



ATSB TRANSPORT SAFETY INVESTIGATION REPORT
 Rail Occurrence Investigation No. 2007/002
 Final

Level Crossing Accident – Chapple Street, Kalgoorlie (WA)

14 May 2007

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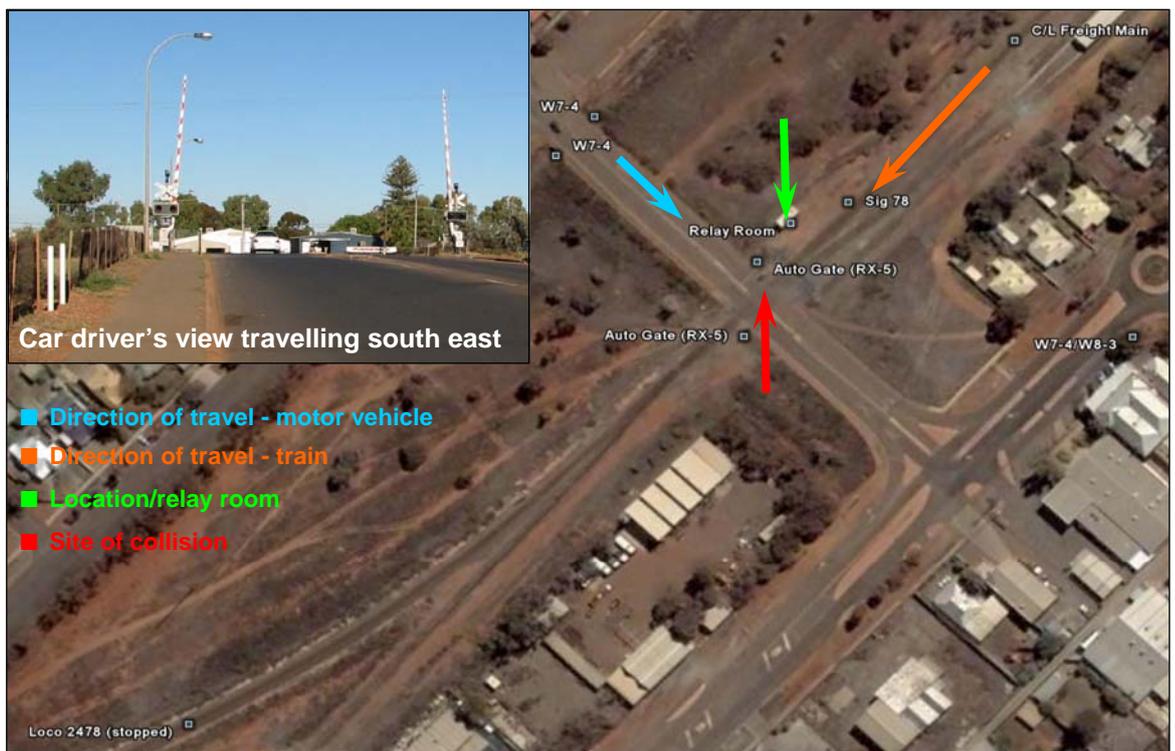
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At 1915¹ on Monday 14 May 2007 a south-west bound Australian Railroad Group (ARG) mineral train (2478) collided with a south-east bound motor vehicle which was traversing the active² level crossing of Chapple Street, Kalgoorlie in WA.

Figure 1: Aerial view, Chapple Street level crossing.

As a result of the collision, the driver of the car sustained minor injuries, the train drivers were uninjured. The car was extensively damaged, with only minor damage to the train.

The investigation found that the flashing lights, bells and boom gates failed to operate as the train approached the level crossing.



Aerial Photograph - Google Earth. Copyright ©.

Kalgoorlie is located about 550 km east of Perth. The main line (Defined Interstate Rail Network) and a freight line to Leonora passes through the city of Kalgoorlie.

Chapple Street level crossing (Fig. 1) is located about 350 m to the south-west of the main railway station and within the station yard. The road crosses two tracks, called the Freight Main and the Passenger Main, at an angle of approximately 90°. Chapple Street rises steeply

- 1 The 24-hour clock is used in this report to describe the local time of day, Western Standard Time (WST).
- 2 Active control - Control of the movement of vehicular or pedestrian traffic across a railway crossing by devices such as flashing signals, gates or barriers, or a combination of these, where the device is activated prior to and during the passage of a train through the crossing. (Source AS1742.7 – 2007)

as it approaches the two tracks. There is only limited visibility of approaching trains for motorists looking towards the north-east (the direction from which the train was coming, ie heading south-west).

