OTSI Office of Transport Safety Investigations

RAIL SAFETY INVESTIGATION REPORT

SAFEWORKING BREACH

GLENLEE

28 OCTOBER 2009

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THE OFFICE OF TRANSPORT SAFETY INVESTIGATIONS

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The locality map shown in Figure 1 was reproduced with the permission of *Sydways*.

GLOSSARY OF TERMS

Absolute Signal	A signal that must not be passed at Stop without the authority of a Signaller or Special Proceed Authority (SPA).
Area Control	The function responsible for managing train paths and issuing authorities. (See also Network Control.)
Blocking Facility	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.
Controlled Signal Blocking	A method used by Qualified Workers to carry out work on track using controlled signals set and kept at STOP.
Danger Zone	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.
Down and Up Lines	Trains that travel away from Sydney are Down trains. The lines that carry them are Down lines. Trains that travel towards Sydney are Up trains. The lines that carry them are Up lines.
Kilometrage	The track distance measured from the buffer stop at No. 1 Platform in Sydney Terminal (Central Station).
Four Foot	The area between the rails of a railway track.
Hot box detector	A device capable of detecting abnormal heating in axle journal bearings on passing trains.
Network Control	The function responsible for managing train paths and issuing authorities. (The term *Network Controller* will be used for ARTC positions undertaking this function and *Area Controller* for RailCorp positions.)
Phoenix System	An ARTC telemetry system forming the interface between the signal system and the Network Controller.
Six Foot	This is the area between the closest rails of adjacent tracks.
Train Controller	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.
Train Transit Manager	The manager of an ARTC Network Control Centre.
WB Radio	Local or WB radio provides open channel communications on the UHF frequency 450.050 MHz.

EXECUTIVE SUMMARY

At approximately 1:44pm on 28 October 2009 at Glenlee, Pacific National (PN) freight train 3BM4 almost struck the Co-driver of another PN freight train, 2XW4, who was returning to his locomotive after conducting an axle bearing inspection. The Co-driver believed there would be no trains running on the adjacent 'Down Main' line after communicating with a Network Controller at the Network Control Centre South at Junee (NCCS).

The Network Controller had earlier made a request to the Co-driver of 2XW4 that the train be stopped so an inspection could be carried out on one of the train's axle bearings in response to a hot box detector alert received at NCCS. From the brief communication with the Network Controller, the Co-driver thought that both the 'Up Main' line and the 'Down Main' line had blocking facilities applied. However, he did not confirm that the 'Down Main' line was safe to access before conducting the on-track inspection as required under Network Rules.

Having found nothing wrong from the inspection, the Co-driver was returning to his locomotive along the 'Down Main' line when he received a radio call from the Driver warning of an approaching train. At the same time, the Co-driver sensed the approaching train from "*humming*" on the track and moved quickly to a safe place between the 'Up Main' and 'Down Main' lines.

The incident occurred at the operational interface between Australian Rail Track Corporation (ARTC) and RailCorp territory. At the location 2XW4 came to a stand, the signals to the rear on the 'Up Main' line are controlled by ARTC and the signals on the adjacent 'Down Main' line are operated by RailCorp under ARTC's control.

The Network Controller was a trainee undertaking on-job training. This was the first occasion on which he had had to request a train driver stop and undertake an axle bearing inspection in response to a hot box detector alert. Procedures to deal with hot box detector alerts were not covered in his off-job training and, at the critical time, his supervising Network Controller was distracted by a personal telephone call.

Additionally, there are no specific procedures for the application of blocking facilities at operational interfaces.

The workload of both the trainee and supervising Network Controllers was high prior to and at the time of the incident. They had worked continuously since beginning their shift at 7:00am and had received a high number of calls throughout the morning. Neither had any scheduled rest or meal breaks during the shift.

In the course of the investigation, poor voice communication practices and non-adherence to protocols were identified as commonplace among controllers and train crews. Similar issues were addressed in recommendations of the Glenbrook and Waterfall Inquiries and continue to be identified as deficient throughout the industry.

The majority of recommendations are addressed to ARTC and include action in relation to:

- blocking procedures at operational interfaces;
- content of the training program for network controllers; and
- rostering policies and procedures at the NCCS.

In relation to voice communications, key recommendations are that both ARTC and PN conduct regular auditing to promote adherence to network rules and improve compliance with protocols, and that the Independent Transport Safety Regulator (ITSR) continues to monitor the implementation of ARTC's and PN's Safety Management Systems in relation to voice communication. It is also recommended that ARTC and RailCorp establish an agreed and unambiguous location for the operational interface and have it signposted.

The full details of the Findings and Recommendations of this rail safety investigation are contained in Parts 2 and 3 respectively.

PART 1 CIRCUMSTANCES OF THE INCIDENT

The Incident

1.1 At approximately 1:35pm on 28 October 2009, Pacific National (PN) freight service 2XW4 was proceeding towards Campbelltown on the 'Up Main' line when it set off a hot axle bearing alert from a trackside hot box detector at Menangle at kilometrage 67.255. This alert was automatically relayed to a Network Controller at Network Control Centre South at Junee (NCCS) where an alarm sounded on his control panel. The Co-driver of 2XW4 was then contacted by the Network Controller who asked that the train be brought to a stand and axle 162 be inspected as it had set off the hot box detector alert.

1.2 The communication between the Network Controller and the Co-driver was brief and lacked detail. The Co-driver asked if there was "*Anything behind us*". The Network Controller replied; "*I've put the blocks on*", which he intended to mean that a blocking facility was in place for the 'Up Main' line behind 2XW4. There was a misunderstanding in that the Co-driver thought the use of the term 'blocks' meant that a blocking facility was also in place for the adjacent 'Down Main' line, which would enable him to safely access the 'Down Main' line to conduct the axle bearing inspection and then return to his locomotive.

1.3 There are network rules concerning 'Work on Track' and in particular the application of a form of protection called 'Controlled Signal Blocking'.[1] According to ARTC's Network Rule ANWT 308 *Controlled Signal Blocking*:

> *"Before work starts, the Protection Officer must confirm from the Signaller that:*
>
> - *the protecting signals have been set at stop with blocking facilities applied, and*
> - *there is no rail traffic approaching the worksite."*

In this case the Co-driver was in effect the Protection Officer and this rule was not followed before he entered the Danger Zone. There was no confirmation by him that blocking facilities had been set, nor was there any confirmation that there was any rail traffic approaching the worksite. No planning was undertaken in accordance with Network Rule ANWT 300 *Planning Work in the*

[1] ARTC Network Rules ANWT300 *Planning Work in the Rail Corridor* and ANWT308 *Controlled Signal Blocking*.

Rail Corridor and, as soon as the term 'blocks' was used, the Co-driver assumed Controlled Signal Blocking was being implemented as the form of worksite protection.

1.4 In this instance the Network Controller and the Co-driver needed to share communication in a more detailed and explicit manner. Because he had received the call from the Network Controller, the Co-driver assumed that blocking facilities had been applied to the 'Down Main' line. He did not think that he was in the role of a Protection Officer who needed to assess the sort of protection to be applied to his worksite. This lack of planning by the Co-driver demonstrated a failure to appreciate his role as Protection Officer. Planning for the axle inspection work on the track should have been completed before he exited the locomotive's cab and planned in conjunction with the other member of the Train Crew, the Driver.

1.5 The train stopped at kilometrage 61.600 at a location known as Glenlee (see *Figure 1*) in order that the inspection could take place.

