Australian Government

Australian Transport Safety Bureau

ATSB TRANSPORT SAFETY REPORT
Rail Occurrence Investigation – 2007/001
Final

Level crossing collision
Back Creek, New South Wales

10 March 2007

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Abstract

At approximately 1830 on Saturday 10 March 2007, a semi trailer partially loaded with hay bales drove into the path of empty grain train 3835 at the Tallabung to Back Creek Road level crossing, NSW. The semi trailer driver was fatally injured in the collision.

The train derailed and, with the crushed semi trailer underneath the leading locomotive, travelled 144 m further onto and over the timber and concrete rail bridge over the Back Creek watercourse. The leading locomotive came to a rest off the track on the embankment past the bridge; the other two locomotives came to rest on the bridge.

The wreckage caught fire following the collision, ultimately destroying all three locomotives, the bridge superstructure and the semi trailer. The train crew, although injured, were able to exit the leading locomotive and escape from the fire.

The investigation found that the semi trailer driver drove into the path of the train without stopping at the level crossing's 'Stop' sign. On the evidence available there was nothing the train crew could have done to prevent or lessen the impact with the semi trailer.

THE AUSTRALIAN TRANSPORT SAFETY BUREAU

The Australian Transport Safety Bureau (ATSB) is an operationally independent multi-modal Bureau within the Australian Government Department of Infrastructure, Transport, Regional Development and Local Government. ATSB investigations are independent of regulatory, operator or other external organisations.

The ATSB is responsible for investigating accidents and other transport safety matters involving civil aviation, marine and rail operations in Australia that fall within Commonwealth jurisdiction, as well as participating in overseas investigations involving Australian registered aircraft and ships. A primary concern is the safety of commercial transport, with particular regard to fare-paying passenger operations.

The ATSB performs its functions in accordance with the provisions of the Transport Safety Investigation Act 2003 and Regulations and, where applicable, relevant international agreements.

Purpose of safety investigations

The object of a safety investigation is to enhance safety. To reduce safety-related risk, ATSB investigations determine and communicate the safety factors related to the transport safety matter being investigated.

It is not the object of an investigation to determine blame or liability. However, an investigation report must include factual material of sufficient weight to support the analysis and findings. At all times the ATSB endeavours to balance the use of material that could imply adverse comment with the need to properly explain what happened, and why, in a fair and unbiased manner.

Developing safety action

Central to the ATSB's investigation of transport safety matters is the early identification of safety issues in the transport environment. The ATSB prefers to encourage the relevant organisation(s) to proactively initiate safety action rather than release formal recommendations. However, depending on the level of risk associated with a safety issue and the extent of corrective action undertaken by the relevant organisation, a recommendation may be issued either during or at the end of an investigation.

The ATSB has decided that when safety recommendations are issued, they will focus on clearly describing the safety issue of concern, rather than providing instructions or opinions on the method of corrective action. As with equivalent overseas organisations, the ATSB has no power to implement its recommendations. It is a matter for the body to which an ATSB recommendation is directed (for example the relevant regulator in consultation with industry) to assess the costs and benefits of any particular means of addressing a safety issue.

TERMINOLOGY USED IN THIS REPORT

Occurrence: accident or incident.

Safety factor: an event or condition that increases safety risk. In other words, it is something that, if it occurred in the future, would increase the likelihood of an occurrence, and/or the severity of the adverse consequences associated with an occurrence. Safety factors include the occurrence events (e.g. engine failure, signal passed at danger, grounding), individual actions (e.g. errors and violations), local conditions, risk controls and organisational influences.

Contributing safety factor: a safety factor that, if it had not occurred or existed at the relevant time, then either: (a) the occurrence would probably not have occurred; or (b) the adverse consequences associated with the occurrence would probably not have occurred or have been as serious, or (c) another contributing safety factor would probably not have occurred or existed.

Other safety factor: a safety factor identified during an occurrence investigation which did not meet the definition of contributing safety factor but was still considered to be important to communicate in an investigation report.

