RAIL SAFETY INVESTIGATION REPORT
NEAR STRIKE WITH SIGNAL MAINTENANCE STAFF
STRATHFIELD
1 APRIL 2010
THE OFFICE OF TRANSPORT SAFETY INVESTIGATIONS

The Office of Transport Safety Investigations (OTSI) is an independent NSW agency whose purpose is to improve transport safety through the investigation of accidents and incidents in the rail, bus and ferry industries. OTSI investigations are independent of regulatory, operator or other external entities.

Established on 1 January 2004 by the Transport Administration Act 1988, and confirmed by amending legislation as an independent statutory office on 1 July 2005, OTSI is responsible for determining the causes and contributing factors of accidents and to make recommendations for the implementation of remedial safety action to prevent recurrence. Importantly, however, OTSI does not confine itself to the consideration of just those matters that caused or contributed to a particular accident; it also seeks to identify any transport safety matters which, if left unaddressed, might contribute to other accidents.

OTSI's investigations are conducted under powers conferred by the Rail Safety Act 2008 and the Passenger Transport Act 1990. OTSI investigators normally seek to obtain information cooperatively when conducting an accident investigation. However, where it is necessary to do so, OTSI investigators may exercise statutory powers to interview persons, enter premises and examine and retain physical and documentary evidence.

It is not within OTSI’s jurisdiction, nor an object of its investigations, to apportion blame or determine liability. At all times, OTSI’s investigation reports strive to reflect a “Just Culture” approach to the investigative process by balancing the presentation of potentially judgemental material in a manner that properly explains what happened, and why, in a fair and unbiased manner.

Once OTSI has completed an investigation, its report is provided to the NSW Minister for Transport for tabling in Parliament. The Minister is required to table the report in both Houses of the NSW Parliament within seven days of receiving it. Following tabling, the report is published on OTSI’s website at www.otsi.nsw.gov.au.

OTSI cannot compel any party to implement its recommendations and its investigative responsibilities do not extend to overseeing the implementation of recommendations it makes in its investigation reports. However, OTSI takes a close interest in the extent to which its recommendations have been accepted and acted upon. In addition, a mechanism exists through which OTSI is provided with formal advice by the Independent Transport Safety Regulator (ITSR) in relation to the status of actions taken by those parties to whom its recommendations are directed.
# CONTENTS

| TABLE OF PHOTOS | ii |
| TABLE OF FIGURES | ii |
| ACRONYMS AND ABBREVIATIONS | iii |
| GLOSSARY OF TERMS | iv |
| EXECUTIVE SUMMARY | v |

## PART 1 CIRCUMSTANCES OF THE INCIDENT

1. Points Failure
2. Signal Maintenance Team
3. Establishing Protection for the Worksite
4. Work Underway
5. The Train
6. The Train Crew
7. Approaching Strathfield
8. Near Strike
9. The Driver’s Reaction
10. The Area Controller’s Response
11. The Maintenance Team’s Response
12. After the Incident
13. The Driver
14. The Maintenance Team
15. The Protection Officer and the Lookout
16. The Points

## PART 2 FACTORS CONTRIBUTING TO THE NEAR STRIKE

13. Anomalies in evidence
14. Initial response to the points failure
15. Worksite protection
16. The Lookout
17. Points maintenance
18. Fatigue
19. Competencies
20. Train Lights
21. Communication

## PART 3 RELATED ISSUES

29. Worksite Protection Project
30. Monitoring and auditing of worksites using NAR
31. Similarities with Singleton 2007

## PART 4 FINDINGS

37. Immediate cause
38. Causal factors
39. Contributory factors
40. Anticipation and Management of Risk
41. Incident Response

## PART 5 RECOMMENDATIONS

40. RailCorp
41. Independent Transport Safety Regulator

## PART 6 APPENDICES

42. Appendix 1 Worksie Protection Plan and Pre-work Briefing Forms
43. Appendix 2 Sources and Submissions
TABLE OF PHOTOS

Photograph 1: Looking from 538A points towards approaching trains 3
Photograph 2: Looking towards approaching trains in dark conditions 4
Photograph 3: K Set including front lighting configuration at the time of the incident 6
Photograph 4: Driver’s view of incident site in dark conditions 9
Photograph 5: Points assembly including spring assist 12
Photograph 6: Position of stanchions 12+140 and 12+182 from 538A points 14

TABLE OF FIGURES

Figure 1: Location of 538A points and route of N804 2
Figure 2: Network map indicating route of N804 and incident location. 7

Acknowledgements

Figures 1 and 2 and are reproduced with the permission of RailCorp.
### ACRONYMS AND ABBREVIATIONS

<table>
<thead>
<tr>
<th>Acronym</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ALARP</td>
<td>As Low As Reasonably Practical</td>
</tr>
<tr>
<td>ARTC</td>
<td>Australian Rail Track Corporation</td>
</tr>
<tr>
<td>ATWS</td>
<td>Automatic Train Warning System</td>
</tr>
<tr>
<td>BOM</td>
<td>Bureau of Meteorology</td>
</tr>
<tr>
<td>CAN</td>
<td>Condition Affecting the Network</td>
</tr>
<tr>
<td>CoC</td>
<td>Certificate of Competency</td>
</tr>
<tr>
<td>CSB</td>
<td>Controlled Signal Blocking</td>
</tr>
<tr>
<td>CSN</td>
<td>Corridor Safety Number</td>
</tr>
<tr>
<td>CSS</td>
<td>Corridor Safety System</td>
</tr>
<tr>
<td>DIP</td>
<td>Directly Involved Party</td>
</tr>
<tr>
<td>FAID</td>
<td>Fatigue Audit InterDyne</td>
</tr>
<tr>
<td>ITSR</td>
<td>Independent Transport Safety Regulator&lt;sup&gt;1&lt;/sup&gt;</td>
</tr>
<tr>
<td>ITSRR</td>
<td>Independent Transport Safety and Reliability Regulator</td>
</tr>
<tr>
<td>NAR</td>
<td>No Authority Required</td>
</tr>
<tr>
<td>NOS</td>
<td>Network Operations Superintendent</td>
</tr>
<tr>
<td>OTSI</td>
<td>Office of Transport Safety Investigations</td>
</tr>
<tr>
<td>PPE</td>
<td>Personal Protection Equipment</td>
</tr>
<tr>
<td>RISSB</td>
<td>Rail Industry Safety Standards Board</td>
</tr>
<tr>
<td>RMC</td>
<td>(RailCorp) Rail Management Centre</td>
</tr>
<tr>
<td>SMS</td>
<td>Safety Management System</td>
</tr>
<tr>
<td>SOI</td>
<td>Standard Operating Instruction</td>
</tr>
<tr>
<td>SCC</td>
<td>Strathfield Signalling Control Centre</td>
</tr>
<tr>
<td>SWI</td>
<td>Safeworking Instructions</td>
</tr>
<tr>
<td>SWMS</td>
<td>Safeworking Method Statements</td>
</tr>
</tbody>
</table>

<sup>1</sup> With effect 1 July 2010, the Independent Transport Safety and Reliability Regulator’s reliability responsibilities were transferred to Transport NSW resulting in ITSRR becoming the Independent Transport Safety Regulator (ITSR).
## GLOSSARY OF TERMS