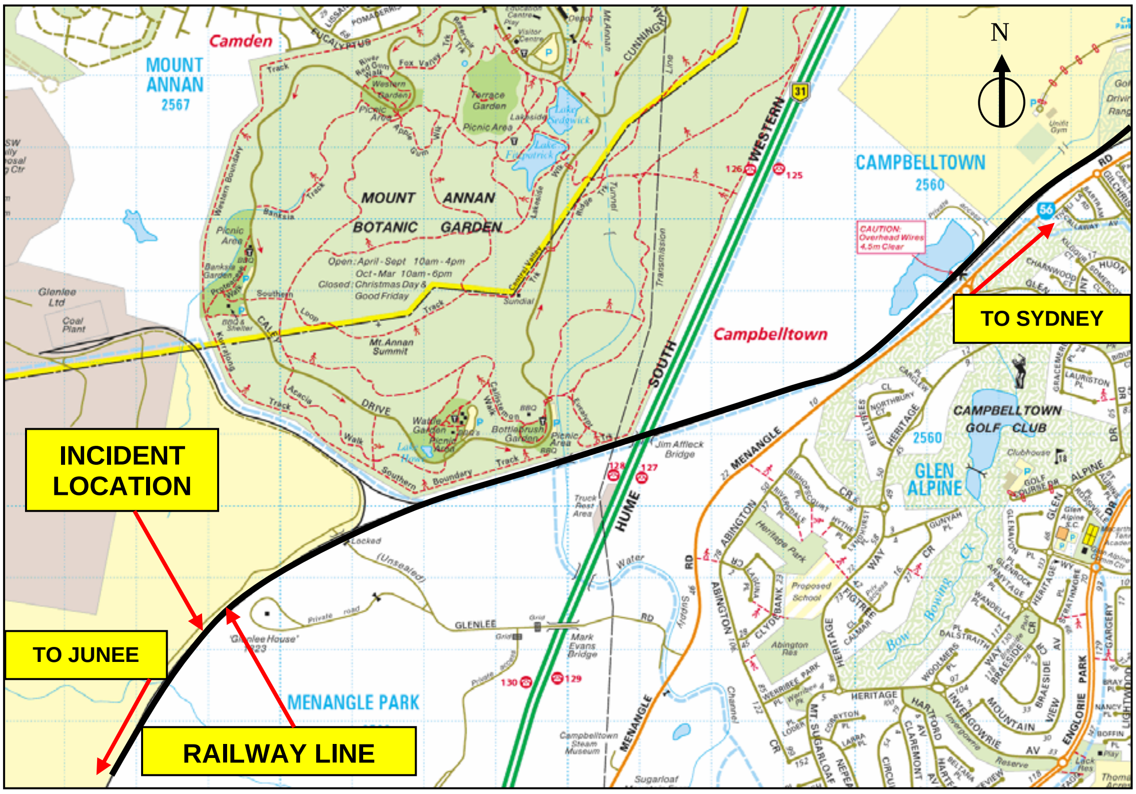

Figure 1: Incident Location at Glenlee

1.6 Glenlee is a rural locality on the outskirts of Sydney's metropolitan area approximately 61km South-West of the Sydney CBD by rail. It is located on the main Sydney to Melbourne railway line, the 'Main South' line, and is part of the Defined Interstate Rail Network (DIRN).

1.7 The incident occurred in the vicinity of the operational interface for train control functions between RailCorp and the Australian Rail Track Corporation (ARTC). At the time of the incident the operational interface was defined as occurring at approximately kilometrage 59.300. The section of the 'Main South' line at Glenlee consists of two standard gauge tracks, an 'Up Main' line and a 'Down Main' line. At kilometrage 61.600 where the Co-driver exited from the cab to check the axle bearing, the two tracks are approximately 1.9m apart with visibility to the 'Up' direction of over 300m and to the 'Down' direction of about 150m. All witnesses said that visibility at the time of the incident was good. The temperature was 25°C.

1.8 The Driver of 2XW4 remained in the cab of the leading locomotive while the Co-driver exited from the cab on the 'Down' side to count the axles as 2XW4 moved slowly past him. He decided this was an easier method for counting the axles than walking and counting at the same time. The Driver of 2XW4 moved the train slowly forward and stopped short of Signal 37.6 at kilometrage 60.683.[2] Once the Co-driver had inspected the suspect axle bearing and other axle bearings around it, he checked the axle bearing on the other side of the train, the 'Up' side. He found nothing wrong and then returned to the 'Down' side and informed the Driver using a hand-held WB radio that he was returning to the front of the train.

1.9 Meanwhile, PN Freight service 3BM4 was travelling through Campbelltown Station and in a few minutes would be travelling through Glenlee on the 'Down Main' line. It was given clearance by Campbelltown Signal Box to proceed and 3MB4 had a clear run of signals on the 'Down Main' line as it was heading South. The train crew of 3BM4 had no warning that another service had stopped and that a person was on the tracks.

1.10 In order to return to the cab of 2XW4, the Co-driver walked towards Campbelltown along the 'Down Main' line (see *Figure 2*), in the 'four foot', believing that a blocking facility had been applied to this line. The PN freight

[2] Signal 37.6 is designated as Signal 5 on the Campbelltown Signal Box control panel. All signal numbers used in this report will refer to the signal post number.

service, 3BM4, heading towards Menangle, was approaching in the opposite direction and was observed by the Driver of 2XW4 who was waiting in the cab for his Co-driver to return. The Driver warned the Co-driver on his WB radio that there was an approaching train and to get clear of the tracks. The time was then 1:43pm.

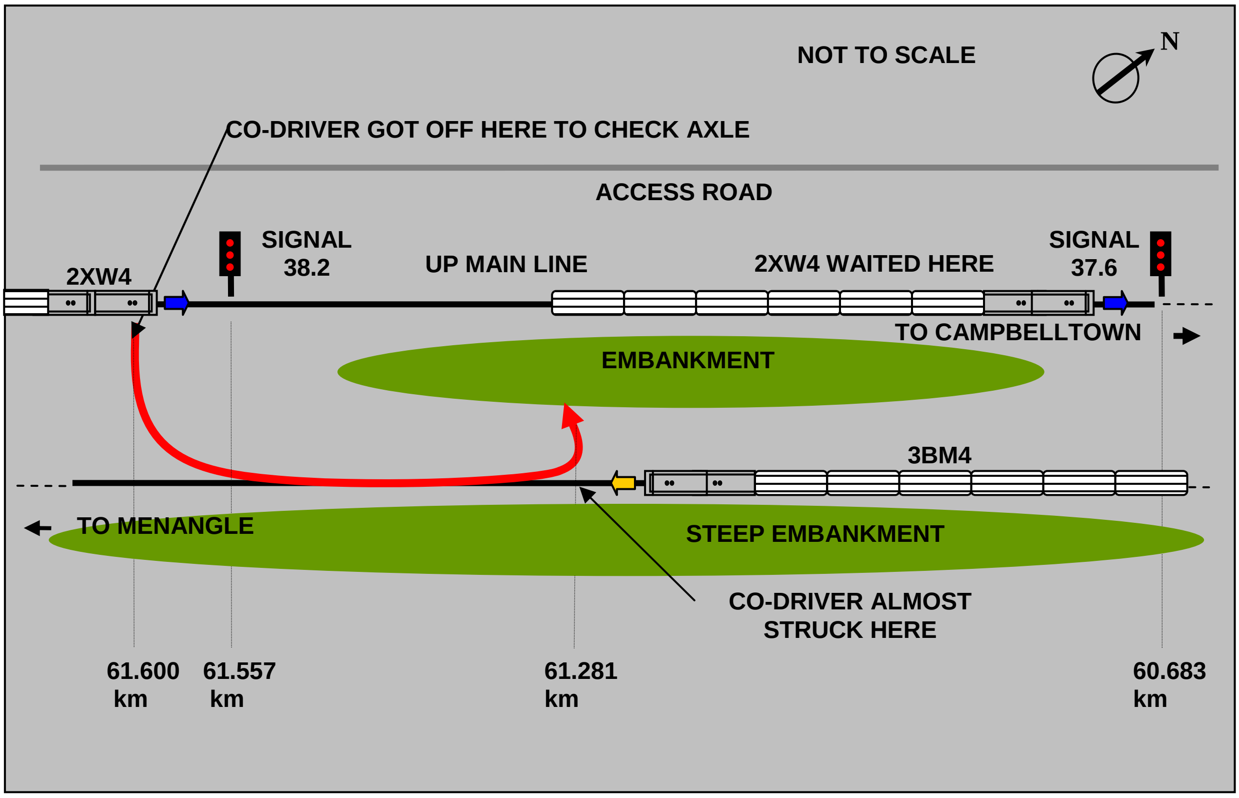

Figure 2: Track layout with path of Co-driver shown in red

1.11 The Co-driver became aware of the approaching train at the same time as he sensed "*the tracks were humming*". He said that; "*I only just got out of the way, wasn't much* (in it)". The approaching train was travelling at 100km/h, and the Co-driver had little time to move out of the way. It is estimated that, although he may have only seen 3BM4 about three seconds before it reached him, he may have had about 11 seconds warning from the time he felt the track vibration and received the radio call from the Driver. The Co-driver was able to move clear of the track into the 'six foot' and stand on a pile of old sleepers (see *Photo 1*). Had he moved in the other direction he risked falling down a steep embankment.

