were examined for the fortnight prior to the incident. In some cases, a software

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based fatigue management tool (FAID)\textsuperscript{28} was used by Sydney Trains to analyse the work rosters. During interviews, the key personnel were asked about their sleep and work patterns, general well-being, how they were feeling leading up to the incident and the length of time on task. From consideration of these factors, it was concluded that only the performance of the area controller was likely to have been impaired due to fatigue. An analysis of the roster indicated that, at various times in the past fortnight, the area controller was not provided with an adequate opportunity for sleep. In particular, the elevated fatigue risk tended to be affected by a combination of factors, the main two being:

- only two single rest days in the 14 day shift cycle
- only 8 hours break between the end of a late shift on Day 8 and the beginning of an early shift on Day 9.

2.44 While considered appropriate to use as one tool to help evaluate group rosters, bio-mathematical fatigue management tools have a number of documented limitations.\textsuperscript{29} In general, software based models do not have the capacity to predict fatigue or fatigue induced errors in all cases for all individuals and should only be considered within the context of a broader fatigue risk management system.

2.45 Sydney Trains Level 3 investigation report examined in detail the potential for the area controller to be affected by fatigue and utilised internal human factor expertise in developing a viewpoint. Significant factors which led the organisation to contend he may have been affected included the area controller’s recollection of events, the fact he acknowledged some of the safeworking documents available to him at the panel (and notated in the TRB) and his roster (elevated FAID score). Their report concluded: “The analysis does not definitively indicate that fatigue was a factor in this particular incident. However, changes made from the planned roster may have been made without sufficient consideration of fatigue risk or without

\textsuperscript{28} FAID (Fatigue Audit InterDyne) is a commercially available computer program that derives a fatigue score based on hours worked or rostered. The FAID results were included amongst the working rosters provided by Sydney Trains.

sufficient governance to ensure that operational rostering decisions remained risk-based. Looking at the worker’s extended roster, before and after the incident, there may be further evidence of rosters that are inconsistent with the rostering principles – suggesting that the issues raised above during the 14 day period are not a unique occurrence.”

2.46 Notably, there was strong evidence, including the elevated FAID score, that the roster worked by the area controller was not consistent with rostering principles in *Sydney Trains Procedure SMS 08-OP-3128*.

2.47 Although the Findings in the Level 3 investigation report indicated an elevated fatigue risk, this investigation found other factors which, in part, mitigated this risk. These factors included:

- The area controller was a seasoned shift worker, preferred the ‘day work’ shift, had an optimum sleep environment at home and had no interruptions to his normal sleep or day work readiness routine.

- The area controller held a reasonable assumption that the necessary documents and blocking facilities had been in place and effective for some length of time, prior to him commencing his shift.

- The area controller clearly recalled receipt of *STN 1130-2014*, but maintained he was not made aware of the existence of *Tables Telegram 194* or other associated documents. The TRB showing only one document notated (*STN 1130-2014*) supports his assertion.

2.48 In summary, there was insufficient evidence to determine conclusively if the area controller was significantly affected by fatigue at the time of the incident. However, there was strong evidence, including the elevated FAID score, that the roster worked by the area controller was not consistent with rostering principles in *Sydney Trains Procedure SMS 08-OP-3128*. The Sydney Trains Level 3 investigation report suggested this may not have been an isolated situation, at least amongst area controllers at Strathfield signal box. Sydney Trains recognised the potential for fatigue to affect safety. Thus, there is scope for Sydney Trains to review compliance with their rostering framework.
Difficulties in identifying the strap as a hazard (Driver’s perspective)

2.49 CCTV footage provided evidence that there were a number of factors combining to limit the visibility of the portable rail connection to the driver and other workers in the yard (who were not intimately familiar with overhead wiring infrastructure). It was particularly useful in showing the perspective of the driver who was likely to be in the best position to sight the portable rail connection in the path of the train (see Photograph 2). These factors included:

- Obvious difficulties in recognising a fouling object, like a strap, wire, or line amongst the complex array of overhead wiring lines and structures throughout the yard (see Photographs 2 and 3).
- There were no other visible cues near or on the strap (such as tags, flags, lights) to further highlight the position of the strap.
- The strap was not obviously foul of the train body, yet it was sufficiently foul of the leading pantograph\(^{30}\) to entangle it.
- The driver’s attention and vision were being directed towards points, signals (along the path) and the workgroup (with high visibility vests). All of these competed for the driver’s attention and were positioned at a much lower level than that of the OHW infrastructure.