<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Area Controller</td>
<td>A Qualified Worker who monitors and controls train movements from a Control Centre.</td>
</tr>
<tr>
<td>Blocking Facility</td>
<td>A facility or device used by a Qualified Worker to prevent either the unintended issue of a Proceed Authority, or the operation of points or signalling equipment.</td>
</tr>
<tr>
<td>Cess</td>
<td>The space between an outermost rail and the Rail Corridor boundary.</td>
</tr>
<tr>
<td>Controlled Signal</td>
<td>A signal that is, or may be, controlled or operated by a Signaller or a Qualified Worker.</td>
</tr>
<tr>
<td>Danger Zone</td>
<td>Everywhere within 3m horizontally from the nearest rail and any distance above or below this 3m, unless a safe place exists or has been created</td>
</tr>
<tr>
<td>Down and Up direction</td>
<td>Training travelling away from Sydney are referred to as Down trains. Movements in this direction are referred to as being in the Down direction. Training travelling towards Sydney are referred to as Up trains. Movements in this direction are referred to as being in the Up direction.</td>
</tr>
<tr>
<td>FAID (Fatigue Audit Interdyne)</td>
<td>A computerised model that calculates a fatigue score which is compared with the fatigue expected to be induced by working a particular pattern of work. The principal use of FAID is to better manage shiftwork, scheduling and fatigue risk.</td>
</tr>
<tr>
<td>Kilometrage</td>
<td>The distance by rail as measured from Central Station in Sydney.</td>
</tr>
<tr>
<td>Light Non-Powered Hand Tool</td>
<td>A tool that can be easily carried by one person and is not powered by compressed air, gas, electricity, hydraulics, explosive charges or an internal combustion engine.</td>
</tr>
<tr>
<td>Lookout</td>
<td>A Qualified Worker responsible for keeping watch for approaching rail traffic, and for warning other workers to stand clear of the line before the arrival of rail traffic.</td>
</tr>
<tr>
<td>Mimic Panel</td>
<td>An electronic panel simulating the geographical layout of the railway track which displays the status of points and signalling.</td>
</tr>
<tr>
<td>Network Control Officer</td>
<td>A Train Controller for an unattended location, a Signaller for an attended location, or a delegate carrying out some functions of a Train Controller or Signaller</td>
</tr>
<tr>
<td>Normal and Reverse Position</td>
<td>Terms used to describe the direction the points are set. In the normal position, train movements generally follow the main line. In the reverse position, train movements generally cross from the main line to another line.</td>
</tr>
<tr>
<td>Points</td>
<td>A crossing comprising of two matching half sets of points together with associated components. A set of points permits rail traffic to change from one track to another. Points are nominally referred to as left or right hand denoting the turnout direction as viewed from the toe end.</td>
</tr>
<tr>
<td>Protection Officer</td>
<td>The Qualified Worker responsible for the protection of a worksite.</td>
</tr>
<tr>
<td>Rail Corridor</td>
<td>From fence-line to fence-line, or if there are no fences, everywhere within 15m of the outermost rails.</td>
</tr>
<tr>
<td>Safe Place</td>
<td>A place where employees and equipment cannot be struck by rail traffic.</td>
</tr>
<tr>
<td>Train Controller</td>
<td>A Qualified Worker who authorises, and may issue, occupancies and Proceed Authorities, and who manages train paths to ensure safe and efficient transit of rail traffic in the RailCorp Network.</td>
</tr>
<tr>
<td>Turnout Speed Signs</td>
<td>Turnout speed signs have black text on a yellow background. The letter “X” before the numbers on a permanent speed sign shows the maximum speed for the turnout. If there is no speed sign at a turnout, rail traffic must not travel faster than 25km/h through the turnout. Drivers and track vehicle operators must maintain the correct speed until the last vehicle clears the turnout.</td>
</tr>
<tr>
<td>Visibility Lights</td>
<td>Lights of a train or track vehicle, other than headlights, marker lights, or number lights, provided for forward visibility.</td>
</tr>
<tr>
<td>Warning Light</td>
<td>An illuminated white or orange warning light provided at locations where workers on track have a restricted view of approaching rail traffic. If rail traffic approaches, the light goes out in time for workers to go to, or remain in, a safe place.</td>
</tr>
</tbody>
</table>
EXECUTIVE SUMMARY

Shortly after 5:00am on 1 April 2010, the Driver of N804 CityRail Gosford to Sydney Terminal interurban service reported to the Area Controller at Strathfield Signal Control Centre that his train had nearly struck four members of a signal maintenance team working at 538A points on approach to Platform 1 at Strathfield Station. The Team had been called by the Area Controller to attend 538A points which had failed.

The Team arrived at the site shortly after 4:50am where the Protection Officer determined they could inspect the points using Network Rule NWT 310 No Authority Required (NAR) as the method of worksite protection. Although NAR requires at least one member of the Team to maintain a lookout to warn of approaching rail traffic, no member of the Team was formally nominated as the lookout. The task was assumed by a member of the Team who became the least involved in the maintenance work at the points. NAR does not require any warning be given to train crews of the presence of rail safety workers on or near the track.

RailCorp Standard Operating Instructions require the Protection Officer to calculate the minimum sighting distances for approaching trains and track clearance times to ensure workers clear the track with a margin for safety. However, this was not done. Instead, the maintenance team relied on a warning light positioned 24m on the approach side of the points to provide warning of approaching trains. The warning light acts as a safety measure by extinguishing when an approaching train occupies the related track circuited area and is positioned to provide a minimum of 29 seconds from the time the light is extinguished until a train travelling at track speed reaches the points.

The maintenance worker who assumed the lookout role stated that he saw the warning light extinguish (when N804 reached the track circuited area) and warned the other team members that a train was approaching. However, instead of moving immediately to a safe place, another member of the maintenance team instructed the lookout to keep looking out for the approaching train while the Team continued to work on the points in the danger zone.
As N804 approached 538A points, the Driver saw the four workers standing in the middle of the track with their backs to the train. He immediately applied the emergency brake and sounded the horn. At this point, the train was within 50m of the points and had decelerated to 39km/h. In response to the horn blast, the workers moved very quickly in a disorganised fashion to clear off the track. Expecting it was likely the train would strike one or more of the workers, the Driver ducked underneath the dashboard and waited for the train to come to a stand, which it did at the points. Here, the Driver recognised the workers as signal maintenance crew and abused them for their actions. He then reported the incident to the Area Controller at Strathfield.

The near strike was the direct result of the signal maintenance team workers choosing to remain in the danger zone after the initial warning of the approaching train. Subsequently, none of them became alert to the presence of the train until its horn was sounded by the Driver.

The investigation highlighted the limitations of NAR as a method of worksite protection. It is the most expedient method to implement but provides the least protection as it depends solely on the diligence of the track work team members for its effectiveness. Consequently, the safety assessment supporting the decision to implement NAR must be just as rigorous as that supporting any other method, as must the accompanying Worksite Protection Plan and Pre-work Briefing. Notwithstanding an aid such as a warning light, NAR relies on a single defence provided by timely warning from a vigilant lookout and immediate reaction from the warned track workers to move to the designated safe place in accordance with the Worksite Protection Plan and Pre-work Briefing. In this case, safer options were readily available.

NAR has been scrutinised on several occasions, in a Worksite Protection Project completed by RailCorp in 2005 and by both OTSI and the Coroner in their investigations into fatal injuries to two track maintenance workers who were using NAR while repairing a set of points at Singleton in 2007. Responsiveness to the recommendations resulting from these investigations appears to have been inconsistent among operators, and not all recommendations have yet been implemented.
The primary recommendation from the investigation is that RailCorp develops and implements additional safety measures or defences in conjunction with NAR, or any derivative of it, to guard against an ineffective lookout. If that proves not to be achievable, it should be dispensed with as an approved worksite protection method. Other recommendations directed to RailCorp concern issues relating to:

- the warning of train crews of the presence of track workers on or about the track;
- the monitoring and auditing of worksites using NAR, and associated record keeping requirements;
- repair and maintenance of points;
- conspicuity of trains; and
- recertification of staff following their involvement in safety incidents.

Recommendations directed to the Independent Transport Safety Regulator are that it:

- Undertakes a targeted audit to ensure that RailCorp’s monitoring and auditing program for worksite protection methods is effective and complies with Section 12 (2) of the Rail Safety Act 2008; and
- Ensures amendments made to Network Rules and Procedures by infrastructure owners and operators conform to the requirements of Part 5 of the Rail Safety (General) Regulation 2008.

The full details of the Findings and Recommendations of this rail safety investigation are contained in Parts 4 and 5 respectively.
PART 1 CIRCUMSTANCES OF THE INCIDENT

Points Failure

1.1 At 4:38am, the Area Controller operating the Strathfield panel at the Strathfield Signalling Control Centre (SSCC) noticed 538A points had failed when he attempted to restore them to the normal position after the passage of suburban service 101A. The failure was indicated by an inability to lock the points in either the normal or reverse directions and a warning on his mimic panel that the points were still in transit.

1.2 The Area Controller then attempted to rectify the problem by operating (‘throwing’) the points a number of times after which he found that the points would lock in the normal position but not in reverse. Being unable to regain full control of the points, he called a standby signal maintenance team based at the SSCC to attend to the problem.

1.3 The 538A points are located at 12.117kms on the Up North Main Line (see Figure 1). These points are electro-pneumatically driven and, in the normal position, direct train movements from the Up North Main line into Platform 1 at Strathfield Station. In the reverse position, train movements are directed from the Up North Main line onto the Up Main line and into Platform 2.

Signal Maintenance Team

1.4 The signal maintenance team consisted of two signal electricians with 33 and 10 years experience respectively and two mechanical staff with 10 and 5 years experience respectively. The senior signal electrician of the Team was also designated as Signals Electrical Work Group Leader (Team Leader) and so was responsible for the supervision of the Team. Three team members were qualified Protection Officer Level 3 (PO3) and one was qualified as a Protection Officer Level 4 (PO4). As qualified Protection Officers, they were authorised to establish worksites and implement worksite protection arrangements in accordance with Network Rule NWT 310 No Authority.

2 Strathfield, a suburb located 12kms by rail West of the Sydney CBD, is a major rail junction for passenger train services to and from the Northern, Southern and Western regions of the city and State.
Required (NAR) and Network Rule NWT 308 Controlled Signal Blocking (CSB).

![Diagram](image.png)

**Figure 1: Location of 538A points and route of N804**

(Figure courtesy of RailCorp)

### Establishing Protection for the Worksite

1.5 The maintenance team arrived in the vicinity of 538A points shortly after 4:50am. The Team Leader, as Protection Officer for the Team, advised OTSI’s investigator that he planned the work in accordance with Network Rule NWT 300 Planning Work in the Rail Corridor before compiling the requisite Worksite Protection Plan and Pre-work Briefing forms.

1.6 The Protection Officer also believed that his safety assessment showed that the Team could access the danger zone using NAR on the basis that:

- there was a “safe place” immediately accessible in the Up side cess at the points;
- a lookout was available;
the Team would be using only light, non-powered hand tools; and
there was a warning light in place (see Photograph 1).