Train information

Train 2478 was operated by ARG and consisted of two locomotives (L3108 leading and 42211 trailing) hauling 26 wagons. The train had a total length of 515 m and gross weight of 2318 tonnes.

The train crew comprised two drivers. Both had extensive experience and had regularly worked the corridor where the collision occurred.

At the time of the collision, both drivers were appropriately qualified, assessed as competent and medically fit for duty.

Motor vehicle information

The car involved in the collision was a late model Ford Falcon (first registered 2004) station wagon.

The motorist was a 52 year old female from Boulder, WA. She was appropriately licensed to drive the class of motor vehicle involved in the collision. The motorist had used the crossing regularly in the past.

Level crossing information

The Chapple Street level crossing is controlled by flashing lights, half barrier gates and bells. The crossing protection system is activated automatically by approaching trains. Warning signs and road markings in the approaches to the crossing help motorists to identify its presence. Signage was required to be in compliance with Australian Standard *Manual of uniform traffic control devices Part 7: Railway crossings* AS 1742.7-1993³.

Responsibility for the maintenance of the railway signalling equipment (including the level crossing) and associated control systems resides with WestNet Rail (WNR). The Kalgoorlie-Boulder City Council is responsible for the maintenance of the approach warning

signs excluding the signs mounted on the flashing light assemblies.

The level crossing control equipment is housed in a secure location/relay room situated on the northern side (Fig. 1) of the crossing. This room also houses safety-related signalling control equipment used for regulating train movements through the Kalgoorlie station yard.

Occurrence

Early in 2007 WNR identified a need to undertake work on the signalling wiring in the Chapple Street location/relay room (Fig. 1). The work was associated with track modifications that had previously occurred at the north-east end of the Kalgoorlie station yard.

The signalling work involved removal of redundant wiring, insertion of new wiring and the testing of each affected signal circuit for operational integrity before being returned to service. Circuit plans were prepared and checked well in advance.

The work was considered to be of a minor nature and only involved signal wiring for the north-east end of the yard. Chapple Street level crossing is located at the south-west end of the yard. A WNR risk assessment identified the project as a 'Minor Commissioning', this meant that the work could be undertaken between train movements and would be managed in consultation with the West Kalgoorlie signal controller. A 'Special Train Notice'⁴ was not promulgated as the work was considered minor. A 'Flag Attendant'⁵, was also not provided as the work was not identified as impacting on the operation of the Chapple Street level crossing.

Preparatory work was undertaken on 24 April 2007 during which time wiring to be removed was identified and labelled. The final modifications/wiring changes were programmed to be undertaken on Monday 14 May 2007. On this day the commissioning engineer flew in from Perth, arriving at the Kalgoorlie airport at

³ Now superseded by AS1742.7-2007.

⁴ Train Notice - Operational information issued by or on behalf of the infrastructure owner. (Source: Glossary for the National Codes of Practice and Dictionary of Railway Terminology)

⁵ Flag Attendant - A person who is competent in the manual protection of a protected level crossing.

0725. He was met by a locally based signal technician. They called at the Kalgoorlie signal maintenance depot before driving to the Chapple Street location/relay room, arriving at approximately 0830.

After consulting with the West Kalgoorlie signal controller regarding the availability of time slots (a period when no trains were present) to undertake the work, they started to remove the redundant wiring.

Work progressed smoothly and without incident. Redundant wiring was removed and new wiring inserted, followed by tests for operational integrity. Circuit plans were marked off as each element of the work was completed.

At approximately 1140 the removal of some wiring from a common loop circuit caused the unintended operation of the Chapple Street level crossing. The boom gates descended and the flashing lights operated continuously. As a 'Flag Attendant' was not available to guide motor vehicles through the level crossing, the engineer and technician decided to insert a temporary wiring strap into the crossing control circuit and by-pass the normal operation of the system. This caused the gates to rise and stopped the flashing lights from operating. This action effectively negated the fail-safe functionality of the level crossing, but was done in the knowledge that no trains would be pathed over the level crossing by the signal controller. The temporary wiring strap was removed immediately on reinstating the common loop circuit. The level crossing was returned to its normal operating mode and was set to function correctly for any approaching train.