\(^{30}\) This area of a pantograph is generally referred to as the ‘pallet’ and contains the metal/carbon contact strips which are in direct contact with the live overhead wiring ‘contact’ wire.
Photograph 2: View from forward facing CCTV camera on front of S12A

Photograph 3: Infrastructure at the entrance to Flemington Maintenance Centre
2.50 In the absence of additional visual cues, the position and visibility of the incorrectly placed portable rail connection was not obvious amongst the complex array of yard infrastructure to have been readily identifiable to non-electrical staff.

Remedial actions

2.51 On 8 August 2014, Sydney Trains published an internal ‘Information Bulletin’ titled ‘SHORT BRIEFING OHW Incident Flemington Car Sidings’ which was directed to ‘All Electrical Maintenance staff’. This bulletin provided some background, then reminded staff to:

- Read all the special instructions on an authority
- Ensure you have an operating diagram and a copy of the authority on site
- Ensure you have adequate documentation/maps to assist in ensuring you are at the right location/track
- Make sure you always test dead before rail connecting
- Familiarise yourself with an area you will be working in before the day
- Ensure OHW rail connections are installed clear of structure gauge
- Do not take short cuts when things are running late
- Plan your work in advance.

2.52 On 16 September 2014, Sydney Trains published ‘Possession Notice 8’ titled ‘Improving Possession Safety and performance’ which was directed to staff, external parties and contractors. This Notice:

- specifically referenced the Flemington incident
- had an aim of improving possession safety and performance
- provided details on the background to the incident and included scenarios that impacted on the safety of that weekend
- reinforced key possession stages, timings (deadlines) and future planning and consent arrangements.

2.53 Sydney Trains then engaged an independent investigator to undertake the investigation into the incident and publish the findings and recommended safety actions in a Level 3 Investigation Final Report. Sydney Trains then:
- conducted preliminary ‘verification of ownership’ consultation with internal stakeholders for all 19 recommended safety actions (two were subsequently rejected)
- incorporated the recommended safety actions into its St James Issue and Action Management System (SJAMS) application
- attached target dates to each of the recommended safety actions.

2.54 Sydney Trains advised the status of action in implementing the 17 accepted recommendations as at 18 September 2015 as:
- four finalised and closed
- four finalised and closed pending verification of action
- remaining nine on schedule for their respective targets dates with the last due to be closed 16 December 2016 at the latest.

2.55 OTSI considers that, if fully implemented, these recommendations will adequately address many of the issues that have been identified with their safety management system, possession planning, switching processes and documentation control.
PART 3 FINDINGS

Causation

3.1 Train S12A collided with a portable rail connection because the connection had been incorrectly located on the overhead wire some seven hours earlier by an electrical switching team.

Contributing factors

3.2 Routing of the train by the area controller was not compatible with the possession parameters within a modified possession configuration.

3.3 Many associated documents produced by separate internal entities contained errors and required amendments within the week leading up to the start of work. There was a widespread lack of visibility/awareness of the possession protection arrangements and understanding of the limits of the possession and overhead wire isolation at Flemington Maintenance Centre. This meant that the Transfer Road was not sufficiently protected (blocked) from unauthorised rail movements by the controlling signal box, or in the field.

3.4 Unique environmental and human circumstances combined resulting in the portable rail connection not being located according to procedural requirements. Procedural defences and controls for switching and isolating the power failed to detect:

- that the portable rail connection was not in the correct location
- that the power had not been isolated in accordance with the documented parameters.

Furthermore, these anomalies existed without alerts being generated to the switching personnel, other workers, or the EOC which was tasked with remotely monitoring the state of the power supply.

3.5 The incident occurred during a standard possession, modified at relatively short notice to accommodate passenger transport to Olympic Park. The possession was modified within a period of significant organisational
reform. Planning and implementation were further compromised due to a combination of the following:

- Concerns were documented about the intended possession strategy and switching, earthing and livening-up risks. However, those concerns appeared to be largely outweighed by the competing interest of providing train services to the event. The organisation did not have effective mechanisms in place such that those concerns could be escalated to senior management and, in some cases, the Executive Team.

- Several safety critical publications, including electrical documentation directly affecting the planning and implementation of the work contained conflicting and incorrect information, some even released outside of timeframes documented in Sydney Trains Safety Management System.

- These anomalies resulted in confusion over the limits of the possession and insufficient protection being in place to protect unauthorised movements onto the Transfer Road.