Other key finding: any finding, other than that associated with safety factors, considered important to include in an investigation report. Such findings may resolve ambiguity or controversy, describe possible scenarios or safety factors when firm safety factor findings were not able to be made, or note events or conditions which 'saved the day' or played an important role in reducing the risk associated with an occurrence.

Safety issue: a safety factor that (a) can reasonably be regarded as having the potential to adversely affect the safety of future operations, and (b) is a characteristic of an organisation or a system, rather than a characteristic of a specific individual, or characteristic of an operational environment at a specific point in time.

Safety issues can broadly be classified in terms of their level of risk as follows:

- **Critical safety issue**: associated with an intolerable level of risk.
- **Significant safety issue**: associated with a risk level regarded as acceptable only if it is kept as low as reasonably practicable.
- **Minor safety issue**: associated with a broadly acceptable level of risk.

EXECUTIVE SUMMARY

At approximately 1830 on Saturday 10 March 2007, a semi trailer loaded with hay bales drove into the path of empty grain train 3835 at the Tallabung to Back Creek Road level crossing. The semi trailer driver was fatally injured in the ensuing collision.

Back Creek is a railway siding with grain loading facilities that is located about 62 km south of Parkes in central NSW. The Tallabung – Back Creek road is a gravel (unsealed) rural road

Train 3835 consisted of three locomotives hauling 20 empty grain wagons, with a weight of 420 tonnes and a length of 337 m. The train originated in Cootamundra and was travelling north to Gilgandra in northern central NSW to load wheat. The train had an operating crew of two. The semi trailer consisted of a Ford L9000 prime mover hauling a trailer partially loaded with 24 hay bales and a hay bale loader. The combination weighed 19.2 tonnes and was 19 m long.

As the semi trailer approached the level crossing, it was observed by the train drivers to be travelling slowly, to the extent that they thought it was going to stop. Immediately before the train entered the level crossing, the train drivers saw the truck 'lurch' forward onto the rail line and into the path of the train. The train struck the back half of the prime mover at an estimated speed of between 40 and 55 km/h, ejecting the semi trailer driver. The train continued with the wreckage of the semi trailer wedged under the lead locomotive, crossing the rail bridge over Back Creek watercourse in the process. Once across the bridge, the lead locomotive slewed down the ballast shoulder and came to a rest at an angle of about 60° to the track and 144 m beyond the level crossing. The two trailing locomotives came to rest on the bridge and partially derailed.

The wreckage caught fire during the collision sequence, with the fire subsequently destroying all three locomotives, the bridge superstructure and the semi trailer. The train drivers, although injured, were able to exit the leading locomotive and escape from the fire. All of the recorded information on the locomotive data loggers was destroyed by the fire.

Local emergency services (Police, Ambulance, NSW Rural Fire Service and NSW Fire Brigade) progressively arrived on site from around 1850. The fire authorities deemed that the area around the burning locomotives, which were precariously located on the burning bridge, was unsafe and so they were allowed to burn out. Resulting localised bush fires were contained.

The investigation found that the semi trailer driver drove into the path of the train without stopping at the 'Stop' sign at the level crossing. Factors that probably influenced the actions of the truck driver included a low expectation that a train would be encountered at the crossing, failure to sight the train due to glare from the sun and, possibility, fatigue. Based on the evidence there was nothing that the drivers of train 3835 could have done to prevent or lessen the impact of the collision with the semi trailer.

Although not factors which contributed to the collision, safety issues relating to the level crossing's signage and the preservation of locomotive data recorder evidence were also identified by the investigation.

1 FACTUAL INFORMATION

1.1 Overview

Shortly before 1832 on Saturday 10 March 2007, the driver of a semi-trailer loaded with hay bales drove onto the Tallabung - Back Creek Road level crossing at Back Creek, NSW, into the path of an empty wheat train. The semi trailer driver was fatally injured; the two train drivers were moderately injured. The semi trailer (prime mover and trailer) and the train's three locomotives were destroyed by the collision and the ensuing fire.