1.7 There were a number of obstructions to the sighting of trains approaching 538A points from the North (see Photograph 1). These included:

- curvature of the track;
- overhead wiring stanchions;
- cyclone fencing erected along the rail corridor boundary;
- vegetation growing over the boundary fencing; and
- a ballast dump positioned on the Up side of the rail corridor approximately 200m prior to the worksite.

Photograph 1: Looking from 538A points towards approaching trains

1.8 Because of the poor sighting conditions at the location, a warning light is positioned in the cess at 12.141kms, 24m prior to the points, installed in accordance with RailCorp’s Signal Design Principles ESG 100.20 Warning
1.9 The worksite is in an area not equipped with any form of trackside lighting. However, a nearby, pole mounted street light affords limited illumination of the area (see Photographs 1 and 2). The team members stated that the warning light, when lit, had provided additional illumination of 538A points.

Photograph 2: Looking towards approaching trains in dark conditions

1.10 The Protection Officer stated that all four team members entered the danger zone and commenced the inspection of the points after the Worksite Protection Plan and Pre-work Briefing forms had been signed (copies of which are attached at Appendix 1). Significantly, despite being part of the safety assessment, no warning methods were discussed, no minimum warning times were calculated\(^3\) and no lookout was designated.

\(^3\) Minimum warning time is determined by adding together "see time", "move time" and "safe time" which is set as 10 seconds.
Work Underway

1.11 At 4:56:19am, the Protection Officer telephoned the Area Controller regarding the problem with the points. The Protection Officer requested that the Area Controller operate the points a number of times in order to assist him diagnose the problem. As the points were being tested, the Area Controller advised the Protection Officer that a train was approaching the worksite “on the Down going North”. The Protection Officer acknowledged the advice but took no action as the worksite was not encroaching on the Down line.

1.12 The Team then identified a problem with the mechanical operation of the points. As rectification of the problem required mechanical staff to measure various clearances, the second signal electrician moved aside from the inspection and commenced to perform the role of lookout to allow both mechanical staff members to undertake the work. He noticed that the warning light was illuminated at the time he assumed the lookout role.

1.13 At 4:57:46am, the Area Controller advised the Protection Officer that he had “a train to get out of the way on the Up” (N804) and that it would be “coming in about two minutes”. The Protection Officer acknowledged, but did not repeat back, this advice. He was then put on hold by the Area Controller. When the conversation resumed eight seconds later, the Protection Officer entered into a discussion about the likely cause of the points failure. On finishing the call, the Area Controller directed the Protection Officer to ensure the points were left set in the normal position (i.e., towards Platform 1). He did not seek any assurance by way of an authority or certification that the points could then be safely trafficked.

The Train

1.14 Interurban passenger service N804, a two-car suburban Electric Multiple Unit “K” set (K4), departed Gosford at 3:45am and was scheduled to arrive at Strathfield at 5:02am then at Central at 5:16am. The service, which was carrying an estimated 30 to 50 passengers at the time, ran without incident on the journey towards Strathfield.
The train was running with the illumination of only two white marker lights on its front (see Photograph 3). Although available, a two x 250W globe headlight system was switched off in accordance with Network Rule NTR 406 Using train lights.

Photograph 3: K Set including front lighting configuration at the time of the incident

The Train Crew

The train crew consisted of a driver and a guard, both based out of the Gosford depot. Both had signed on for duty at the depot at 3:30am. The Driver had 19 years experience driving electric trains and the Guard had been employed as a guard for 40 years. Both crew members were within their respective medical and competency assessment periods and were familiar with, and qualified for, the routes on the Northern line.
Approaching Strathfield

1.17 Train movements in the Strathfield region are controlled under Network Rule NSY 500 *Rail Vehicle Detection System* with signalling and points operated from the SSCC. The posted track speed on the Up North Main line between Rhodes and North Strathfield is 115km/h before reducing to 80km/h then 60km/h on approach to 538A points (see Figure 2). A turnout speed of 25km/h is signposted for train movements traversing the points into Platform 1 at Strathfield.

![Network map indicating route of N804 and incident location](image)

**Figure 2: Network map indicating route of N804 and incident location**

(Figure courtesy of RailCorp)

1.18 Event logs for the signalling system indicated that the Area Controller commenced to clear the route for N804 at 4:57:19am during his conversation with the Protection Officer, with Signals ST160N, ST144N and ST138N
1.19 At 4:58:03am, N804 passed Signal ST160N, the third signal prior to 538A points and the worksite. Signal ST160N is positioned at 12.881kms, 764m on the approach side of 538A points. As the warning light is track circuit operated, it extinguished as N804 passed the signal. The lookout stated that he noticed the warning light had extinguished and warned the other team members of the approaching train. However, instead of immediately clearing the danger zone, the team members continued with their measurements and instructed him to warn of the approaching train when it came into view.

1.20 At 4:59:40am, N804 passed Signal ST144N, the second signal out from 538A points. Here, the Driver reduced the train speed in accordance with the restrictive signal indications being displayed by this signal and the next signal, Signal ST138N. He was also reducing train speed to traverse 538A points in accordance with the 25km/h turnout speed sign. Signal ST138N is positioned at 12.311kms, 194m prior to 538A points and indicates the route through the points. As Signal ST138N displayed a proceed indication, he then concentrated on looking through the curvature of the track and the trackside shrubbery for the indication in the following signal, ST126N, which was positioned past the points but just prior to the station platforms.

Near Strike

1.21 As the train approached 538A points, the Driver observed four people in the middle of the track wearing vests, all with their backs to the train. Photograph 4 provides an indication of the Driver’s view at that stage. He immediately released the deadman handle to apply emergency brakes then sounded a long (six second) blast of the train horn. In response to the horn blast, the four persons moved “very quickly…..they were running into each other in Keystone Cop fashion” off the track. At no stage did he receive an ‘all clear’ signal from the lookout in accordance with Network Procedure NPR 711 Lookouts.

---

4 As described by the Driver at interview.
1.22 The Driver, thinking that he was about to strike the persons on the track, ducked his head down under the dashboard and waited for the train to come to a stand. He estimated that N804 came to a stand approximately one metre past where the persons had been standing. Event recorder analysis of the incident by RailCorp established that N804 was travelling at 44km/h at the time the emergency brakes were applied and 39km/h when the horn was sounded two seconds later. In total, it took nine seconds and 72m for the train to stop after the emergency brakes were applied.

The Driver’s Reaction

1.23 When the train came to a stand, the Driver realised he had not hit anyone. At interview, he explained that, on observing that the persons were track workers, he opened the cab window and abused them for their actions. Shocked by the incident, he then became distressed and called the Guard to come forward before reporting the incident to the Area Controller. In reporting the incident to the Area Controller, he queried whether anyone knew the
workers were on the track stating that he had missed them by “about three foot”. Voice logs show that the Driver notified the Area Controller at 5:00:58am.

The Area Controller’s Response

1.24 When notified of the incident by the Driver, the Area Controller immediately called the Protection Officer to verify the occurrence. On receipt of confirmation of the incident, he reported it to the Train Controller at the Rail Management Centre (RMC) stating that the train had “missed the electricians by four foot”. Significantly, the Train Controller asked the Area Controller whether the Driver had been warned about workers being on the track. The Area Controller replied that no warning had been given to the Driver.

The Maintenance Team’s Response

1.25 All four members of the Team stated that they had moved immediately to a safe place when the lookout warned that the train had come into view. However, the Protection Officer, when telephoned by the Area Controller after the incident, acknowledged that an incident had occurred stating that “well it was pretty…well it was close but he didn’t hit us or anything”, “we f***ed up” and “we should have seen him coming”.

After the Incident

The Driver

1.26 After speaking to the Area Controller, the Driver regained his composure and moved the train into Platform 1. Here, he again lost his composure as he waited for the Guard to come forward. Once the Guard had joined him, the Driver departed for Central where he was subsequently interviewed by supervisory staff.

The Maintenance Team

1.27 After the incident had been reported to the Train Controller, the Protection Officer received a call from an officer from the Infrastructure Operating Centre within the RMC directing the Team to stop work immediately. They were then
directed to return to the SSCC and wait to be interviewed by the local Network Operations Superintendent (NOS).

The Protection Officer and the Lookout

1.28 After being interviewed and submitting to drug and alcohol tests, both the Protection Officer and the electrician who had acted as lookout, had their Safewarking Certificates of Competency (CoC) withdrawn by the NOS pending further investigation of the incident, as required by Section 7.3 of RailCorp’s *Network Rules and Network Procedures Certification Standard*.

1.29 Both the Protection Officer and the Lookout were reinstated to full safeworking duties on the afternoon of the incident after drug and alcohol test results were returned negative. This is contrary to the *Network Rules and Network Procedures Certification Standard* which requires the retention of the CoC card by the General Manager Training “*until the (RailCorp) investigation has been completed*”. RailCorp’s initial investigation was not completed until the following week. Additionally, neither undertook any competency assessments or document reviews, which are processes usually associated with any breach of the Network Rules and Procedures. The Team Manager later commented that the main reasons for the early return of the CoC were that there was a general shortage of signal maintenance staff together with a requirement to ensure that sufficient staff would be available for the increase of train services operating to the Easter Show which opened on the morning of the incident.