- Procedures within the signal box to capture and distribute *Tables Telegram 194-14GM* were inadequate. No formal handover procedure existed to ensure accurate and complete information about possession limits and current activities were passed onto subsequent area controllers. The area controllers’ handovers were informal, key information was exchanged verbally, and there was no requirement to login/logout or to advise a train controller of a staff changeover.

3.6 In the absence of additional visual cues, the position and visibility of the incorrectly placed portable rail connection was not obvious amongst the complex array of yard infrastructure.

**Other findings**

3.7 The area controller’s roster revealed rostering practices outside documented policies and principles that were the main contributor to an elevated fatigue level indication. Whilst this may indicate a systemic issue, the impact of fatigue was mitigated by the area controller’s own self-management of shiftwork and optimising his sleep environment.
3.8 As the chosen method in this case, Local Possession Authority was adequate for and compatible with the type of work to be performed.

3.9 Sydney Trains commissioned an independent investigation into this incident and are implementing 17 of its 19 recommendations.
PART 4 RECOMMENDATIONS

In accepting Sydney Trains stated intention to fully implement 17 recommendations from their Level 3 Investigation Final Report, OTSI makes the following additional recommendations to Sydney Trains in relation to matters identified in the course of this investigation:

4.1 Identify and remove barriers to timely and accurate reporting of safety critical information to senior management and, where appropriate, the Executive Team.

4.2 Revise the process related to modifications of possession configurations to ensure that sufficient lead times are available to deliver the required tasks safely and efficiently.

4.3 Implement a more robust handover process which can reinforce the possession and electrical isolation limits, as applicable, with area controllers.

4.4 Implement a more robust process in their SMS to guard against:
   • a portable rail connection not being properly located
   • power not being isolated in accordance with documented parameters.

[It is noted that Sydney Trains has undertaken to review the SMS document SMS-06-EN-0570 1500 Volt Operating Procedures, Section 8 Rail Connecting Equipment and the human factors around isolation processes.]

4.5 Improve the distribution process of safety critical documentation to and throughout Strathfield signal box.

[It is noted that Sydney Trains has undertaken to review the distribution process used for safety critical documentation at all signalling locations.]

4.6 Audit rostering practices of signallers/area controllers from a systemic point of view and implement action to address any non-compliance with documented rostering principles.
[It is noted that Sydney Trains has undertaken to conduct an audit of rostering practices and take action to address any identified non-compliance.]
PART 5 APPENDICES

Appendix 1: Authority for Removal of Supply from 1500 Volt Sections No: 629/14

Critical switching instructions incorrectly shown here on the Authority

Switching instructions this area of the Authority
Worksite protection incident, Flemington Maintenance Centre, 2 August 2014
## Appendix 2: Table of documents associated with the possession and OHW isolation