The engineer and technician had a break for lunch at approximately 1245 and recommenced work at about 1330.

They continued wiring alterations after lunch without further incident until approximately 1730. At that time a further modification to the common loop circuit again caused the level crossing to operate. As on the previous occasion a temporary wiring strap was inserted into the circuit, however on this occasion the crossing continued to operate, ie the gates remained down and the lights continued to flash. To minimise road traffic delays, the technician immediately went to the crossing and

flagged traffic through the crossing before returning to the location/relay room to help the engineer identify the fault. The fault was eventually identified as a loss of the 50 volt power supply.

At about 1815 the engineer and technician finalised working on the signal circuits. They contacted the signal controller requesting a route availability check, ie the signal controller set all available train routes through the Kalgoorlie yard. However, this did not include a check of the level crossing as the wiring changes did not involve alterations to it.

After completing the route availability check, full site control was handed back to the West Kalgoorlie signal controller. The engineer and technician finished work for the day with the intent of returning the following morning to finalise outstanding wiring modifications.

Earlier during the same day the train drivers involved in the collision booked on duty at approximately 1530. They travelled by motor vehicle to join train 2478 on the Leonora to Kalgoorlie section of track, approximately 94 km from Kalgoorlie between Comet Vale and Goongarrie. At about 1900, when approximately 10 to 12 km from Kalgoorlie, the driver of the train contacted the signal controller in accordance with standard operating procedures requesting authority to enter the Kalgoorlie yard. The controller cleared the yard entry signal to allow for the passage of the train. When close to Kalgoorlie, the drivers observed the controlling signal displaying a 'proceed' aspect signifying authority to pass through Kalgoorlie. The train driver stated that he proceeded through the Kalgoorlie yard travelling at a speed of approximately 40 km/h.

At about this time the motorist involved in the collision was travelling from Bourke Street through to Chapple Street before passing over the level crossing.

As train 2478 entered the Kalgoorlie yard, the locomotive drivers observed an interstate passenger train, The Indian Pacific (IP), standing at the passenger platform and three maintenance workers walking in the 'six foot'⁶

⁶ The area between the closest rails of adjacent tracks.

inspecting the train. The train driver sounded the whistle at that time, visibility was good.

At a distance of approximately 100 m from the Chapple Street level crossing both train drivers observed that the half barrier gates were in the vertical position (this was not consistent with the normal operation of the gates which by now should have been in the horizontal/lowered position) and cars were still passing over the level crossing. The train driver sounded the whistle and soon after made an emergency brake application.

The motorist, now almost on the crossing, proceeded over it, assuming it to be safe with no trains present as the lights and bells were not operating and the gates were in the vertical position. In the final seconds before the collision the motorist heard a whistle and was then struck by the train. The time was now about 1915. The driver of the train immediately contacted the West Kalgoorlie signal controller and advised that his train had collided with a south-east bound motor vehicle which was traversing the crossing. The train driver further reported that the crossing was not operating at the time of the collision. This was confirmed by several independent witnesses who provided assistance to the motorist.

As a consequence of the collision, the motorist suffered minor injuries and shock. The train drivers were uninjured.

The motor vehicle was severely damaged but the train sustained only minor damage.

Post occurrence

Immediately following the collision, the West Kalgoorlie signal controller requested the attendance of the police and emergency services. The response was quick and appropriately resourced with police being on site by 1924.

Breath testing of the motorist was administered by an officer of the WA Police and returned a zero reading.

Breath testing of the train drivers was administered by an authorised ARG officer and returned zero readings.

Breath testing of the engineer and technician was administered by an authorised officer of WNR and returned zero readings.

WNR also arranged for an independent audit of the level crossing equipment in accordance with its standard operating procedures.

ANALYSIS

On 14 May 2007, two investigators from the Australian Transport Safety Bureau (ATSB) were despatched to investigate the collision.

Evidence was sourced from the motorist, the train drivers, witnesses, the WA Police, the Office of Rail Safety (WA), WNR and ARG. Without being limited, evidence included interviews, photographs, train running information, voice and data logs, engineering documentation, site plans/circuits and safety policies/procedures.