1.12 When 3BM4 sounded its horn the Co-driver raised his arm to indicate 'all clear' and watched 3BM4 go past. The Driver of 2XW4 then communicated with the

Driver of 3BM4 by train radio and asked him whether he had "*got his mate*", to which the answer was *"no, he was out of the way"*.

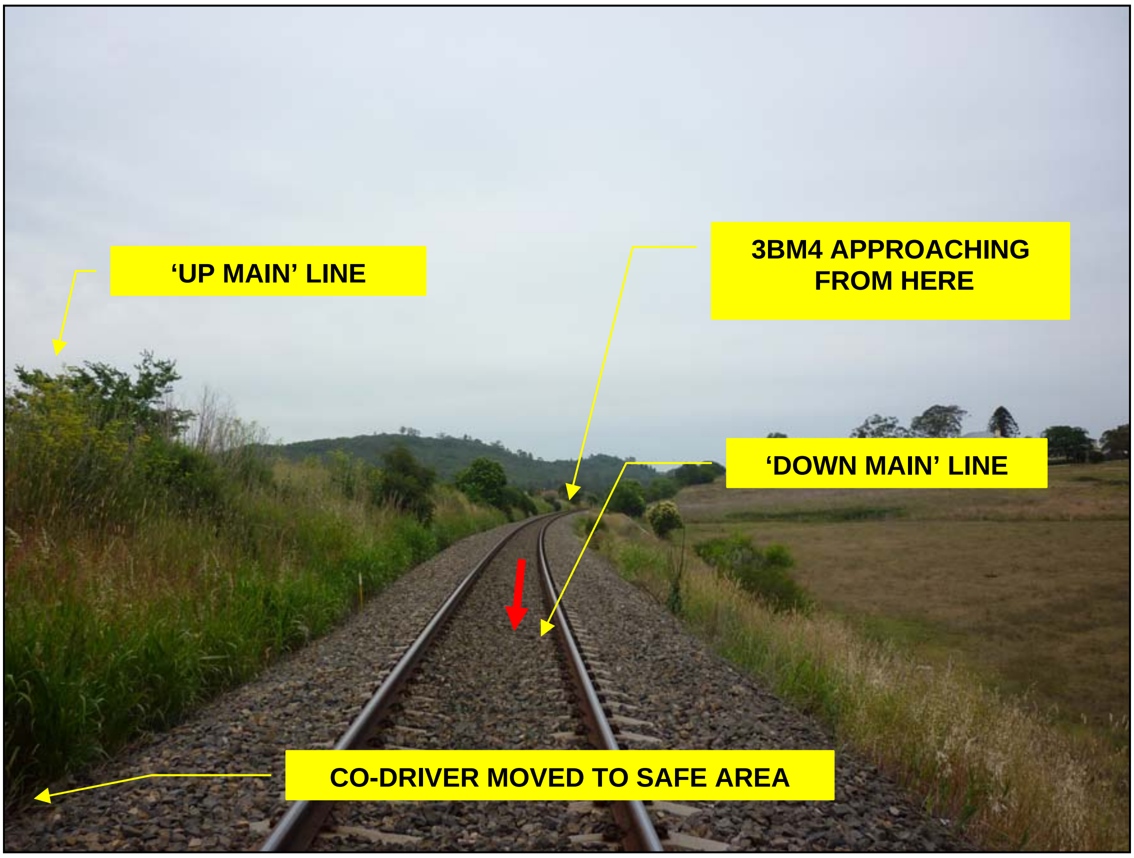

Photo 1: Looking North along 'Down Main' line, the Co-driver's view of approaching train (Red arrow indicates direction 3BM4 was travelling.)

1.13 On overhearing the radio communication between Co-driver and Driver of 2XW4 talking about the incident, the Area Controller in Campbelltown Signal Box contacted the Driver of 2XW4. He applied blocking facilities to the 'Down Main' line after confirming that there were no trains already in the section.

1.14 The Co-driver was distressed by the incident and, while walking back to the train's cab on the 'Down Main' line, spoke to the Driver a number of times on the WB radio. The Driver of 2XW4 asked his Co-driver about his condition and if he was fit to continue, also asking if he wanted to be relieved. The Co-driver stated that he was able to continue and that he just wanted to finish his shift. At 1:52pm, 2XW4 recommenced its journey to Sydney Freight Terminal at Chullora where the Crew completed their shift as scheduled at 3:10pm.

1.15 As no injuries or major damage resulted from this incident there was no requirement for emergency services to attend. The near miss was not reported immediately by the train crew of 2XW4 but their talk about it between themselves on the WB radio was picked up by an Area Controller at Campbelltown Signal Box. From here news of the incident was relayed to RailCorp's Train Control then to the Train Transit Manager at NCCS.

Train Information

1.16 PN freight service 2XW4 was a regular service that originated from Spencer Junction in South Australia, and was travelling to Port Kembla via Melbourne and Chullora. It consisted of two NR Class diesel-electric powered locomotives (see *Photo 2*) and 49 freight wagons. 2XW4 had a total length of 905m and a weight of 1,730t.

Photo 2: PN NR Class locomotives at Glenlee

1.17 PN freight service 3BM4 was a regular service that originated in Brisbane, and was travelling to Melbourne via Chullora. It consisted of two NR Class and one AN Class diesel-electric powered locomotives and 34 freight wagons. 3BM4 had a total length of 1,413m and a weight of 2,471t.

Employee Information

1.18 **Train Crew.** The PN freight service 2XW4 was operated by a Driver and a Co-driver. Both were qualified and experienced drivers who were medically fit and had signed on as fit for duty at 6:50am in Junee. The Driver commenced with PN in 2004 having had previous driving experience with FreightCorp. The Co-driver commenced with National Rail in 1994 having had previous driving experience with Freight Rail and State Rail. National Rail was sold in 2002 and under new ownership the organisation is now known as Pacific National.

1.19 **Network Controllers.** The Network Controller operating the Main South 'A' Panel at NCCS was undertaking on-job training under supervision to qualify as a network controller. He had commenced training on 24 August 2009 and completed the off-job (theory) component a month before the incident. He had no previous rail industry experience. His supervisor had spent 26 years in the rail industry and had commenced work as a network controller at NCCS in 2006 having previously worked as an area controller at Parkes Signal Box.

1.20 Both the Network Controller and his supervisor had signed on at 7:00am and were due to complete their shift at 3:00pm. This was the first day they had worked together.

Hot Box Detector Alerts and Axle Bearing Inspection Procedures

Photo 3: Hot box detector at Menangle

1.21 The Menangle hot box detector is located at kilometrage 67.255 (see *Photo 3*) and is operated and maintained by ARTC. It is a device that measures the temperature of passing axle journal bearings and automatically sends an alert to the NCCS if the temperature exceeds a certain level. The network controller is alerted by a flashing light on his panel and an audible alarm.

1.22 The hot box detector at Menangle had identified axle 162 as having an elevated journal bearing temperature which can be an indicator of a potential bearing failure. Extensive delays will result if a bearing failure occurs and a train is disabled when it is in the Sydney metropolitan rail network. A more serious consequence is the potential for a derailment. This is why it is preferable to conduct an inspection before the train reaches the metropolitan network. The distance between the Menangle hot box detector and the start of the metropolitan network at Macarthur is approximately 10km.