The Points

1.30 Another signal maintenance team from Strathfield was sent to inspect and repair 538A points. They found that the spring assist (see *Photograph 5*), a mechanism which aids in driving the switch blades fully into position, was binding. The points were then lubricated and their operation recertified at 7:28am. RailCorp attributed the binding to the loss of lubrication which had been washed away by heavy rain.
Photograph 5: Points assembly including spring assist
PART 2  FACTORS CONTRIBUTING TO THE NEAR STRIKE

Anomalies in evidence

2.1 During its internal investigation into the incident, RailCorp identified a number of apparent anomalies between the statements made by the signal maintenance team and the voice recordings associated with the incident. These anomalies related to where N804 came to a stand, the position of team members at the site and their actions in moving to a safe place.

2.2 Each member of the signal maintenance team contended that the train had pulled up at least 10m short of the points and so did not consider the incident to be a near strike. However, this contradicted the statements made by the Driver who reiterated from a previous RailCorp interview that:

- all four team members were in the middle of the track at the points with their backs to the train when he noticed them;
- the train was just over the points when it came to a stand; and
- the team members were standing directly below his cab window at the points when he leaned out and abused them.

2.3 The following serves to corroborate the Driver’s version of events:

- the recorded conversation between the Protection Officer and the Area Controller immediately after the incident in which the Protection Officer stated that “he pulled up at the points”;
- the recorded conversation between the Driver and the Area Controller immediately after the incident in which the Driver stated that he had “missed them by about three foot”; and
- the recorded conversation between the Driver and the Area Controller immediately after the incident in which the Driver asked the Area Controller if he knew about the maintenance team on the track.

The significance of the last point is in the ability of each maintenance team member to recall with fair precision the wording of that particular conversation as they believed that it had been directed towards them. However, the Driver
stated that this wording had only ever been used in his conversation with the Area Controller. It must be concluded then that this places the Team at, or in very close proximity to, the Driver’s cab window at the time the Driver was in radio contact with the Area Controller.

2.4 Event recorder analysis established that the Driver applied the emergency brakes 72m and nine seconds prior to the train coming to a stand. This placed the train in the vicinity of electrical stanchion 12+182 (see Photograph 6). As the Team only cleared the track after the Driver sounded the horn two seconds later, it placed the train then between electrical stanchions 12+182 and 12+140. It also placed the train within 50m of the Team before they commenced clearing the danger zone.

2.5 Further, in their statements to RailCorp investigators, each team member recalled that they had heard “the air go” on the train as it approached them. This was in reference to the release of the deadman handle by the Driver which vented the system from under the corner of the Driver’s cab to apply the emergency brakes. Yet, the only time this would have been audible to the
Team was in the two seconds between the time the Driver released the deadman handle and his (six second) sounding of the horn when they were still in the danger zone. This serves to confirm how close the maintenance team members were to being struck.

2.6 Regardless of the precise point at which the train came to a stand, there is clear evidence that:

- the Team had remained engaged in “at risk behaviour” within the danger zone after the warning light extinguished despite having a minimum of 29 seconds warning to clear the track;
- the Team did not clear the danger zone before the mandatory 10 seconds “safe time” as required when using NAR;
- contrary to Network Rule NTW 310 and Network Procedure NPR 711, the lookout did not maintain a proper vigil for approaching trains after the warning light had extinguished; and
- contrary to Network Procedure NPR 711, the lookout did not provide an ‘all clear’ hand signal to the train before or after the incident.

**Initial response to the points failure**

2.7 As the Area Controller was unable to gain full control of the points, he called for maintenance support, advised the Train Controller of the failure, and left the points as they were. Though he had no knowledge as to the cause of the problem or whether any unsafe conditions existed, he did not apply blocking facilities to the points or signal controls as required by Network Procedure NPR 740 *Responding to faulty points* in circumstances where “points do not respond correctly to signal box control”.

2.8 When the Team arrived on site, the Area Controller operated the points a number of times at the direction of the Protection Officer. It should be noted that, during this process, all controlled signals approaching the points were held at stop by virtue of the interlocking system between the points and the signals. As such, the worksite was protected by a pseudo form of Controlled Signal Blocking (CSB) although no blocking facilities had been formally applied. However, despite still not knowing the cause of the failure, the Area
Controller set the route for N804 on the basis that the points were indicated as
locked and signals could be cleared. He did not seek or receive any
assurances that the points were safe for the passage of the train when
advising the Team of its approach.

2.9 Conditions that potentially can or do affect the safety of operations in the
network must be reported in accordance with Network Rule NGE 206
Reporting and responding to a Condition Affecting the Network (CAN).
Maintenance staff undertaking any work on or around the track must be
considered to pose a potential hazard to rail traffic and vice versa.
Additionally, in the case in question, the Area Controller did not know the
reason for the points failure or the possible existence of any related safety
issues. On these grounds, a risk assessment could justify the initiation of
CAN procedures, in which case:

- the Driver would have been notified of the situation;
- the train would have been restrained in approaching the worksite; and
- recertification of the points would have been required before traffic on the
  line resumed.

In this regard, it is considered significant that, when notified of the near strike
by the Area Controller, the Train Controller at the RMC queried whether the
Driver of N804 had been warned about the Team being on the track.

2.10 It is pertinent to note here that RailCorp and OTSI have different perspectives
of the efficacy of sharing operational information when work is being
undertaken under NAR arrangements. RailCorp holds the view that advising
work crews of anticipated rail traffic and train drivers of worksites in the
danger zone would most likely increase risk rather than reduce it. They
contend that an inappropriate, subtle shift of responsibility from work crews to
train drivers would then occur over time. The underlying philosophy is that
those who create the risk must manage it and, when NAR is implemented in
accordance with prevailing rules and procedures, the risk is known and is
adequately managed. RailCorp also highlights the increased burden on area
controllers in maintaining the information up to date for all parties, potentially
in relation to a number of concurrent work on track activities.
Worksite protection

2.11 The signals maintenance team asserted they were working on track using NAR, one of five methods of worksite protection that has been used in NSW since 2002 for work on or about the track. While each method provides differing levels of worksite protection, work on track must be carefully planned and assessed for safety in accordance with Network Rule NWT 300 Planning Work in the Rail Corridor prior to the implementation of any method. NWT 300 requires that all worksites have a Protection Officer who must:

- “make a safety assessment;
- make sure the work is done safely; and
- keep records about the protection arrangements.”

2.12 Protection arrangements are recorded on a Worksite Protection Plan form (SMS-06-FM-0774) and a Pre-work Briefing form (SMS-06-FM-0163). These forms are defined as train safety records in accordance with Section 75 of the Rail Safety Act 2008 and are required to be kept for a period of 90 days.

2.13 NAR provides the lowest level of worksite protection. As its use does not require any authorisation from Train Control to implement, it is also the most expedient and least onerous method to implement, and has the least impact on train running. However, it does not provide similar levels of separation of trains and workers as provided by other methods of worksite protection and so comes with a greater risk to workers of being struck by rail traffic. Yet, it has only one safety measure to control this risk, the lookout. The effectiveness of the lookout as a safety measure is entirely dependent on the vigilance and diligence of those tasked with the role. There are no other safety measures that protect against the failure of the lookout. Given NAR does provide the lowest level of protection, it could be expected that its planning and execution would attract active and continuous scrutiny by supervisory and management staff.

2.14 In 2008, because of an increasing number of incidents involving NAR\(^5\), RailCorp introduced Standard Operating Instruction (SOI) SMS-OI-01289

---

\(^5\) RailCorp information indicated that it had investigated 173 worksite protection incidents between 2004 and 2008. Of the 173 incidents, it found that 85 incidents (approx. 50%) related to near misses when using NAR although this was disputed by the track workers involved in half the cases.
**Minimum Warning Time when using No Authority Required** which requires workers using NAR to have at least 10 seconds in a “safe place” before rail traffic enters their work location. Under this SOI, the Protection Officer is also required to determine sighting distances, track speeds and minimum warning times when conducting the safety assessment for the Worksite Protection Plan. Though worthy procedural enhancements, these measures do not change the fact that NAR is reliant on the vigilance of the lookout.

2.15 In this case, each team member was adamant that the worksite had been planned and that a safety assessment had been conducted at the location before they had signed the Worksite Protection Plan and Pre-work Briefing forms and gone on track. However, an examination of the Worksite Protection Plan and Pre-work Briefing forms revealed a number of irregularities:

- the start and briefing times recorded on both forms are post-incident which conflicts with the assertion by all team members that the briefing was conducted prior to proceeding on track;
- the safety assessment only identifies the routine hazards of “trains”, “feet and hands around points” and “needles” for which only minimal controls are proposed;
- no minimum warning time or related calculations are documented; and
- the diagram of the worksite protection arrangements labels the points as 638A and does not show the crossover, direction of approaching trains, signals, stanchions, kilometrage markers or any safe places.