The examination of this material and an inspection of the Chapple Street location/relay room established that a temporary wiring strap had unintentionally been left in situ while making wiring alterations. The wiring strap had by-passed the normal function of the level crossing circuit which caused the boom gates to remain in the vertical position and prevented the flashing lights and bells from operating for the passage of train 2478.

The investigation also established that:

- The level crossing signage was generally in compliance with AS1742.7-1993. It was noted however, that at least one approach warning sign (RX-7 assembly) had not been installed on the Forrest Street/north-west approach to the Chapple Street level crossing. It was also noted that the 'Stop on Red Signal' signs (R6-9) did not comply with current standards. The sign did however conform to an earlier standard – 'black background with white' lettering as compared with the newer standard 'white background with black' lettering. Both of these issues are, however, not considered factors that would have contributed to the accident.

- There were no deficiencies that relate to the mechanical condition of the train. Braking, headlight illumination and the sounding of the whistle were appropriate. Train speed was not available from the locomotive data logger as the recorded information was corrupt. The locomotive data logger was inappropriately maintained. However, the train speed was determined using track side timing points⁷. This information established that the speed of the train was 45 to 48 km/h, ie 5 to 8 km/h higher than the 40 km/h yard speed limit.
- The train crew were appropriately trained, qualified, and medically fit at the time of the accident.
- Had the train drivers been travelling slower and responded to the failure of the level crossing earlier and applied emergency braking sooner, it is possible that the motorist may have traversed the level crossing without being hit. However, it is unreasonable to expect that the train drivers could have anticipated that the level crossing protection system would not be operating. The performance of the train crew is therefore not considered to be a significant factor in the collision.
- The motorist was appropriately licensed to drive the class of motor vehicle involved in the accident.
- Had the motorist seen the train and responded earlier it is possible that she may have been able to avoid the collision. However, sighting to the north-east side of the Chapple Street level crossing is obscured by vegetation/trees and the background lighting from the IP and the Kalgoorlie passenger platform would have made it difficult for the motorist to appreciate the presence of train 2478. In addition, the reasonable expectation and past experience of the motorist was that the level crossing

protection system would indicate the presence of any approaching trains. The performance of the motorist is therefore not considered to be a significant factor in the collision.

The principal cause of the accident was the failure of the Chapple Street level crossing protection system to operate for the approaching train. This was caused by a wiring strap being unintentionally left in a level crossing circuit, a simple error made by the engineer and technician performing the work. It is however appropriate to examine organisational controls to establish if these should have prevented the accident.

Safety management system

Railway signalling involves complex safety systems, alterations to these systems are always governed by strictly documented procedures and alterations should only ever be undertaken by suitably qualified and authorised engineering staff.

In Western Australia accredited rail service providers, such as WNR, are required to demonstrate safe operations through the provision of a comprehensive 'Safety Management System' (SMS). The SMS is generally required to comply with the Australian Standard 'Railway Safety Management' AS 4292.1 – 2006.

Without limiting other factors, section 6 of the standard prescribes that an organisation should have in place procedures for the modification, testing, commissioning and inspection of safety-related engineering systems which includes railway signalling.

All signalling changes encompass a high degree of risk and strategies must be in place to ensure that the integrity of the signalling system is maintained. WNR has a formal risk assessment process that broadly groups commissioning work into two distinct categories:

Major Commissioning - A commissioning that does not qualify as minor.

Minor Commissioning - A commissioning that can be carried out safely between trains without affecting any actively protected level crossings.

⁷ The Chapple Street level crossing incorporates a data recorder. This unit records the occupation and clearance times of a train on the various level crossing approach circuits. Knowing these times and the length of each of these approach circuits it is possible to accurately determine the speed of a train as it approaches the level crossing.

The commissioning engineer assessed the works at Kalgoorlie as a 'Minor Commissioning'. This appraisal was reviewed and endorsed by WNR⁸. An examination of the extent of signalling changes supports this conclusion, however the commissioning plan, and associated risk assessment, was flawed in that it did not provide sufficient guidance for unforeseen occurrences eg if a level crossing should inadvertently operate, what actions should be considered/taken by engineering staff.

Under WNR guidelines a 'Major Commissioning' is any signalling work that involves active level crossings. Had the work initially been identified or subsequently reclassified (as a result of the inadvertent operation of the level crossing operation) as a 'Major Commissioning' it should have been protected by a 'Flag Attendant' and it would then not have been necessary for the engineer/technician to use a temporary wiring strap to by-pass the safe operation of the level crossing circuit. This action almost certainly would have prevented the collision which followed.