1.23 Once a network controller receives the alert they contact the train crew of the affected train using their desk phone. The Network Controller had never previously experienced a hot box detector alert, nor had he had cause to request a train to stop prior to this incident. He knew what a hot box detector alert was but had not received specific training on how to handle the consequent procedure.

1.24 A train which sets off the hot box detector at Menangle can travel quite a distance before it can to be contacted by the network controller. In this case, the Network Controller had difficulty in contacting the train and made three attempts before contacting the Train Crew. It is possible that a train travelling in the 'Up' direction might reach the metropolitan area before being able to be stopped. A train travelling at track speed of 100km/h would reach Macarthur in approximately six minutes.

1.25 When a crew member conducts an inspection, it is necessary to conduct the inspection from the track. This inspection includes: counting the axles from the front of the train; inspecting the axle bearing to see if the bearing is intact; checking the heat of the bearing; checking for any grease leakage; and checking if there are any other signs of damage such as a skidded wheel or scale on wheels. If the bearing is damaged it may be necessary to involve maintenance crews on site.

1.26 The Co-driver exited the locomotive on the 'Down' side which meant that he was stepping directly into the 'six foot'. The other side, while safer, was more difficult to access due to the slope and vegetation. There was no indication from the Network Controller about the side of the train on which the hot axle bearing was detected nor did the Co-driver request this information. The visibility for approaching trains on the 'Down Main' line at the location where the inspection was undertaken was approximately 300m looking in the 'Up' direction.

1.27 The incident happened after the axle bearing inspection was finished and when the Co-driver was returning to the cab. In order to return to the cab of the leading locomotive after conducting the axle bearing inspection the Co-driver of 2XW4 made the decision to walk along the 'Down Main' line believing that this line had blocking facilities applied. He thought that signals would prevent any train from entering the section from either direction (see *Figure 2*).

1.28 He was walking in an area where the 'Up Main' line was higher than the 'Down Main' line by about one metre. Between the two tracks is a barrier of dense vegetation (see *Photo 4*).

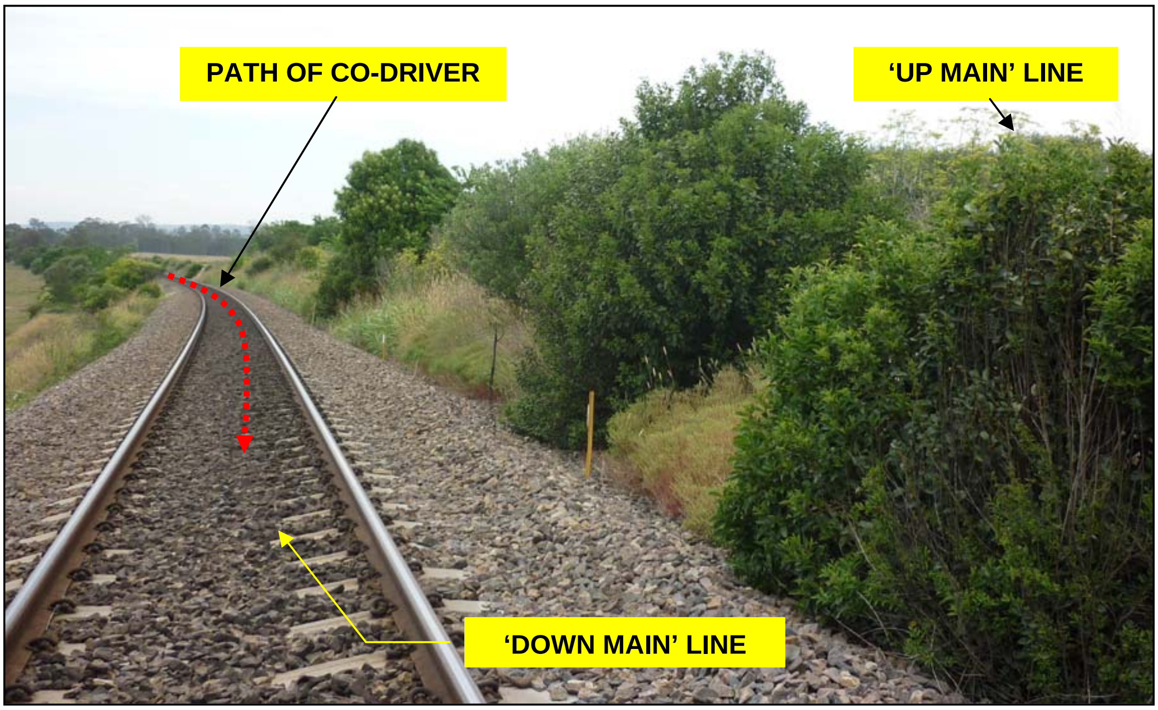

Photo 4: Vegetation between tracks, looking South

1.29 The vegetation and the difference in track height restrict access to the 'Up' side. On the 'Down' side there is a steep embankment making the area where the incident occurred particularly hazardous.

1.30 Due to the track curve and vegetation the Co-driver's view of oncoming trains was restricted to about 90m (see *Photo 1*). 3BM4 was travelling at 100km/h which meant the Co-driver would see the oncoming train about 3 seconds before it reached him. As the Co-driver was walking in the direction facing oncoming trains it meant his reaction time was shorter as he did not have to turn around when he became aware of 3BM4.

1.31 When an axle bearing inspection is undertaken and there are dual tracks, there is often no safe place between the tracks. If there is no safe place then some sort of protection should be put in place on the adjacent track. Currently there are no specified ARTC procedures which cover the placement of blocking facilities when on-track examinations are being conducted at operational interfaces.

1.32 Consideration should be given to specifying locations where it is safe for train crew to conduct axle bearing inspections in the vicinity of hot box detectors. Such locations would need good access for the inspection and good visibility for the person on the track. There is a falling grade for 'Up Main' line trains around Menangle and train drivers and track maintenance staff have been reporting that false positive hot box detector alarms were set off by braking locomotives on this downhill grade.

1.33 It is noted that the 2010 Federal Budget announced funding for crossing loops to be implemented at a number of locations including Glenlee. It may be an opportune time to incorporate the systems needed for a safe inspection area into any changes to the infrastructure. At Menangle, the location should take into account the desirability of the network controller having direct panel operability for the area under control rather than having to contact another signal box.

Communication Protocols

1.34 The rules for spoken and written communication for use in the ARTC rail network are set out in the ARTC Network Rules ANGE 204 *Network Communication* which specifies that communication must be:

- "*clear, brief, and unambiguous, and*
- *relevant to the task at hand, and*
- *agreed as to its meaning before being acted upon*."

The communication between the Network Controller and the Co-driver was ambiguous and the meaning was not agreed to before it was acted upon.

1.35 In the crucial part of the communication the Network Controller stated: *"… there is nothing behind you, I've put the blocks on mate, so you are right to pull over there"*. In this communication the Co-driver does not clarify what the Network Controller means by 'blocks'. At interview the Co-driver said that the use of the plural 'blocks' implied to him that both tracks had blocking facilities applied by the use of Controlled Signal Blocking. He thought that he was protected from entering traffic as the signals on the 'Down Main' line would be placed at stop and the signals behind his train on the 'Up Main' line would also be placed at stop.

1.36 The Network Controller thought that a blocking facility placed behind the stationary train provided an adequate blocking facility as he expected the inspection would be conducted from the 'Up' side only so the Co-driver would have no need to access the 'Down Main' line. The Network Controller did not inform the driver as to which side of the train the alert pertained although this information was available. The Co-driver did not clarify the message by repeating it back to the Network Controller, and both parties talked over each other and did not finish sentences. Critically, there was no explicit confirmation about where the blocking facilities had been applied.