<table>
<thead>
<tr>
<th>Document</th>
<th>Final issue date</th>
<th>Days in advance of the work</th>
<th>Comments/description</th>
</tr>
</thead>
<tbody>
<tr>
<td>STN 1130–2014</td>
<td>21/07/2014</td>
<td>12</td>
<td>The ‘Proforma’ STN, which defined the parameters/limits of possession and OHW isolation. Possession of the Transfer Road was stated as being ‘clear of No. 644 catchpoints’ but it did not have the OHW isolated i.e. it was ‘live’ over the Transfer Road. The draft was finalised on 13 May 2014, but then subjected to major change because of the modification to the Configuration. An error was only detected after its final issue date. As a result, on 30/07/2014 this STN was subjected to further amendment by Tables Telegram 144-14V.</td>
</tr>
<tr>
<td>STN 1131–2014</td>
<td>18/07/2014</td>
<td>15</td>
<td>The ‘Works program’ STN, which showed the movements of work trains and track vehicles. Refers to a TOC Waiver 203–094 which was never issued.</td>
</tr>
<tr>
<td>STN 1132–2014</td>
<td>18/07/2014</td>
<td>15</td>
<td>The ‘Train working’ STN, which showed alterations to passenger services. On 28/07/2014 Tables Telegram 180-14GM withdrew this STN</td>
</tr>
<tr>
<td>STN 1133–2014</td>
<td>22/07/2014</td>
<td>11</td>
<td>The ‘Freight program’ STN (Config 3 Non Standard - alterations to freight services) which showed alterations to freight services.</td>
</tr>
<tr>
<td>STN 1523–2014</td>
<td>22/07/2014</td>
<td>11</td>
<td>The new ‘Train working’ STN which showed alterations to passenger services for the Super Rugby Final at ANZ Stadium. Tables Telegram 180-14GM activated this STN. However, this STN did not include the timetable for some services, including run S12A/X, so was subjected to further amendment after its final issue date by Tables Telegram 194-14GM which was issued on 30/07/2014.</td>
</tr>
<tr>
<td>Tables Telegram 194-14GM</td>
<td>30/07/2014</td>
<td>3</td>
<td>Amended STN 1523–2014 and included timetable arrangements for event trains, including run S12A, which was scheduled to depart Flemington Maintenance Centre at 1300. This was distributed via e-mail and Strathfield signal box was shown as ‘strathfieldshiftsupervisors’ in this distribution.</td>
</tr>
<tr>
<td>Table/Document</td>
<td>Date</td>
<td>Page</td>
<td>Description</td>
</tr>
<tr>
<td>----------------</td>
<td>------</td>
<td>------</td>
<td>-------------</td>
</tr>
<tr>
<td>Tables Telegram 144-14V</td>
<td>30/07/2014</td>
<td>3</td>
<td>Amended STN 1130–2014, specifically Power Outage No 4 – associated with the isolation within Flemington Maintenance Centre. Header of second page differs from front page. Refers to E17+098, but Authority 629/14 says E17+095.</td>
</tr>
<tr>
<td>TOC Waiver 203-094</td>
<td>Never issued</td>
<td>-</td>
<td>Referred to in STN 1131-2014, but never issued.</td>
</tr>
<tr>
<td>Authority No: 629/14</td>
<td>27/07/2014, but amendments come out of Tables Telegram 0144-14V on 30/07/2014</td>
<td>6</td>
<td>Special instructions and switching operations for removal of supply from 1500 volt sections (OHW isolation) for STN 1130-2014 Power Outage No 4. Issued (3 days out) within 7 days of start of possession. Refers to Config 03, rather than highlighting it was a modified Config. Had errors in Sections F1/1 &amp; F1/12. Had key info on a switching operation to maintain supply at HB15+830 contained within the Special Instructions. This was not carried out in field, so portable rail connection placed in wrong location and testing showed dead, so strap remained in position. Copy given to area controllers, but no direct mention of Transfer Road. NOTE: Sydney Trains were not able to provide a copy of the second page of this document as it had been mislaid.</td>
</tr>
<tr>
<td>Portable Rail Connection/Earthing Schedule SMS-06-FM-0600</td>
<td>30/07/2014</td>
<td>3</td>
<td>To be made available for all persons applying portable earths/rail connections and was directly associated with Authority 629/14. Contained incomplete entries under ‘Rail with Rail Connection applied’ against Location F14+976, which is within subsection FA/1 and in the vicinity of where the portable rail connection should have been located. Portable rail connection was actually connected within subsection FA/2 in the vicinity of location F14+971 (approx. 14.930km).</td>
</tr>
<tr>
<td>1500 volt sectioning diagram No 17, Issue D6</td>
<td>23/04/2014</td>
<td>101</td>
<td>Updated and issued independently of the possession planning and Configuration processes. Refers to No1 Departure Rd, which conflicts with the naming convention in other publications including NLA 116, Driver Route Knowledge Diagram (DRKD) Yards and Maintenance Centres Map 05 and the TOC Manual Track Diagrams Metropolitan Diagram G, which all refer to this as the Departure Rd.</td>
</tr>
</tbody>
</table>
Appendix 3: Sources and submissions

Sources of information
- Office of the National Rail Safety Regulator
- Sydney Trains
- Transport for NSW

Submissions
The Chief investigator forwarded a copy of the Draft Report to the Directly Involved Parties (DIPs) to provide them with the opportunity to contribute to the compilation of the Final Report by verifying the factual information, scrutinising the analysis, findings and recommendations, and to submit recommendations for amendments to the Draft Report that they believed would enhance the accuracy, logic, integrity and resilience of the Investigation Report. The following DIPs were invited to make submissions on the Draft Report:
- Office of the National Rail Safety Regulator
- Sydney Trains
- Sydney Trains Switching Coordinator
- Sydney Trains Area Controller
- Transport for NSW

Responses were received from the Office of the National Rail Safety Regulator, Sydney Trains, Sydney Trains Area Controller and Transport for NSW and were taken into consideration in finalising the Report.