2.16 Though the team members acknowledged all items listed on the Pre-work Briefing form, a number of the items were not applicable, not required, not identified or not available. These included:

- being informed of the requirements of the electrical permit (no permit was required for the job);

---

6 Instead of calculating the minimum warning time, the team relied only on its knowledge of the 29 seconds warning given by the warning light, but this is not shown on the form. In this case the 29 seconds would count as the “see time”. Further, no team member was sure of the track speed at the location; each stating they thought it was 30 or 40km/h.
• being briefed on the Safeworking Method Statements/Safeworking Instructions (SWMS/SWIs) for the job (no references to these were recorded on the Worksite Protection Plan form);

• being instructed in the controls recorded on the Pre-work Briefing form and SWMS/SWIs (see before);

• being made aware of hazardous materials/substances on site (there were none at the site or planned to be used);

• being briefed on the site specific safety management plan (no site specific safety plan was available for the job); and

• being briefed on the hazards of adjoining worksites (no adjoining worksites).

2.17 Despite the Team’s confidence in their familiarity with the general area around Strathfield, it was still necessary to conduct a full safety assessment in accordance with Network Rule NWT 300. This should have taken the following additional points into account:

• the risks specific to the location, e.g., obstructions to sighting, track curvature and vegetation (the reason for the emplacement of the warning light);

• the train running information and location for any approaching rail traffic;

• whether a higher form of worksite protection could be implemented;

• whether trains could be diverted around the worksite;

• noise from trains on adjacent lines or other sources, e.g., road traffic;

• the nomination of a lookout;

• the detailed positioning of the lookout; and

• the need for a torch with which to signal approaching trains.

A risk assessment could also have considered:

• the likely duration of the work in the danger zone;

• fatigue levels;
• lighting conditions at the site; and
• the limited conspicuity of approaching trains which were operating in accordance with Network Rule 406.

2.18 A thorough consideration of these specifics during the safety assessment should have led to the identification of one or more of the following options:
• protect the worksite using a higher, and therefore safer, form of protection such as CSB, although more complex and time consuming for both the Protection Officer and Area Controller to implement; or
• divert trains around the failed points using the Up Northern suburban line; or
• wait until the approaching train had passed after which there were no further trains due for at least 15 minutes.

2.19 Ultimately, the safety assessment could not have been conducted thoroughly as there was only approximately 15 minutes between the Team being advised of the points failure and being on track. In this time the Team had to gather tools, depart the depot, travel 1.3km to the site and open the boundary gate before conducting the on-site safety assessment, developing the work plan, compiling the briefing documentation, conducting and signing off on the briefing and retrieving the tools from their vehicle. Given the team members’ familiarity with the general area, complacency could have influenced the decision to use NAR and curtail the safety assessment. There was also an incentive to complete the task expeditiously as the shift was due to end at 6:00am.7

The Lookout

2.20 The roles and responsibilities of a lookout are detailed in Network Rule NWT 310 and Network Procedure NPR 711. The following extracts are relevant:

“Lookouts must:
• keep watch for rail traffic approaching the worksite from any direction, and

---

7 The team was working 12hr shifts and had signed on duty at 6.00pm the evening before.
• warn workers immediately if rail traffic approaches the worksite." (NWT 310)

"Lookouts give warning about rail traffic movements to workers in the Danger Zone.

WARNING: Lookouts do no work other than give warning about the approach of rail traffic.

... Only if workers are in safe places, face the approaching train or track vehicle and hand signal ALL CLEAR to the Driver or track vehicle operator." (NPR 711)

2.21 When interviewed, the team members stated that, after the warning light had extinguished, they had remained in the danger zone but instructed the Lookout to warn them when he could see the approaching train. They also stated that they had moved to a safe place with sufficient time when alerted by the Lookout. However, these statements are at variance with the following comments made by the Protection Officer during conversations recorded immediately after the incident:

• with the Area Controller at 5:01:29am, when he stated that “we should have seen him (the train) coming”; and

• with the Infrastructure Operating Centre officer at 5:05:10am, when he stated “how nobody didn’t notice it (the warning light) was off, I’m f***ed if I know.”

2.22 At a subsequent interview with OTSI investigators, each team member confirmed they had remained in the danger zone after the lookout light extinguished, thereby defeating the purpose of having the warning light. The Lookout also remained adamant that he had then continued to maintain a vigil for the approaching train and had alerted the other team members in a timely manner when it came into view. However, he could not explain why the Team had only cleared the track when they were alerted to its presence by the sounding of the horn. Similarly, he could not explain why he did not give an ‘all clear’ hand signal to the train Driver after the Team cleared the track despite the requirement to do so by Network Procedure NPR 711. He subsequently advised that he was not in possession of a torch at the time to give this signal to a driver.
Points maintenance

2.23 Post-incident inspection by RailCorp indicated that the failure of 538A points was the result of a lack of lubrication which had been “washed from the chairs during recent heavy rains”. Based on Bureau of Meteorology (BOM) records for Sydney Olympic Park, the last rain event which could have washed the lubrication from the points occurred on 6 March 2010 when 18.6mm fell.

2.24 Maintenance records for 538A points indicated the following:

- the entire assembly had been renewed and commissioned on 24 May 2009;
- two types of routine maintenance inspections are carried out on the points with an SS-01 type inspection conducted on a 30 day cycle and an SS-02 type inspection conducted on a 90 day cycle;
- the new points had failed on a number of occasions with eight separate entries in the records relating to out of course repairs; four of which were attributed to malfunction of the spring assist;
- a similar failure occurred on 10 February 2010 after a seven day period of heavy rain ending 8 February 2010; and
- the last routine maintenance inspection (SS-02) was performed on the points on 20 March 2010 where, by virtue of the schedule, the points should have been lubricated and their operation tested.

2.25 Given the points failures of 1 April 2010 and 10 February 2010 were attributed to lubrication “wash away” midway through the maintenance cycle, it would indicate one or more of the following deficiencies:

- sufficient lubrication had not been applied;
- the type of lubrication was not in accordance with specifications, not fit for the intended purpose or not fit for the operating environment;
- the lubrication period was insufficient and not based on the principles associated with reliability-centred maintenance; or

---

8 The nearest BOM weather observation point to Strathfield.
• there were design and operational issues within the points assembly.

Despite lubrication failures being a common occurrence after bouts of heavy rain, there are no maintenance processes to cover such contingencies.

2.26 Four failures being attributed to malfunction of the spring assist would indicate:

• the spring assist had not been installed correctly; or
• the adjustment of the spring assist was not being done to manufacturer’s specifications; or
• there were problems with the stability of the track and its foundation; or
• there were design issues within the points.

RailCorp has since advised that they have installed rollers under the switch blades and upgraded the lubrication type to reduce the potential for binding in the blade movement and to improve reliability of the operation of the points.

Fatigue

2.27 RailCorp uses the Fatigue Audit InterDyne (FAID) software as a component of its fatigue monitoring program. FAID can be used in a fatigue management system to assist in identifying the propensity for fatigue to become a factor in human work performance and so inform risk management processes. Recent research has identified the fatigue threshold for FAID as represented by a score of approximately 60.9 Scores between 70 and 80 indicate the potential for extreme fatigue and above 80 the potential for severe fatigue.

2.28 Each member of the signal maintenance team worked an identical roster consisting of seven shifts each fortnight on a rotating cycle of 12 hour day and night shifts. Included in the roster was a scheduled eight hours overtime each fortnight and a calculation of the FAID score for each shift.

2.29 On the morning of the incident, the FAID score on the rosters showed a score of 91 for each team member. The rosters also showed the FAID scores for the team members had reached 107 on two occasions between 7 March

---

2010 and 3 April 2010. Despite these scores indicating the potential for severe levels of fatigue, no other indicators of fatigue were identified among the team members. Recorded conversations showed that the Protection Officer was alert and responsive during his conversations with the Area Controller prior to the incident. The Team was also operating in an environment where conditions would not have impaired alertness significantly.

2.30 However, the Team Manager was concerned with the level of the scores on the morning of the incident and requested RailCorp investigators delay the post-incident interviews with the Protection Officer and the Lookout until a later date. His concerns were that any delay in signing the team members off duty would increase their FAID scores further and so risk their availability to respond to problems affecting additional special event (Easter Show) services which had commenced that morning. His request was not granted and both the Protection Officer and the Lookout were not signed off duty until approximately 8:00am which was two hours after their normal finish time. However, the late sign off time did not appear on their timesheets and the additional time was not factored into the last FAID score on the roster.

2.31 On the morning of the incident, the Driver was working his eighth consecutive early morning shift and his roster indicated he had worked a total of 12 shifts during the previous fortnight. His FAID score was 102 but, although this placed him in the severe risk category, no train management issues were identified with the operation of N804 during the journey from Gosford. When he came upon the workers on the track, he reacted in an alert and responsive manner.

2.32 The Area Controller had worked eight mixed shifts in the fortnight prior to the incident and his FAID score reached a maximum of 89 on the day. Again, he appeared alert and responsive during the recorded conversations with the Protection Officer prior to the incident.

2.33 Though the FAID scores indicated very high potential for fatigue to affect the performance of all of the key parties, there was no additional evidence to indicate this was the case. It was therefore concluded that fatigue was unlikely to have been a causal or contributing factor.
Competencies

2.34 A review of the competencies for the Driver, Area Controller and maintenance team members indicated that all were within their respective medical and competency assessment periods and had not undergone any disciplinary procedures within the previous five years.