1.37 Standard terms and protocols were seldom used during the safety critical communication in this incident, as required by ARTC's Network Procedures ANPR 721 *Spoken and Written Communication*. In 14 communications analysed in relation to this incident there was an absence of standard terms and correct procedures. In only one recording did the caller identify himself and, in only one other, was the formal, recommended closure term *"over"* used. In general, the tone of all communications was informal and there was a non-adherence to existing safety critical communication protocols. A report by the United Kingdom's Rail Safety & Standards Board (RSSB), concerning rail safety-critical communication errors, concluded that about one third of all incidents on the railways are caused by miscommunications.[3] The report also found that "*track work is particularly vulnerable to miscommunication, with well over half of all incidents involving a miscommunication component*". Signallers, drivers and the controllers of site safety were roles most commonly involved with miscommunications. The conclusions from this report resonate with what was found to have contributed to this incident.

1.38 In a separate report about formalising communications within the rail industry, the RSSB emphasises that standard terms or phrases should be used in all work-related safety critical communications.[4] The report made a number of useful observations on factors which support effective communication. Based on the review, the report found factors which can support effective communication include:

- practical, on-the-job communication training;
- consequence-based training, using accident/incident case studies which highlight the importance of getting communications right;
- enhancing active listening ('readback and hearback') skills in training;
- monitoring communications and providing feedback;
- introducing a radio communications licence;
- the use of a communications good practice guide;
- using pictorial demonstrations to illustrate how formalisations should be employed in practice; and
- mandating that communications should be accurate, brief and clear (ABC) in communications rule books/manuals.

These results appear to be readily transferable to the Australian context.

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[3] Rail Safety & Standards Board, *T365: The Collection of Railway Safety Critical Communication Error Data, Mobile Technologies Analysis*, 2006, p. 6.

[4] Rail Safety & Standards Board, *T700: Developing Options for the Further Formalisation of Communications within the Rail Industry Report*, 2008, p. 19.

1.39 In his Report into the Glenbrook rail accident, Justice McInerney observed that, in relation to an authority given to pass an automatic signal at stop:

> "*This authorisation, the manner in which it was given, and the earlier conversation with the train controller led the driver of the interurban to believe that the track ahead was clear.*"
>
> and, in relation to another situation,
>
> "*The language used by the signaller in his communications with (Driver A) and (Driver B) was colloquial and imprecise.*"[5]

The report also records the views of a RailCorp training manager that:

> "*There also needed to be training in the effective adoption of communication protocols, discipline in their application and an understanding of why it is important that they be followed.*"
>
> and
>
> "*The area of communications protocols is an area in which there has been inexcusable neglect.*" [6]

There are close similarities between the miscommunications identified in relation to the Glenbrook accident and those which occurred between the Network Controller and the Co-driver at Glenlee. It appears the area of safety critical communication training is an area that remains a matter for concern.

Communication Systems

1.40 The Network Controller attempted three times to contact 2XW4 by radio. The distance from the hot box detector to where 2XW4 stopped was approximately 5.7km which highlights the fact that there are significant potential risks associated with network controllers being unable to contact trains immediately in an emergency.

1.41 When the Co-driver had completed his inspection, he informed the Driver who then attempted to contact the NCCS. The Driver was placed in the on-hold queue for about two minutes before the call was answered, a situation which is symptomatic of a busy control panel.

1.42 While the Driver of 2XW4 was waiting on hold, he looked up and saw 3BM4 approaching. He then cancelled his phone call and went back to the WB radio to warn his Co-driver of the approaching train. This warning was immediate

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5 McInerney, P.A., *Special Commission of Inquiry into the Glenbrook Rail Accident, Final Report,* 2001, pp. 9,10.

6 ibid., p. 119.

and effective, and coincided with the Co-driver sensing the approaching train. The warning enabled him to get clear of the tracks and out of the way of the oncoming train.

1.43 The Campbelltown Area Controller, who should have been informed by NCCS of 2XW4 stopping in RailCorp territory, first became aware of the incident when he overheard the crew of 2XW4 talking on the open channel WB radio. The crew were talking about the lack of blocking facilities on the ‘Down Main’ line which contributed to the incident. The Area Controller spoke to the Driver to confirm the details of what happened and then attempted to call the Network Controller at NCCS but had difficulty getting through. Instead he rang his Train Controller based at the Rail Management Centre at Sydney Central Station who was able to speak to the Train Transit Manager at NCCS.

1.44 There was no communication to 3BM4 to the effect that a train was stopped on the ‘Up Main’ line or a person was conducting an inspection on the track. Had correct procedures been followed and NCCS communicated with Campbelltown, 3BM4 would have been stopped by the Campbelltown Area Controller.

1.45 It should be noted that the WB communication was effective on the day of the incident as the communication exchange between the Driver and Co-driver was overheard by a Campbelltown Signal Box area controller.

1.46 Campbelltown Signal Box staff also stated that there were often problems calling network controllers at NCCS. They said that they would be placed on hold and that it would take a long time before they could speak to a network controller.

Train Control and Operational Interfaces

1.47 Trains travelling in the rail corridor in the ‘Up’ direction in the area of the incident between Menangle and Glenlee are managed by ARTC. Operational control for this area is maintained from the NCCS at Junee where a network controller operates the Main South ‘A’ Panel using the Phoenix System.

1.48 Signal MN4 located at Maldon at kilometrage 84.599 is the last absolute signal controlled by the NCCS for trains heading in the ‘Up’ direction. After Maldon the train location and aspects of signals is not displayed on ARTC’s Phoenix

System. The Maldon to Glenlee part of the Phoenix System is expected to become fully operational once the Sydney South Freight Line is completed.

1.49 Campbelltown Signal Box operates the signals around Glenlee. The Campbelltown panel detects train movements in this area and the position of trains is shown on the control panel (see *Photo 5*). If NCCS needs to apply blocking facilities to the 'Down Main' line in the vicinity of Glenlee then they need to contact Campbelltown Signal Box and request them to operate the signals.

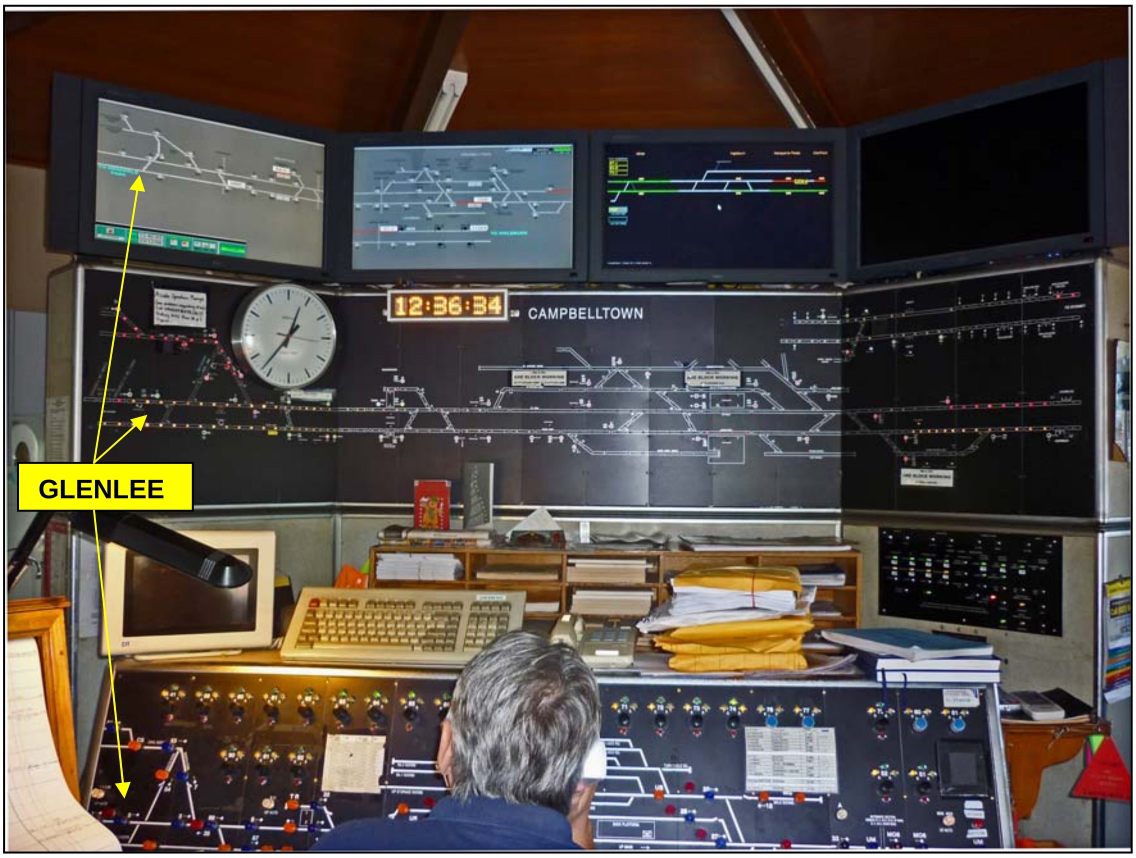

Photo 5: Control panel at Campbelltown Signal Box

1.50 Though not a causal or contributory factor in this incident, it became apparent during the investigation that the location of the operational interface between ARTC and RailCorp was not clear. When questioned about the location of the operational interface, three controllers were unable to specify the location. This was also the case with several drivers and track maintenance staff with whom the incident was discussed. One controller stated: *"the operational boundary could be clearer"*.