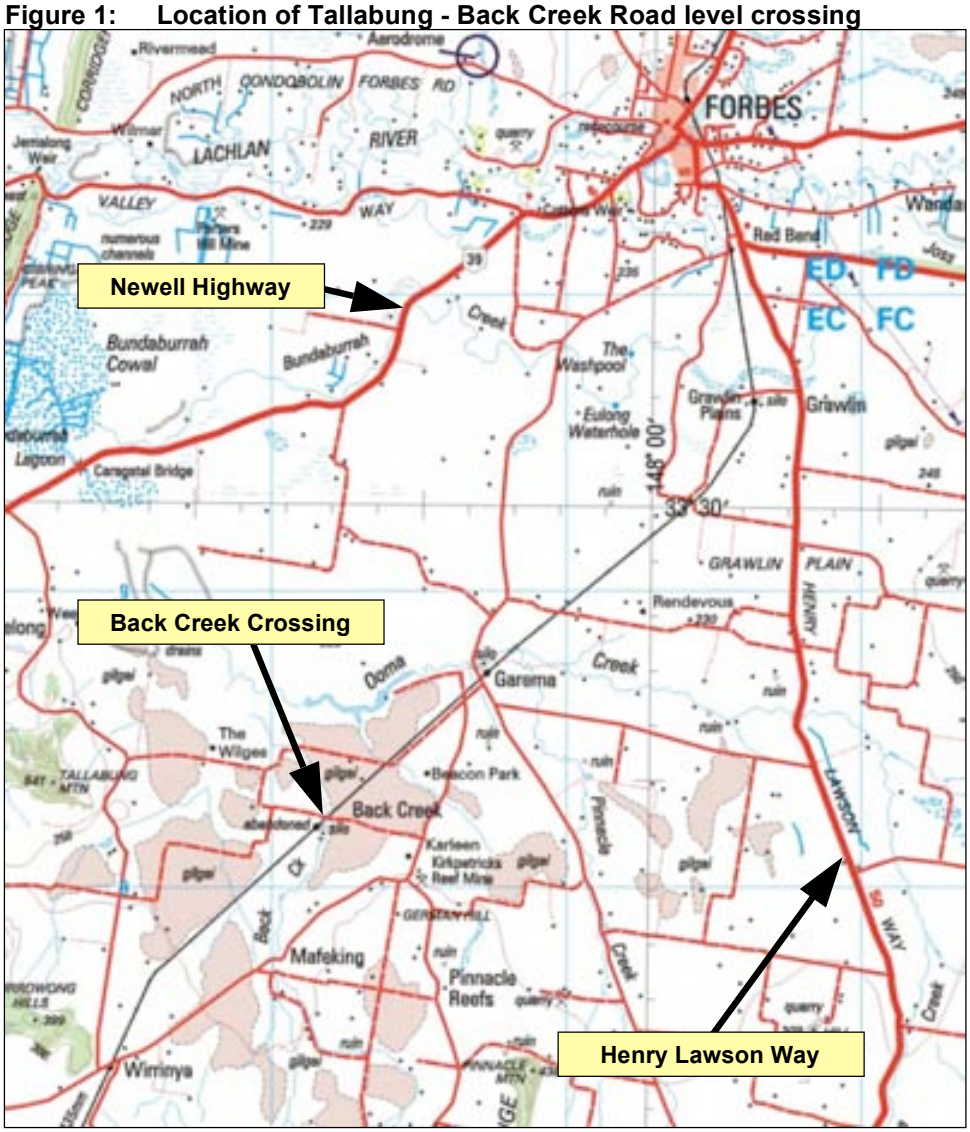
1.1.1 Location

The Tallabung - Back Creek Road level crossing[1] at Back Creek is approximately 137 km north of Cootamundra and 62 km south of Parkes on the rail corridor that links the main southern rail line (at Cootamundra) with the main western rail line (at Parkes). This section of track forms part of the Defined Interstate Rail Network (DIRN) and is leased to the Australian Rail Track Corporation (ARTC) in accordance with the terms of a 60 year lease with the State Rail Authority of NSW and the Rail Infrastructure Corporation. In accordance with this lease the ARTC is responsible for the management and maintenance of the rail corridor.