Train Lights

2.35 The incident occurred at a location and time when train conspicuity was limited. The curvature of the track and trackside obstructions reduced the conspicuity of trains approaching the Team. The prevailing limited light conditions also reduced the visibility of obstructions or hazards to train drivers.

2.36 After entering the Sydney metropolitan area, the Driver extinguished his headlights in accordance with Network Rule NTR 406. This requirement seeks to prevent dazzling of crews of oncoming trains, station staff or personnel working in shunting yards. N804 was then operated with only two (60W) white marker lights illuminated at the front of the train and a light over the front coupling as confirmed from CCTV footage of the train entering Strathfield Station.

2.37 The Protection Officer indicated that he had not considered the limited conspicuity of approaching trains in dark conditions as part of the safety assessment. Further, the Lookout could not describe what lights were illuminated on the front of the train when N804 approached the worksite.

2.38 Luminosity standards for marker lights, headlights and visibility lights on passenger trains operating in Australia are specified in the Rail Industry Safety Standards Board (RISSB) Standard “AS 7531.3: Railway Rolling Stock Lighting and Rolling Stock Visibility, Part 3, Passenger, Dec 2007. While not stipulating the position of marker lights on the car front or rear, the standard requires that headlights on passenger trains be positioned at least 2.4m above the rail. It also stipulates that marker and tail lights shall have a

---

10 The Sydney metropolitan area is defined in NTR 406 as the area, including intermediate branch lines, bounded by Helensburgh, Macarthur, Emu Plains and Cowan.
luminous intensity of at least 0.75 candelas. By comparison, headlights have a peak intensity of 200,000 candelas and a focal range of 240m.

2.39 The marker light and headlight configuration on the “K” sets comply with the standard even though the sets were built in the early 1980’s before the introduction of the Standard.

2.40 Although “K” sets are generally confined to operating within the Sydney metropolitan area, four, including N804, operate on Northern interurban routes where the use of headlights and other forms of visibility lighting are permitted beyond the Sydney metropolitan area. These sets are not fitted with any additional form of visibility lighting (i.e., visibility (ditch) lights, destination board illumination or reflectors) to improve track visibility for drivers or conspicuity during dark or low light conditions. In contrast, other similar aged passenger rolling stock operating on the same routes have this additional lighting. Network Rule NTR 406 provides no instructions or procedures for the use of visibility (ditch) lights.

2.41 During a 2007 investigation into a fatal accident in which a signal maintenance team was struck on the track at Singleton, OTSI found that a lack of train conspicuity was a contributing factor. Although the marker and visibility lights were operating on the train that struck the track workers, its headlights had been extinguished as it passed another train and then approached a shunting yard and station in accordance with ANTR 406, the Australian Rail Track Corporation’s version of NTR 406. OTSI recommended that, to improve train conspicuity, both ARTC and RailCorp amend their rules and permit the use of dimmed headlights when passing trains or approaching nominated locations. However, in its submission to the Coroner’s Inquest, RailCorp contended that the recommendation could not be substantiated because “no formal study of the blinding effect of lights – even when dimmed” had been conducted and that the headlights had been extinguished for safety reasons. This position is inconsistent with RailCorp’s published Safety Policy which seeks a culture characterised by “A willingness and competency to draw constructive conclusions from safety accidents and incidents, and

Although RailCorp has since indicated it has commenced workshopping on the issue, the fact is, over three years have passed since the Singleton accident and no changes have been made to Network Rule NTR 406. Trains are still operating without improvement to lighting function or procedures, particularly on routes outside the bounded area. As such, the conspicuity of approaching trains continues to have the potential to compromise the safety of track workers in the danger zone in low visibility operating conditions.

Communication

2.42 Although NAR working at the time did not require communication about the protection arrangements, the mobile phone exchanges between the Area Controller and the Protection Officer concerned not only the operation of the points but also train running information. Because train running information was transmitted in the communications, compliance with the requirements of Network Rule NGE 204 Network Communication immediately became a procedural necessity.

2.43 Network Rule NGE 204 Network Communication prescribes the rules for spoken communication in the RailCorp network. In particular, it is mandatory that the receiver of a message in relation to specified subjects, such as “a work on track method” and “train running information”, repeat the message back to the sender. In the mobile phone communications recorded in the SSCC between the Area Controller and Protection Officer, no repeat back of safety critical information on train running information was offered or requested.

2.44 NGE 204 also contains the “WARNING” that:

“Qualified Workers must not assume that a receiver has understood a message before the receiver confirms that the message has been understood.”

Despite receiving a partial acknowledgement of his advice that a train was approaching on the Up, the Area Controller did not confirm with the Protection Officer that this advice had been fully comprehended. Instead, after the acknowledgement, there was an eight second break while the Area Controller
commenced setting the route for N804 before a conversation about the cause of the points failure resumed.

2.45 RailCorp’s Network Procedure NPR 721 *Spoken and Written Communication* prescribes a range of standard terms and protocols to be used in operational communications. The communications between the Area Controller and Protection Officer were conversational and informal, lacking the rigour required by NPR 721.
PART 3 RELATED ISSUES

Worksite Protection Project

3.1 In May 2005 RailCorp Infrastructure Group delivered its final report on a comprehensive project undertaken “to research, develop and implement an improved system of worksite protection that would reduce the risk of injury to track workers”. However, implementation of the 37 principal recommendations made in the report, a number of which are relevant to NAR, appears to be progressing slowly. Three controls to risks associated with NAR were recommended:

- in the short term (within six months), signallers to warn drivers of NAR worksites - not yet implemented;
- also in the short term, introduce mandatory minimum sighting distances - implemented in 2008 vide SOI SMS-OI-01289; and
- in the medium (six months to two years) and long term (two to five years), introduce an automatic train warning system (ATWS) – currently under trial.

The Report describes NAR as offering “the lowest level of protection to workgroups on track” and indicates it will only be retained in the short term.

3.2 A recommendation of particular relevance to this investigation is concerned with ensuring Protection Officers “conduct a proper risk assessment and implement effective protection in accordance with Network Rules and Procedures”. It is envisaged that “having risk assessments and work plans reviewed by competent persons and random auditing of the quality and content of risk assessments” would play an important role in achieving the desired outcome. However, the same needs are echoed in a recommendation made in RailCorp’s draft investigation report into the Strathfield incident which required the General Manager, Infrastructure Maintenance, to:

“consider conducting audits/compliance checks of worksite protection arrangements of standby signalling maintenance teams to determine if the arrangements are adequate and comply with RailCorp’s Network..."
From this, it may be concluded that the safety assessments and worksite protection plans compiled by Protection Officers were not being monitored or reviewed.

3.3 A set of Guiding Principles was also developed during the Project as a reference when developing or reviewing policies and procedures. Two of these Principles are of note:

- “Isolation” – “wherever possible, track workers should be isolated from trains …”; and
- “Level of Protection” – “the highest possible level of protection should be used when undertaking work on track …”.

There is also a Principle, “Self-management of protection”, which places on-site responsibilities squarely on the shoulders of track workers who “should have control over their own protection, rather than rely on third parties … to provide, maintain and remove protection”.

Yet, in this instance, the Team did not isolate itself from trains; nor did they use the highest possible level of protection.

**Monitoring and auditing of worksites using NAR**

3.4 In accordance with Section 12 of the *Rail Safety Act 2008*, a rail transport operator is required to have a Safety Management System (SMS) that must, amongst other things:

“specify the controls (including audits, expertise, resources and staff) that are to be used by the rail transport operator to manage risks to safety and to monitor safety in relation to those railway operations”;

and

"include procedures for monitoring, reviewing and revising the adequacy of those controls".

3.5 To comply with the Act and its SMS, RailCorp indicated that it monitors and audits worksite protection methods, including NAR, through inspection of worksites by managers during routine maintenance or at out of course repairs and by the random sampling of Worksite Protection Plans. Monitoring may
also be conducted as part of any inspection made by a NOS in relation to incident investigations or concerns raised by train crews or operations staff during SMS audits by corporate audit teams; or by ITSR officers during any compliance inspections or audits.

3.6 Ten ITSR compliance inspection reports on RailCorp NAR worksites, one in 2007, one in 2009 and eight in the first half of 2010, identified:

- one instance where the lookout had not been maintaining a proper vigil while on track;
- seven instances where deficiencies within the Worksite Protection Plan and the Pre-work Briefing documentation were apparent;
- one instance where employees were not wearing high visibility vests while in the corridor; and
- six instances involving issues with employee certificates of competency.

3.7 The signal maintenance team was one of four based at Strathfield under the control of a Team Manager. When interviewed, the Team Manager could not give an estimate of the number of times NAR is used on a daily basis despite it being the predominant method of worksite protection used by his teams. He indicated that any estimate of its use would be misleading as the teams often compiled a single Worksite Protection Plan for multiple or moving worksites. In relation to monitoring and auditing, the Team Manager responded that he:

- only reviewed a team’s Worksite Protection Plan and Pre-work Briefing when he visited a worksite or after he was notified of an incident;
- did not record the details of any visits to the worksites as part of any monitoring process;
- was unaware of any previous corporate audits or schedules for them;
- had not identified any deficiencies in the safety assessments conducted by the Protection Officers when reviewed; and
- could not recall providing information for or investigating any incidents involving the inappropriate use of NAR by any of his teams.
3.8 OTSI sought to examine the Worksite Protection Plan and Pre-work Briefing forms compiled by the Team during the previous six months as well as records for recent monitoring or audits that had been conducted on the use of NAR by the teams at Strathfield. In response, RailCorp advised that no information or reports could be located or provided. Given the importance of such train safety records, RailCorp’s inability to produce them needs to be rectified expeditiously.