In addition, if a 'Special Train Notice' had been promulgated (generally only issued for a 'Major Commissioning') the train drivers would have been alerted to the works and may have been better prepared to react to any signal abnormality such as the failure of the level crossing protection system.

Engineer and technician – fitness for duty and responsibilities

AS 4292.1 - 2006 at section 4 prescribes that an organisation should have in place procedures to ensure that workers engaged in activities affecting railway safety have:

- (a) The physical and mental fitness to do the work
- (b) an adequate sense of responsibility to be entrusted to do the work; and

- (c) the necessary capacity including communication and technical skills and knowledge to perform the work.

As an accredited service provider WNR is required to have policies and procedures to address these issues and should provide staff with a clear understanding of their role and responsibilities. In addition, they must have in place appropriate measures to ensure that staff is fit for duty.

WNR's safety management system requires a competent commissioning engineer to undertake signalling testing/commissioning works.

The engineer undertaking the signalling testing/commissioning at Chapple Street was a highly competent, well regarded and experienced (consultant) signals engineer. He had over 40 years of industry experience and had regularly undertaken this type of work. He had worked for WNR on an as required basis for approximately nine months before the accident.

The technician was a very senior/experienced employee of WNR. He had over 26 years experience in the maintenance and construction of complex railway signalling systems and had relieved in various supervisory positions throughout the WA network. He was highly regarded and an extremely experienced and competent signal technician.

For this commissioning, the engineer was considered to be responsible for managing the wiring alteration process, ie directing which wires would be removed/replaced and the testing of the modified signalling circuits for integrity. He was certified to direct this type of work, however he was not knowledgeable in WNR train safeworking practices or its signalling policies and procedures. The technician had extensive experience and knowledge of WNR train safeworking practices and the company's signalling policies and procedures. For this project he was effectively the 'Signalling Officer in Charge', ie the person facilitating train safeworking and implementing WNR's signalling policies and procedures. However, he was not in charge of the commissioning.

8 WNR reviewed and considered the modifications to be of a minor nature and only impacting on the north-east end of the yard. Chapple Street level crossing is located at the south-west end of the yard and wiring plans gave no clue that the alterations would have impacted on the operation of the level crossing.

A review of the WNR 'Test & Commissioning Plan' and the commissioning process revealed that the responsibilities of the engineer and technician were not sufficiently clear and this uncertainty may have been an underlying factor in the decisions made by the two men. In particular, the ownership of important train safeworking decisions was not clear. This was particularly important at the time of the first inadvertent operation of the level crossing protection system when the appropriate response would have been to reclassify the work as a 'Major Commissioning' and request a 'Flag Attendant'.

Temporary wiring straps

Under special circumstances WNR signalling policies and procedures do allow for the use of temporary wiring straps for by-passing signal and level crossing control circuits.

However, WNR policies and procedures also require that the use of false feeds⁹ in signalling circuits must be authorised by a suitably qualified officer. In spite of this, most railways would acknowledge that a signalling commissioning is a 'special circumstance' and would recognise the need to use false feeds to facilitate the testing process. The WNR 'Code of Practice for Signal System Testing and Commissioning' (W190-600-002) at clause 10.4 recognises this and stipulates:

Where temporary false feeds have been applied to carry out this testing they shall be removed at the conclusion of the test and signed for on the record of false feeds applied (see Paragraph 6.1) by the person conducting and certifying the tests. Temporary wiring shall be distinctly coloured and labelled.

Test Straps

- must be kept in a locked box. The person conducting and certifying the tests must ensure the safe custody of this box
- must be counted and recorded before the start and at the end of each day's testing work to ensure that no straps have been inadvertently left in position.

WNR 'Procedure for the Temporary Disconnection, Bypass or Removal of a Signalling Apparatus' (W110-600-036) also covers the use of Bypass Strapping.

6.1.4. Bypass Strapping

Signal maintenance personnel must only use distinguishable bypass straps when it is necessary to bypass signalling apparatus for maintenance or testing purposes.

They must be installed in such a way to make it obvious that they do not form part of the permanent wiring.