1.51 The Co-driver was unaware of which rail control centre was applying blocking facilities which were protecting him while he was on the tracks. As he was called by a Network Controller from NCCS, and thought that they were applying blocking facilities, he did not think it necessary to contact RailCorp's Campbelltown Signal Box as well.

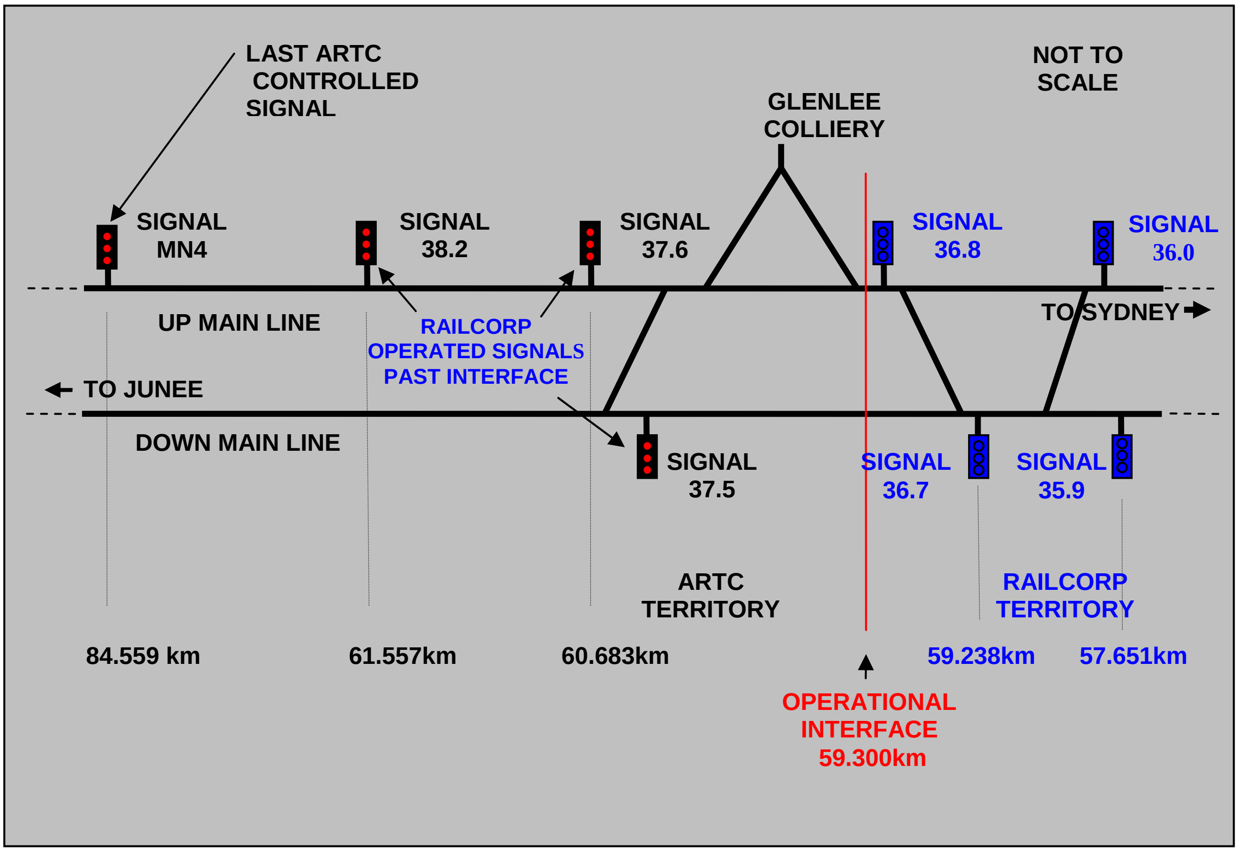

Figure 3: Track layout showing operational interface at time of incident

1.52 The network controllers at Junee and the area controllers at Campbelltown understand which signals they control around Glenlee, and the trains are operated effectively in this area despite the existence of a number of documents concerning the operational interface which differ. In practice, on the 'Up Main' line all the signals on the 'Up' side of kilometrage 61.557 are operated by RailCorp under the control of ARTC (see *Figure 3*). This includes Signal 38.2 and Signal 37.6 which are operated by Campbelltown Signal Box, under direction from NCCS, to allow trains to exit the Glenlee South Fork (from Glenlee Colliery). On the 'Down Main' line it includes Signal 37.5 (kilometrage

60.420) which is operated by Campbelltown Signal Box, under direction from NCCS. This is the signal before the crossover which allows trains to switch tracks to exit the Glenlee South Fork.

1.53 In the course of the train journey from Spencer Junction in South Australia, 2XW4 travelled across numerous operational interfaces. It is necessary for train crews to understand the exact location of operational interfaces especially in circumstances where protection arrangements may straddle the interface. It would be beneficial, then, if the interfaces were clearly signposted. A safety notice issued the day after the incident by PN emphasises the point that train crew should ensure they are aware of operational interfaces and make contact with the relevant network or area controller when crossing into their area of control.[7]

1.54 According to ARTC, the relevant document detailing the location of the operational interface between ARTC and RailCorp states that the operational interface is at "*approx kilometrage 59.300km*" ('Down Main' Signal 36.7 and 'Up Main' Signal 36.8).[8]

1.55 Another undated ARTC document titled *ARTC/RailCorp Interface Boundaries* states that the interface is at approximately kilometrage 60.000 (Down Main 37.5 Signal and Up Main 38.2 Signal).

1.56 RailCorp provided the following information in relation to the operational interface:

> "*The last RailCorp signaller controlled DOWN signal under RailCorp train control is signal S35.9. The RailCorp signaller controls signals S36.7 under the direction of the ARTC network controller. The first RailCorp signaller controlled UP signal under RailCorp train control UP signal is S36.0D. The RailCorp signaller also controls signals S37.4 and GS37.4 under the direction of the ARTC network controller. The first ARTC network controller controlled DOWN signals are S37.5 and GS35.9. The last ARTC network controller controlled UP Signal is GS36.8. The first RailCorp signaller controlled UP signal under ARTC network control is S37.6. The last RailCorp signaller controlled UP signal under ARTC network control is GS36.8. The first RailCorp signaller controlled UP signal under RailCorp train control is S36.0. The last ARTC network controller controlled UP signal is S38.2*."

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7 Pacific National, Linehaul Safety Notice 09/04, *Walking in the Danger Zone*, issued 29 October 2009.

8 The document is titled *Interface definition survey of infrastructure and operational interfaces and property boundaries at the interfaces between the Interstate and Hunter Valley Rail Network and the Metropolitan rail area and Country Regional Network*, Version. 1.4, 25th August 2004.

1.57 The complexity of the exact location of the operational interface is demonstrated by the differences in ARTC and RailCorp documentation. Current practice is that Campbelltown Signal Box operates the signals, under direction from NCCS, on the South side of Glenlee, up to including Signal 38.2 (Kilometrage 61.557). The documentation surrounding the control needs to be made less complex and more consistent.