3.9 The Independent Transport Safety and Reliability Regulator (ITSRR) issued RailCorp with an Improvement Notice in relation to an incident involving the use of NAR at Flemington on 15 June 2009. This Notice required RailCorp to provide information of the methods it employed when conducting audits or inspections of worksites using NAR. However, the Notice was subsequently withdrawn by ITSRR on 25 November 2009 due to a technicality within the wording of the Notice. A new Notice was not issued as RailCorp advised ITSRR that it was conducting random sampling of worksite protection plans and observations of NAR implementation at worksites.

**Similarities with Singleton 2007**

3.10 OTSI and the NSW Coroner conducted separate investigations into fatal injuries to two track maintenance workers who were using NAR while repairing a set of points at Singleton in 2007. This accident resulted in the prosecution of ARTC by ITSRR for breaches of the *Rail Safety Act 2002*.

3.11 There are striking similarities between the circumstances surrounding the Singleton accident and the Strathfield incident. These include non-compliance with various Network Rules and Procedures, similar worksite conditions, inadequate worksite planning, ineffective performance of the lookout role and reduced train conspicuity.

3.12 The Singleton investigations directed a number of recommendations to both ARTC and RailCorp in regard to the use of NAR, train lighting and improved worker visibility on track. In response to these recommendations, ARTC issued Safe Notice 2008 Number: 2-860 *Supporting Protocol for No Authority Required (NAR)* which prescribed the following controls when using ARTC Network Rule ANWT 310 *No Authority Required*: 
• “Access to the Danger Zone under the No Authority Required Rule must only be conducted in DAYLIGHT HOURS.
• The use of No Authority Required is only applicable for appropriate activities within the Danger Zone, as described in ANWT 310. Only light non-powered tools may be used for work using the NAR method.
• The Network Control Officer must be advised of all activities within the rail corridor, but activities conducted outside of the Danger Zone do not require NAR.
• Protection Officers must contact the applicable Network Control Officer and reach agreement before accessing the Danger Zone.
• NAR must be used only where adequate vision of approaching rail traffic is available (terrain, fog, heavy rain, or dust may prevent adequate vision).
• Access to the Danger Zone using NAR must be approved for no more than 2 hours. If access for additional time is required, this must be treated as a new request for access.
• The Network Control Officer must provide to the Protection Officer, information about train movements likely to occur at the location during the period of access. Information about likely rail traffic movements is provided only as a guide for rail traffic movements and is not to be relied upon as the only safety measure.
• The Protection Officer must ensure that workers do not engage in any activity where immediate evacuation from the Danger Zone cannot be achieved.
• The Protection Officer must advise the Network Control Officer when all activities are completed and workers are clear of the Danger Zone.
• In Rail Vehicle Detection (RVD) areas the use of ANWT 308 Controlled Signalled Blocking (CSB) must be used for observation and inspection activities wherever possible.”

3.13 These safety measures are primarily about communications and the exchange of key operational information between the Protection Officer and Network Control Officer, several of which are pertinent to the Strathfield incident. The SAFE Notice also contains the unequivocal statement that the protocol:

“in no way diminishes the absolute responsibility for workers in the Danger Zone to ensure that appropriate protection arrangements are in place to provide for their own personal safety”.

3.14 RailCorp, on the other hand, did not propose any immediate changes to the use of NAR. Rather, in correspondence, they expressed firm opposition to ITSRR allowing ARTC to change their Network Rules in light of Part 5 of the Rail Safety (General) Regulation 2008 which requires that changes to network rules be effectively managed, implemented, and applied (so far as is reasonably practicable) to the whole of the NSW Rail Network.
3.15 RailCorp’s submission to the Coroner’s Inquest, in summary, contended that:

- any recommendations were indirect to the organisation as the workers and the area of operations involved were not owned or controlled by RailCorp despite their having very similar but not identical work on track rules to ARTC;
- it wished to guard against possible recommendations directed at its Network Rules and Procedures;
- any recommendations directed to it may impact heavily on track activities in areas with a high density of train movements;
- it believed it was complying with the requirements to document worksite protection arrangements through Network Rule NWT 300; and
- it believed that the recommendations made to warn train crews of workers on or around the track created additional risks associated with:
  - decreased driver vigilance;
  - increased workloads for Network Control Officers;
  - the potential for information mistakes to be made; and
  - the lack of driver judgement on risk control.

However, many of these areas of contention are in conflict with the recommendations made in its own 2005 Worksite Protection Project report.

3.16 The main points of contention are inconsistent with three of the Network Safeworking Principles contained in RailCorp’s Network Safeworking Standard which overarches the Network Rules and Procedures. The particular principles are:

- “all” relevant information must be provided to workers;
- workers must be warned about hazards within the Rail Corridor; and
- safe routes must be established for all rail traffic.”

NAR does not provide for the safe separation of trains and people on track or for the warning of hazards within the rail corridor.
Nevertheless, as a result of rising incident numbers and increased monitoring by ITSRR, RailCorp initiated a “re-vitalised Worksite Protection Program” in June 2010 which included a reported 23 different improvement projects to worksite protection.\textsuperscript{12} Included in the Program are the following projects:

- a trial Corridor Safety System (CSS) which requires the Protection Officer to conduct an over-the-phone safety assessment with a Call Centre Operator or Safety Expert and obtain a Corridor Safety Number (CSN) before commencing any work in the rail corridor;
- the introduction of new “NO SAFE PLACE” signage at locations where the use of NAR has been assessed as unsafe (which partially implements a short-term recommendation of the Worksite Protection Project report);
- the introduction of a new NAR-specific Worksite Protection Plan form; and
- an improvement to the day-time and night-time visibility of lookouts by using clearly identifiable clothing, self-illuminating personal protection equipment (PPE) or other measures, i.e., trackside beacons to provide visual illumination of the work location and workers.

If these Program initiatives had been in place at the time of the Strathfield incident, only the CSS had the potential to change the circumstances given its aims are to:

“ensure that adequate levels of worksite protection are determined before commencing work in the rail corridor” and “reduce the risk to employees and contractors working in the rail corridor to as low as reasonably practical (ALARP)”.

Had protocols such as those introduced by ARTC been governing the situation, CSB as a minimum would have been implemented as the worksite protection method rather than NAR.

\textsuperscript{12} RailCorp, Worksite Protection News, Issue 1, July 2010.
3.19 On 19 December 2010, RailCorp also introduced an “improved version” of NAR in the form of the national rule called Lookout Working.¹³ Lookout Working introduces four fundamental new requirements to NAR:

- work in the danger zone is not permitted to start until the Protection Officer has spoken to the Network Control Officer about the use of Lookout Working;
- calculation of the minimum warning time (which does not change the extant requirement);
- limitation on additional lookouts to one in each direction of approach; and
- a limitation of 60 minutes on continuous work time for lookouts.

It should be noted, however, that these requirements still do not add any additional safety measures to protect against failure of the lookout or provide any warning to train crews of hazards, i.e., workers on or about the track.

¹³ RailCorp, SafeTracks, Issue 09, August 2010.
PART 4 FINDINGS

Immediate cause

4.1 The near strike occurred when the signal maintenance team, working under the NAR method of worksite protection, did not clear the danger zone as soon as the positioned warning light was automatically extinguished by the approach of train N804. At the time the warning light extinguished, the train was 29 seconds (at track speed) from their location.

Causal factors

4.2 Despite the warning of the train approaching, the Team engaged in “at risk behaviour” by remaining on track and instructing the Lookout to warn them when he saw the train. Contrary to Network Procedures, the Lookout did not continue to perform his role and the Team did not clear the track until the Driver of N804 noticed them and blew his horn.

Contributory factors

4.3 The Team was on track approximately 15 minutes after call-out which indicated that they had insufficient time to complete a full safety assessment and work plan in addition to all other necessary preparatory tasks. This is also indicated by the lack of detail on the Worksite Protection Plan and Pre-work Briefing forms prepared for the task. Although other higher and safer forms of worksite protection or train diversions were available, it appears NAR was chosen by the Protection Officer as the worksite protection method as it was the most expedient and least time consuming method to implement.

4.4 Of the methods available, NAR provides the least amount of protection and relies entirely on the lookout’s vigilance, notwithstanding the fact that in this case he had the assistance of the warning light. It is reasonable to expect that a thorough, conscientious safety assessment at the site should have led to a decision to implement a higher form of worksite protection and, importantly, one which would have provided for separation of trains and workers, as well as informing train crews of the presence of workers on and about the track.
4.5 Safety critical information such as train running detail necessary for work planning and safety assessment purposes was not sought by the Protection Officer or offered by the Area Controller prior to the Team entering the danger zone.

**Anticipation and Management of Risk**

4.6 Reinstatement of the Protection Officer and Lookout to full safeworking duties was not in accordance with the *Network Rules and Network Procedures Certification Standard*. The decisions made to reinstate them on the day of the incident appear to have been based on operational imperatives rather than safety requirements.