6.1.5. Completion of Work

Signal maintenance personnel shall, on completion of work and before securing the work site, ensure that all tags and bypass straps are accounted for.

The wiring strap used to by-pass the operation of the Chapple Street level crossing was a distinct colour (orange) as mandated in WNR procedures and should have been clearly visible against the black wiring of the relay rack. WNR procedures specifically recognise the risk associated with using temporary wiring straps and mandate the need to account for and remove them at the completion of the works.

Figure 2: Chapple Street relay room, wiring rack



⁹ Modification to an electrical circuit, usually using a temporary wiring strap to by-passes the normal function of the electrical circuit.

Both the engineer and technician were well aware of this requirement yet in their haste to prevent road traffic delays¹⁰ failed to record the use of the strap as required.

As a result of this action they overlooked the use of wiring strap at the conclusion of the day's work. Had they recorded the use of the wiring strap (and counted/accounted for them as per the procedures) it is probable that the oversight would not have occurred.

Previous hours of work, cognitive fatigue, medical and toxicology

It is quite common for employees engaged in signal commissioning to work long hours under significant pressure. This arises because of the narrow commissioning window, (ie a demand to minimise traffic disruption, both for road and rail users), the specialised knowledge needed to undertake signalling works, the difficulty in handover from one commissioning team to another (ie because of the complexity and unique attributes of each signalling scheme) and the limited availability of signalling testers/personnel.

Working on a task that requires sustained concentration for an extended period of time can lead to what is termed 'cognitive' or 'mental' fatigue. Cognitive fatigue can have a negative effect¹¹ on a number of aspects of human performance including, alertness, attention, short and long term memory, situational awareness, and decision making.

Cognitive fatigue may also be affected by insufficient rest, one's physical well being and personal stressors.

Typically, individuals may be unaware of the effects of moderate levels of cognitive fatigue on their performance.

WNR use the National Transport Commission's (NTC) *National Standard for Health Assessment of Rail Safety Workers*, as a basis for assessment of rail workers engaged by their company. The National Health standard classifies trackside workers at a level of Category 3, however WestNet Rail has requested that staff working on signalling maintenance and project work undertake a Category 1 process ie High Level *Safety Critical Worker*. This means that all signalling personnel and testers who work for WNR must meet very high medical standards.

The engineer was certified as medically fit through to 7 November 2007. However, during the investigation it was established that he experienced acute chest pain on 12 May 2007 and attended hospital in the early hours of the following morning. He was diagnosed to be in good health. However, he experienced significant anxiety as a result of the incident and although he rested on Sunday afternoon the incident would have also disturbed his normal sleeping pattern.

On the day of the commissioning/collision he woke early at approximately 0430 before travelling by plane to Kalgoorlie. He then worked throughout the day with only a short lunch break of approximately 30 minutes. He finally finished work at 1830, by this stage he had been up and about for over 14 hours.

The technician was certified as medically fit through to 14 October 2010.

On the day of the commissioning/collision he started work at the Kalgoorlie Signal Maintenance Depot at approximately 0645. He then drove by car to the Kalgoorlie airport to pick up the commissioning engineer. They both returned to the signal depot before proceeding to the Chapple Street relay room and started work.

Similar to the engineer, he worked throughout the day only having a short lunch break, approximately 30 minutes before finishing work at 1830, by this stage he had been up and about for over 12 hours.

At the conclusion of the day both the engineer and technician had been awake for in excess of 12 hours.

10 Road traffic delays were occurring at the Chapple Street level crossing when the crossing was inadvertently activated by the actions of the engineer and technician.

11 Schellekens JMH, Sijtsma GJ, Vegter E, & Meijman TF (2000). Immediate and delayed after-effects of long lasting mentally demanding work. *Biological Psychology*, Vol 53, pp 37-56.

The commissioning task, while not identified as a 'Major Commissioning', was nevertheless complex work and mentally demanding, it required sustained levels of concentration. This when coupled with the unforeseen activation of the Chapple Street level crossing causing road traffic delays, meant that both the engineer and technician were possibly suffering from some cognitive fatigue by the end of the day.

FINDINGS

Context

At 1915 on Monday 14 May 2007 a south-west bound Australian Railroad Group (ARG) mineral train (2478) collided with a south-east bound motor vehicle at the Chapple Street level crossing in Kalgoorlie, WA.