Training and Supervision of Network Controllers

1.58 The off-job (theory) component of network controller training is conducted at Junee in the same building as NCCS by a Registered Training Organisation, *The Instruction Training Company Pty Ltd*. This training takes approximately a month and primarily covers the different types of safeworking systems and managing rail traffic movements. The trainees then progress to the on-job component which involves working on the operational panels at NCCS under supervision of experienced network controllers.

1.59 There is little practical 'field' or on-track content in the training. The practical component features only a basic familiarisation with infrastructure in the immediate vicinity of Junee Station. Therefore, trainees without a rail background are at a disadvantage. Network controllers without a practical knowledge of the environment in their areas of operation have to rely on the schematic representation provided by the Phoenix System. Justice McInerney recommended that the training of rail employees should include:

> "*an appropriate balance between the practical work experience and classroom components of any training program.*"[9]

1.60 The Network Controller said that he had not had occasion to stop a train before. Additionally, he had not experienced a hot box detector alert before, had no specific training in the procedures relating to hot box detector alerts, and no familiarity with the area where the train was stopped. It is apparent that there needs to be a review of the amount of on-job knowledge and instruction provided before trainee network controllers are allowed to undertake live network control under supervision.

1.61 The on-job training commences with trainees sitting with experienced network controllers and watching what they do. After a period of time, which is decided

[9] McInerney, P.A., op. cit., p. 179.

on an informal, apparently subjective, basis, a trainee takes over and performs the role while the supervisor sits nearby with headphones listening to proceedings. If any errors occur, the supervisor is able to correct them.

1.62 There is no formal feedback mechanism for a supervisor in order to report on a trainee's progress and no formal competency assessment undertaken. Additionally, the supervising Network Controller at the time of the incident advised that, although his role was referred to as a mentor, he had not received any training for this role.

Workload Issues for Network Controllers

1.63 The Main South 'A' Panel is an active operational panel and is a challenging environment when it is busy or there are network problems, such as train delays or breakdowns. On the day of the incident there were a number of network delays in the morning which increased the workload for the network controllers on the Main South 'A' Panel. By the time of the hot box detector alert at 1:32pm, both the trainee and supervising network controllers had not had any break since 7:00am. The investigation found that this was normal practice and that rest breaks were taken at times of low activity when a network controller in an adjoining work area could take over. Often meals were eaten while sitting at the panel. There was no scheduled break roster nor were there any relief controllers rostered.

1.64 According to call log statistics provide by ARTC. there were 544 incoming calls to the Main South 'A' Panel in the 24-hour period on the day of the incident. This was compared to an average of 522 calls per day for the preceding week and 547 for the preceding Wednesday. Since the start of the shift at 7:00am the Main South 'A' Panel had received approximately 277 incoming calls. The Network Controller commented that he felt he was "*under the pump*". The supervising Network Controller said that it was a busy day operationally primarily because: "*The 'A' panel was still in a heavy workload situation owing to the follow-on effect of late running trains.*" According to a RSSB survey, the signallers and drivers ranked workload as the highest precursor to an error. A high workload is recognised as a major contributing factor to safety-critical communication errors.[10]

[10] Rail Safety & Standards Board, *T014: Improving Driver/Signaller Safety Critical Communications*, 2004, p. 62.

1.65 Research into optimising the work environment of air traffic controllers found that:

> *"to guarantee the best level of performance efficiency and avoid excessive mental stress and fatigue, particular attention has to be paid to arranging duty periods."* [11]

This research cites the United Kingdom's regulation on Air Traffic Control hours which specifies that no operational duty shall exceed a period of two hours without a rest break. The rest break should be of no less than 30 minutes and during periods of high traffic density more frequent short breaks should be provided.

1.66 An examination of the rosters of the two Network Controllers and Crew of 2XW4 showed they were within acceptable industry limits for fatigue for the day of the incident.

Distraction Issues for Network Controllers

1.67 As well as taking calls there is a deal of paperwork associated with network control and, in the time leading up to the incident, the supervising Network Controller was completing necessary paperwork for the shift.

1.68 At the time of the communication between the Network Controller and the Co-driver about the hot box detector alert, the supervising Network Controller was receiving a personal phone call which distracted him from what the Network Controller was doing. This was a key factor in the supervising Network Controller not being aware that the Network Controller had not contacted Campbelltown Signal Box to ensure that blocking facilities were put on the 'Down Main' line.

1.69 Soon after the call to 2XW4, the supervising Network Controller left the Centre and was replaced by another network controller. On taking up his position, the new Network Controller was told that 2XW4 was stopped at Glenlee and the Co-driver was inspecting the train. He realised that Campbelltown Signal Box had not been contacted and that the Co-driver on the track was at risk. At the same time a call came through to report the near miss with the Co-driver and it was then realised that a serious incident had occurred.

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[11] Costa, G., *Occupational stress and stress prevention in air traffic control,* International Labour Office, 1995, p. 13.

1.70 The practice of allowing direct personal calls during working hours has the ability to distract network controllers at critical times. With the pervasiveness of mobile phones and other communication devices, it is difficult to prevent them being used in the workplace; however, the restriction on their use should be emphasised and monitored. In other traffic control centres, such as air traffic control, the policy of not allowing personal communication using mobile phones in the control centre is rigidly enforced.

Work Environment at Network Control Centre South

1.71 There are seven separate network controller's work stations at NCCS. In front of each network controller is a number of computer screens which mimic the location of trains in their respective area of control (see *Photo 6*). On a flat desk directly in front of the network controller is a train graph on which is plotted the time of train movements for the day. The controllers wear a headset with a microphone to facilitate better communication. An inspection of facilities showed a quiet and comfortable work environment. The lighting is a mixture of natural and artificial indirect lighting which provides diffused lighting without glare or shadows.

Photo 6: Main South 'A' Panel at Junee

Regulatory Aspects

1.72 A number of deficiencies in communications were identified by the Glenbrook and Waterfall inquiries resulting in a range of recommendations including:

> "*All communications protocols should be strictly enforced by accredited rail organisations.*"[12]

and

> "*Communication protocols and procedures should be standardised and mandated by regulations making them a condition of accreditation.*"[13]

1.73 Since these Inquiries, a number of changes instituted by ITSR have increased the responsibilities of rail organisations in implementing their safety management systems. These include ensuring that communications protocols as prescribed by the network rules are used by relevant personnel in network control centres. Accredited rail organisations are required to ensure that these systems are documented, communications are monitored, non-conformances are detected and appropriately actioned, and improvements instituted.

1.74 *Rail Safety (General) Regulation 2008* requires rail infrastructure owners, such as ARTC and RailCorp, to consult prior to amending their Network Rules. This ensures any changes, including communications terminology protocols and procedures, apply consistently throughout NSW, thereby reducing risks arising from misunderstandings during safety critical communications.

1.75 On a national basis the Rail Industry Safety and Standards Board (RISSB), an industry body, is continuing to develop a national rule book, (through the Australian Network Rules Project) that will include mandatory communications protocols, standardised communications terminology, protocols and procedures.

1.76 To ensure compliance with these Network Rules, ITSR targets communication protocols in its audit and inspection programs and reviews audio tapes as part of any investigation it undertakes. Since 2005 ITSR has conducted seven targeted compliance inspections on rail organisations including ARTC, PN and RailCorp. These inspections involved either monitoring audio tapes to ensure

[12] McInerney, P.A., op. cit., p. 182.

[13] McInerney, P.A., *Special Commission of Inquiry into the Waterfall Rail Accident,* Final Report, vol. 1, January 2005, p. 337. (Recommendation 43)

compliance with communications protocols or reviewing an operator's internal processes for monitoring compliance with communications protocols, including procedures for actioning non-conformances. Some of the earlier inspections found that compliance with communications protocols was poor. Inspections conducted by ITSR in 2009/10 confirmed that ARTC and RailCorp had systems in place to effectively manage and monitor compliance with communications protocols.