4.7 Though the lighting on N804 met prevailing standards, the conspicuity of “K” set rolling stock is not the same as more modern rolling stock and could be enhanced by the addition of low height visibility (ditch) lights which are standard on later model passenger rolling stock. Further, the use of visibility lighting is not covered in Network Rule NTR 406 *Use of train lights*.

4.8 There had been serviceability problems with the 538A points over the 10 months since their replacement but the routine maintenance system had not provided timely detection and rectification of these problems. Points failure attributed to lubrication “wash away” indicates a possible underlying problem or combination of problems with the lubricant being used, its application or the points themselves.

4.9 The points failure initially presented circumstances which could reasonably be classified as an “unsafe condition”. As such, good practice would have been to handle the situation as a CAN in which case the Driver of N804 would have been alerted to the situation and the potentially dangerous circumstances of the maintenance team.

4.10 Communications between the Protection Officer and Area Controller were conversational and informal rather than operationally formal according to prevailing communication protocols.

4.11 Management supervision of worksite protection through on-site monitoring of work-on-track activity and auditing of worksite planning and briefing documentation does not appear to be as regular and rigorous as it ought to be. Such activity is a legislative requirement and the need for it has been
highlighted on several occasions including in RailCorp’s Worksite Protection Project and by the Regulator.

4.12 The unilateral issue of SOI’s by both ARTC and RailCorp to amend the network rules, procedures and operating instructions associated with NAR was not in accordance with the provisions of Part 5 of the Rail Safety (General) Regulation 2008.

4.13 NAR has been the subject of scrutiny over a number of years but near strikes continue to occur within worksites using it as the method of protection. The 2005 RailCorp Worksite Protection Project recommended some changes to the management and conduct of NAR but not all of its recommendations have yet been implemented.

4.14 There are significant similarities between the Strathfield incident and the circumstances surrounding the double fatality at Singleton in 2007. In response to the focus placed on NAR by the Coroner and OTSI, both RailCorp and ARTC have responded by implementing different limitations on its use or changes to the rule. However, none of the changes adequately address the risks when the lookout is ineffective, or provide warnings to train crews about the presence of track workers in the danger zone.

4.15 RailCorp has introduced Lookout Working, a national rule which increases the requirements associated with implementing NAR. Though Lookout Working may result in some constraint in the use of NAR, again, it does not change the basic characteristics of NAR – the reliance on the lookout and the absence of communication of relevant information to train crews.

4.16 While NAR or its derivatives remain in their current form with the minimum of control measures and reliance on a single safety measure, the lookout, it will continue to present the highest of risks to track workers. Much safer alternatives are available.

**Incident Response**

4.17 The Driver was diligent in spotting the workers on the track and warning them of the train’s approach.
PART 5 RECOMMENDATIONS

5.1 To prevent a recurrence of this type of rail incident, it is recommended that the following remedial safety actions be undertaken by the specified responsible entities.

RailCorp

5.2 Develop and implement additional safety measures or defences in conjunction with NAR or its derivatives to guard against ineffective lookout performance but, should that not be achievable, dispense with the use of such worksite protection methods.

5.3 Require track faults, including points failures which need attention and certification by maintenance staff, to be treated as a “Condition Affecting the Network” in accordance with Network Rule NGE 206 Reporting and responding to a Condition Affecting the Network (CAN). Consequently, it will be necessary to warn train crews about the presence of track workers in the danger zone.

5.4 Develop and implement a more effective monitoring and auditing regime for testing compliance with worksite protection rules and procedures.

5.5 Amend Network Rule NTR 406 Using train lights to include the use of low level visibility lights to improve train conspicuity. Ensure all rolling stock operating on its network is fitted with similar lighting configurations.

5.6 Ensure that current schedules for points’ maintenance are achieving timely identification and rectification of defects, and monitor adherence to the requirements of the schedules.

5.7 Ensure the lubricant types and lubrication practices currently in use for points are providing effective lubrication under all operating conditions.

5.8 Develop and implement a method of storage of train safety records that complies with current legislative requirements and facilitates ready record recovery and review.

5.9 Institute procedures to ensure the methods used to recertify staff after incidents conform to the Network Rules and Network Procedures Certification
Standard, and implement safeguards to prevent manipulation of the requirements for the purposes of operational expediency, or for resolving staff shortages or fatigue related issues.

5.10 Notify all changes to Network Rules and Procedures, including associated explanatory material, and ensure that any changes are processed through ITSR in accordance with Part 5 of the Rail Safety (General) Regulation 2008.

### Independent Transport Safety Regulator

5.11 Undertake a targeted audit to ensure that RailCorp’s monitoring and auditing program for worksite protection methods is effective and complies with Section 12 (2) of the Rail Safety Act 2008.

5.12 Ensure any amendments made to Network Rules and Procedures by infrastructure owners and operators conform to the requirements of Part 5 of the Rail Safety (General) Regulation 2008 and that these requirements are not circumvented through alternatively titled documentation.
Appendix 1 Worksite Protection Plan and Pre-work Briefing Forms
# Pre-work Briefing

<table>
<thead>
<tr>
<th>Work location:</th>
<th>Strathfield</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scope of work:</td>
<td>Points, Sub-line</td>
</tr>
<tr>
<td>Work on track method (LPA, TOA, TWA, CSB, NAR):</td>
<td>New</td>
</tr>
<tr>
<td>Emergency assembly point:</td>
<td>Double Gates</td>
</tr>
<tr>
<td>First aid kit location:</td>
<td>Truck</td>
</tr>
<tr>
<td>Briefing Date: DD/MM/YY</td>
<td>4/10</td>
</tr>
<tr>
<td>Site Supervisor:</td>
<td>[Redacted]</td>
</tr>
<tr>
<td>Protection Officer:</td>
<td>[Redacted]</td>
</tr>
<tr>
<td>Phone:</td>
<td>[Redacted]</td>
</tr>
<tr>
<td>Briefer:</td>
<td>As above</td>
</tr>
<tr>
<td>Briefer's signature:</td>
<td>[Redacted]</td>
</tr>
<tr>
<td>SWMS/SWI Ref #:</td>
<td>[Redacted]</td>
</tr>
</tbody>
</table>

## Hazards
- TRAINS
- FEET HANDS around points

## Controls
- Look out
- Always put in recovery parts
- Due care

**Hazard Control Implementation**

<table>
<thead>
<tr>
<th>Controls (to be implemented to eliminate or reduce the risk to the lowest practicable level)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lockout</td>
</tr>
<tr>
<td>About put in recovery parts</td>
</tr>
<tr>
<td>Due care</td>
</tr>
</tbody>
</table>
## Pre-work Briefing

All incidents and injuries must be reported to the site supervisor (Line Manager) and the Safety Incident and Injury Hotline on 1800 772 779.

All persons listed below acknowledge that they:

- [ ] have been inducted to the site
- [ ] held the applicable and current certificates of competency, trade licence and/or induction record eg Construction Industry Induction
- [ ] wear the appropriate Personal Protective Equipment (PPE)
- [ ] have been briefed on the contents of the Worksite Protection Plan for work within the Rail Corridor
- [ ] have been informed of the requirements of the electrical permit (if required)

**NOTE:** Persons are to question the Briefer if they don’t understand any part of this briefing.

<table>
<thead>
<tr>
<th>Name</th>
<th>Signature</th>
<th>Time of Briefing</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>05:50</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Name</th>
<th>Signature</th>
<th>Time of Briefing</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Name</th>
<th>Signature</th>
<th>Time of Briefing</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Name</th>
<th>Signature</th>
<th>Time of Briefing</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Name</th>
<th>Signature</th>
<th>Time of Briefing</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Name</th>
<th>Signature</th>
<th>Time of Briefing</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- [ ] have been briefed on the SWMS/SWIs for the job
- [ ] have been instructed in the controls recorded in this document and SWMS/SWIs
- [ ] are free from the effects of alcohol/drugs/fatigue
- [ ] have been made aware of any hazardous materials / substances on site
- [ ] have been briefed on Material Safety Data Sheets (MSDS), if applicable
- [ ] have been briefed on the site specific safety management plan
- [ ] have been briefed on the hazards of adjoining workites

Review date: 25/05

Issue date: 25/05
Appendix 2 Sources and Submissions

Sources of Information

- RailCorp
- Independent Transport Safety Regulator
- Bureau of Meteorology

References

- Australian Rail Track Corporation Network Rules, Procedures and Safe Notices
- Glossary for the National Codes of Practice and Dictionary of Railway Terminology
- Passenger Transport Act 1990 (NSW)
- RailCorp Infrastructure Group *Worksite Protection Report May 2005*
- RailCorp Network Rules Standard
- RailCorp Network Rules and Procedures
- RailCorp *SafeTracks* August 2010
- RailCorp Safety Policy
- RailCorp *Worksite Protection News* July 2010
- Rail Industry Safety Standards Board Rolling Stock Standards
- Rail Safety Act 2008 (NSW)
- Rail Safety (General) Regulation 2008 (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:

- RailCorp
- Independent Transport Safety Regulator

Submissions were received from both Directly Involved Parties.