The Cootamundra to Parkes rail corridor has two northbound and two southbound timetabled freight trains per day. In addition, grain trains run as required on a seasonal basis. There are no regular passenger trains on this corridor.

1 Referred to hereafter in this report as the 'Back Creek Road' level crossing

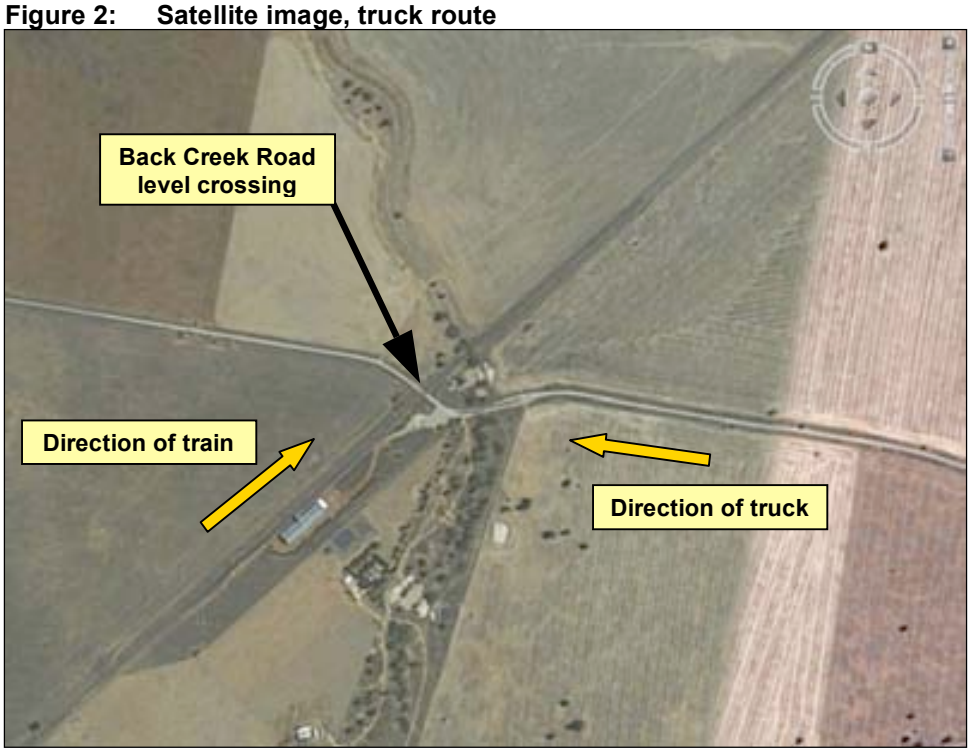
Figure 1: Location of Tallabung - Back Creek Road level crossing



Map - Geoscience Australia Crown Copyright ©

The Tallabung - Back Creek Road is an unsealed gravel road that generally runs east-west and services local rural traffic. About 200 m from the level crossing at Back Creek, the Tallabung – Back Creek Road veers to the left, crosses over the Back Creek watercourse and then veers back to the right (Figure 2). A Parkes-bound train travels towards the level crossing in a predominantly northerly direction. The result is that the road and rail line intersect at about 75° at the level crossing. The 'westerly' direction of the Tallabung -Back Creek Road is then resumed about 100 m beyond the level crossing.