Worksite Protection Classification

1.77 Although this incident does not fall into the category of a typical worksite protection incident involving maintenance workers on track, a train driver who is undertaking an inspection on the track should be afforded the same level of protection as other track workers. ITSR has found *"a continued high number of serious irregularities in the systems used for protection of workers on track*".[14] Safe work on track is a corporate priority for them and in 2008-09 they expanded their compliance activities for worksite protection.

Remedial Actions

1.78 In response to the incident, PN issued a Safety Notice to all drivers reminding them of precautions that should be taken before entering the Danger Zone:

> "*All drivers that may be required to place themselves in the Danger Zone, on adjacent lines, are to ensure appropriate signal block protection is placed on the adjacent lines PRIOR to leaving the locomotive. Following the request, a confirmation must be obtained from the Train Controller / Signaller that the signal block protection has actually been applied.*"
>
> and
>
> *"… additionally, if drivers are required to enter the Danger Zone near areas that are the boundary between ARTC and any other network provider, they should ensure the signal block protection is applied through the correct Train Controller / Signaller that controls the approach to their location.*"[15]

1.79 Following the incident, the ARTC Train Transit Manager at NCCS told all network controllers that Campbelltown Signal Box was to be called immediately any blocking facilities were placed in the area around Glenlee. It reinforced the importance of communication between the two organisations at an operational interface.

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[14] ITSRR, *Rail Industry Safety Report 08-09*, December 2009.

[15] Pacific National, op. cit.

1.80 In a recent "*SafeTracks*" information bulletin, RailCorp reminded its staff of the importance of effective communication in maintaining safety within the RailCorp network.[16] The bulletin reiterates the mandatory requirement for the receiver to confirm the content of a message by repeating the message back to the sender if the communication involves situations such as a work on track authority.

1.81 RailCorp has amended its Network Rules NWT 308 *Controlled Signal Blocking* requiring that:

> *"Prior to authorising the CSB, the signaller must tell the Train Controller about the request to exclude rail traffic."*

This is consistent with the requirements of ARTC's equivalent Network Rules.

1.82 RailCorp has also prepared border signs to be posted at the operational interface at kilometrage 57.965. When approved they will be installed in accordance with their configuration change control process.

1.83 In response to two incidents which occurred in April 2010, one a track worker fatality at Kogarah and another involving a near miss with a number of track workers at Strathfield, both the subject of OTSI investigations, ITSR issued a Safety Notice reinforcing the importance of communication between parties when Controlled Signal Blocking is implemented.[17] It states that:

> *"The Rules and Procedures make it clear that while the Signaller has the initial responsibility for these actions, the Protection Officer has a separate responsibility to "confirm" with the Signaller that the actions have taken place."*

1.84 As ITSR points out in this Notice, there is shared responsibility on all parties to ensure that the necessary communication takes place to ensure the correct signals have been placed at stop and that there is no rail traffic between the protecting signals and the work area. It also emphasises the explicit action that the Protection Officer, in this case the Co-driver, must ask for and receive. It is essential that this confirmation take place before the danger zone is entered.

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[16] RailCorp, Safetracks Bulletin, *Effective Network Communications,* Issue No. 2, 9 November 2009.

[17] ITSRR, Rail Industry Safety Notice No. 30, *Controlled Signal Blocking,* issued 6 May 2010.

PART 2 FINDINGS

Causation

2.1 In relation to those matters prescribed by the Terms of Reference as the principal lines of inquiry, OTSI finds that the reason 3BM4 entered the section and almost struck the Co-driver of 2XW4 was that no blocking facility was requested to be placed on the 'Down Main' line to prevent a train from entering into that section.

Contributory Factors

2.2 Contrary to Network Rules, the Co-driver of 2XW4 did not confirm that the 'Down Main' line was safe to access, either by calling the Campbelltown Signal Box or confirming the protection arrangements with the Network Controller at Junee before he exited the train. The Co-driver made the assumption that the protection arrangements put in place provided protection from traffic in both directions.

2.3 The Network Controller was a trainee undertaking on-job training under supervision. This was the first occasion on which he had had to request a train driver to stop and undertake an axle bearing inspection in response to a hot box detector alert. Procedures to deal with hot box detector alerts were not covered in his off-job training. Additionally, he was not familiar with the area around the operational interface.

2.4 The supervising Network Controller was distracted by an incoming personal telephone call at this operationally critical time so, in effect, the trainee was acting unsupervised.

2.5 The communication between the Network Controller and the Co-driver was poor. It was brief and lacking detail, in particular, there was no feedback or clarification about the protection arrangements which needed to be applied to the 'Down Main' line if the axle bearing inspection was to take place.

2.6 The workload of both the trainee and supervising Network Controllers was high prior to and at the time of the incident. They had worked continuously since beginning their shift at 7:00am and had received a high number of calls mainly associated with train delay problems throughout the morning. Neither had any scheduled rest or meal breaks during the shift and there were no allocated personnel in the Control Centre to act as reliefs for meal breaks or in the case of a need to take unscheduled breaks.

Other Safety Matters

2.7 Communication practices between the Control Centre and the train crew were poor. In general, transmissions were informal and conversational rather than operationally formal according to prevailing communications protocols.

2.8 ITSR has conducted auditing of voice radio communications to monitor adherence to communication protocols in response to the recommendations of the Waterfall Inquiry. These audits have identified the need for rail operators to continue to focus on making improvements in this area.

2.9 The understanding of the operational interface for the ‘Main South’ line between ARTC and RailCorp territory is inconsistent and unclear. There is a lack of procedures in managing the application of blocking facilities at this operational interface.

2.10 The control panel at NCCS that displays the Maldon to Campbelltown area is not active.

2.11 There is a high volume of calls in NCCS which is causing long waiting times for incoming communications.

PART 3 RECOMMENDATIONS

3.1 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.

Australian Rail Track Corporation

3.2 Develop and implement a procedure for the application of blocking facilities at operational interfaces where networks adjoin.

3.3 Revise the training program for network controllers so as to include in the off-job component of the syllabus:

- coverage of the response to hot box detector alerts, including simulation exercises;
- increased emphasis on communication practice and understanding of the consequences of non-compliance with communication rules, procedures and protocols; and
- on-site familiarisation with areas of responsibility.

3.4 Institute policies that ensure network controllers are not distracted by non-work related influences while on duty including, in particular, prohibiting the use of personal mobile phones in the work area.

3.5 Conduct regular auditing of communication procedures between network controllers and train crews so as to promote adherence to network rules and improve compliance with communication protocols at network control centres.

3.6 Revise the work roster as it applies to network controllers to ensure that it specifies adequate meal, rest and convenience breaks and makes provision for relief arrangements at peak workload occasions, and amend rostering practices accordingly.

3.7 Establish and fully document an agreement with Rail Corp on an unambiguous location for the operational interface in the vicinity of Glenlee and clearly signpost it for the benefit of train drivers.

3.8 Complete the Phoenix Control System coverage of the ‘Main South’ line so that all areas under ARTC operational control can be viewed and controlled directly by the network controllers.

RailCorp

3.9 Establish and fully document an agreement with ARTC on an unambiguous location for the operational interface in the vicinity of Glenlee.

Pacific National

3.10 Continue to reinforce the requirement that drivers check and confirm effective protection is in place before conducting on-track train inspections.

3.11 Conduct regular auditing of voice communication procedures between train crews and network/area controllers so as to promote adherence to network rules and improve compliance with communication protocols.

ITSR

3.12 Continue to monitor the implementation of ARTC's and PN's Safety Management Systems in relation to voice communications and note the protocol deficiencies identified in this report.

APPENDIX 1 SOURCES AND SUBMISSIONS

Sources of Information

- Australian Rail Track Corporation
- Bureau of Meteorology
- Independent Transport Safety Regulator
- Pacific National
- RailCorp
- Rail Safety & Standards Board

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:

- Australian Rail Track Corporation
- Independent Transport Safety Regulator
- Pacific National
- RailCorp

Submissions were received from all of the Directly Involved Parties.

The Chief Investigator considered all representations made by DIPs and responded to the author of each of the submissions advising which of their recommended amendments would be incorporated in the Final Report, and those that would not. Where any recommended amendment was excluded, the reasons for doing so were explained.