Based on available evidence, the following findings are made with respect to the collision but should not be read as apportioning blame or liability to any particular individual or organisation.

Contributing Factors

At the time of the collision the level crossing protection system did not operate as intended because a temporary wiring strap had inadvertently been left in situ by engineering staff while making modifications to signalling circuitry. While WestNet Rail had procedures governing the use of the temporary wiring strap, they did not prevent the mistake made by the engineering staff. *[Safety Issue]*

In undertaking the initial risk assessment of the signalling works, WestNet Rail identified it as a 'Minor Commissioning'. It was not foreseen that the works would impact on the operation of the Chapple Street level crossing protection system. Had the work been initially identified as a 'Major Commissioning', or reclassified as a 'Major Commissioning' when it became evident that the work was affecting the level crossing, a 'Flag Attendant' would have been placed to direct traffic. In addition, if a 'Special Train Notice' had been promulgated regarding the signalling works the train drivers may have been alerted to the problems with the level crossing. The risk assessment process was thus ineffective in identifying all of the risks associated with the commissioning work, or

alternatively, ensuring that the commissioning plan provided for appropriate action to be taken in the event of unforeseen circumstances ie the unintended operation of the level crossing protection system. *[Safety Issue]*

On the day of the commissioning, the engineer and technician had been active in excess of 14 and 12 hours respectively. The commissioning works required sustained levels of concentration which meant both men were probably suffering from some degree of cognitive fatigue at the end of the day when they inadvertently left the temporary wiring strap in situ. In the case of the signal engineer, any such fatigue would have been compounded by disturbed sleep and his anxiety as a result of a health scare the previous day. Personnel performing safety critical signal work should be fully cognisant of the risks associated with fatigue and any factors which may predispose them to degraded work performance as a result of fatigue. Planning safety critical work should also take into account the risks associated with cognitive fatigue and include measures to effectively mitigate such risks. *[Safety Issue]*

Other safety factors

The 'Test & Commissioning Plan' was deficient in that it did not adequately address the split of responsibilities between the engineer (responsible for managing the wiring alteration process) and the technician (for facilitating train safeworking and implementing WNR's signalling policies and procedures). This uncertainty may have led to some confusion regarding the ownership of important train safeworking decisions. *[Safety Issue]*

There were no mechanical deficiencies with the train, however the data recorded by the locomotive logger was corrupt, probably as a result of poor maintenance. *[Safety Issue]*

At least one approach warning sign (RX-7 assembly) had not been installed on the Forrest Street/north-west approach to the Chapple Street level crossing. *[Safety Issue]*

Other key findings

The train drivers were competent and medically fit for duty.

The signal engineer was certified as competent and assessed as medically fit.

The signal technician was certified as competent and assessed as medically fit.

Breath testing of the motorist, train drivers and engineer/technician returned zero readings.

The 'Stop on Red Signal' sign (R6-9) did not comply with current standards.

There is limited visibility of approaching trains for motorists looking towards the north-east (direction from which the train was coming).

The train crew were appropriately trained, qualified, and medically fit at the time of the collision. The performance of the train crew is not considered a significant factor in the accident. However, ARG should reinforce the need for train drivers to be vigilant when approaching actively protected level crossings and monitor their correct operation. Early action by a train driver has the capacity to reduce the impact/severity of an accident should it be imminent.

The motorist was appropriately licensed to drive the class of motor vehicle involved in the collision. The performance of the motorist was not considered a significant factor in this accident.

SAFETY ACTIONS

Safety actions are taken and/or recommended with the intention of improving railway operational safety. Rather than provide prescriptive solutions, recommendations are intended to guide interested parties on the issues that need to be considered.

WestNet Rail

Safety Issue

At the time of the collision the level crossing protection system did not operate as intended because a temporary wiring strap had inadvertently been left in situ by engineering staff while making modifications to signalling circuitry. While WestNet Rail had procedures governing the use of the temporary wiring strap, they did not prevent the mistake made by the engineering staff.

Action taken by WestNet Rail

WestNet Rail has reviewed and revised procedures associated with disabling level crossings including the application of temporary wiring straps.

ATSB assessment of action

The Australian Transport Safety Bureau notes that WestNet Rail has taken action to address this safety issue.

Safety Issue

In undertaking the initial risk assessment of the signalling works, WestNet Rail identified it as a 'Minor Commissioning'. It was not foreseen that the works would impact on the operation of the Chapple Street level crossing protection system. Had the work been initially identified as a 'Major Commissioning', or reclassified as a 'Major Commissioning' when it became evident that the work was affecting the level crossing, a 'Flag Attendant' would have been placed to direct traffic. In addition, if a 'Special Train Notice' had been promulgated regarding the signalling works the train drivers may have been alerted to the problems with the level crossing. The risk assessment process was thus ineffective in identifying all of the risks associated with the commissioning work, or alternatively, ensuring that the commissioning plan provided for appropriate action to be taken in the event of unforeseen circumstances ie the unintended operation of the level crossing protection system.

Action taken by WestNet Rail

WestNet Rail has reviewed and revised the procedures dealing with the testing and commissioning processes.

ATSB assessment of action

The Australian Transport Safety Bureau notes that WestNet Rail has taken action to address this safety issue.

Safety Issue

On the day of the commissioning, the engineer and technician had been awake in excess of 14 and 12 hours respectively. The commissioning works required sustained levels of concentration which meant both men were probably suffering from some degree of

cognitive fatigue at the end of the day when they inadvertently left the temporary wiring strap in situ. In the case of the signal engineer, any such fatigue would have been compounded by disturbed sleep and his anxiety as a result of a health scare the previous day. Personnel performing safety critical signal work should be fully cognisant of the risks associated with fatigue and any factors which may predispose them to degraded work performance as a result of fatigue. Planning safety critical work should also take into account the risks associated with cognitive fatigue and include measures to effectively mitigate such risks.

ATSB Safety recommendation RR20070028

The Australian Transport Safety Bureau recommends that WestNet Rail take action to address this safety issue.

Safety Issue

The 'Test & Commissioning Plan' was deficient in that it did not adequately address the split of responsibilities between the engineer (responsible for managing the wiring alteration process) and the technician (for facilitating train safeworking and implementing WNR's signalling policies and procedures). This uncertainty may have led to some confusion regarding the ownership of important train safeworking decisions.

ATSB Safety recommendation RR20070029

The Australian Transport Safety Bureau recommends that WestNet Rail take action to address this safety issue.

Kalgoorlie-Boulder City Council

Safety Issue

At least one approach warning sign (RX-7 assembly) had not been installed on the Forrest Street/north-west approach to the Chapple Street level crossing.

ATSB Safety recommendation RR20070030

The Australian Transport Safety Bureau recommends that Kalgoorlie-Boulder City Council take action to address this safety issue.

Australian Railroad Group

Safety Issue

There were no mechanical deficiencies with the train, however the data recorded by the locomotive logger was corrupt, probably as a result of poor maintenance.

ATSB Safety recommendation RR20070031

The Australian Transport Safety Bureau recommends that the Australian Railroad Group take action to address this safety issue.

SUBMISSIONS

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

A draft of this report was provided to:

- Office of Rail Safety WA
- WestNet Rail
- Australian Railroad Group
- City of Kalgoorlie-Boulder
- Engineer and technician
- Train driver(s)
- Driver of motor vehicle
- Witnesses

Submissions were received from:

The Office of Rail Safety WA, WestNet Rail and the driver of train 2478 have made a number of comments and observations on the draft report issued to directly involved parties.

The submissions were reviewed and where considered appropriate, the text of the report was amended accordingly.

MEDIA RELEASE

Level crossing protection system inoperative prior to collision

The ATSB has found that a collision between a freight train and motor car occurred because the flashing lights, bells and boom gates failed to operate as the train approached the level crossing.

The Australian Transport Safety Bureau has today released its final report into the investigation of a collision that occurred at the Chapple Street level crossing at Kalgoorlie in Western Australia on 14 May 2007.

At the time of the collision the Chapple Street level crossing was controlled by flashing lights, bells and boom gates. The investigation established that the level crossing protection system did not operate as intended because a temporary wiring strap had inadvertently been left in place by engineering staff while making modifications to signalling circuitry.

The investigation established that although WestNet Rail had procedures governing the use of the temporary wiring strap this did not prevent the mistake from occurring.

In the interest of enhancing future road/rail safety WestNet Rail has been proactive in adopting a number of recommendations that address various safety issues including the need to re-examine risk assessment and engineering maintenance/testing procedures in relation to rail signal systems.