Figure 2: Satellite image, truck route



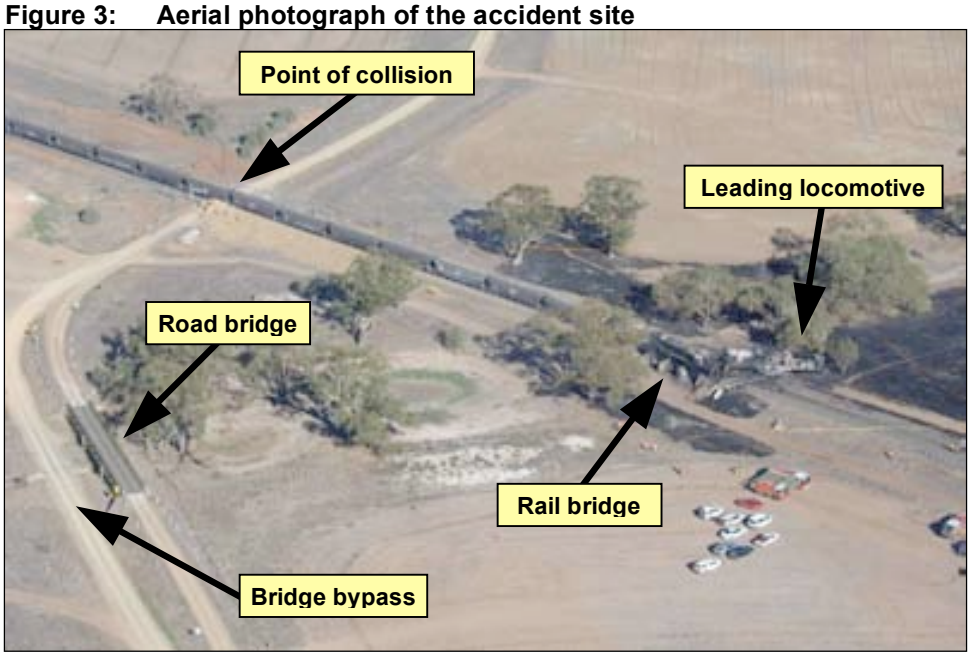
Google Earth – 2008 MapData Sciences Pty Ltd Copyright ©

The Tallabung – Back Creek Road crosses the Back Creek watercourse via a bridge (rated at 24 tonnes) or a creek bed deviation (for heavier vehicles).The evidence indicates that the majority of road vehicles use the creek bed by-pass in preference to the bridge.

The Back Creek Road level crossing is controlled by signage that directs road users to stop at the 'Stop' sign and give way to trains that may be either on, or approaching, the level crossing. The rail line approaching the level crossing from the 'south' is straight on a very slightly falling grade of 1 in 719. The Tallabung - Back Creek Road is almost level with the exception of the Back Creek watercourse crossing where there are either short rising or falling gradients either side of the watercourse (if the creek bed by-pass is used).

The speed limit for road traffic on the Tallabung - Back Creek Road is 100 km/h; the speed limit for rail traffic is 100 km/h, but a permanent speed restriction of 40 km/h was in place on the rail bridge over the Back Creek watercourse at the time of the collision. The proximity of this bridge to the Back Creek Road level crossing meant that, in practice, the speed of trains would be substantially less than 100 km/h. Likewise, the proximity and layout of the Back Creek watercourse crossings to the level crossing means that the speed of road traffic, particularly heavy vehicles, would be substantially less than 100 km/h.

Figure 3: Aerial photograph of the accident site



1.1.2 Road vehicle information

The semi trailer involved in the collision was owned and operated by the driver. His business included the transportation of stock feed throughout NSW and southern Queensland. The semi trailer combination consisted of a 1990 Ford L9000 prime mover (bonneted design) towing a JTB TRI03A tri-axle drop deck low loader trailer. The length of the semi trailer combination was 19 m. At the time of the accident, it was loaded with 24 bales of hay and a hay bale loader for a gross combination weight of about 19.2 tonnes. The maximum allowed length for a semi trailer of this type is 19 m. The maximum allowable gross weight is 42.5 tonnes.

The prime mover was certified as roadworthy at a registered inspection station in Forbes on 1 August 2006. The prime mover was regularly maintained and in a serviceable condition at the time of the accident. The trailer was only about 5 months old; there was no evidence of any mechanical deficiencies.

Road vehicle driver information

The driver of the semi trailer was a 33 year old male from the local area. He lived part time on his family's property about 4 km from the level crossing and part time in Forbes (about 31 km away). He had been self employed for some years in the hay and stockfeed supply industry, as well as assisting on his family's wheat/sheep property.

The driver had no known medical condition that would have precluded him from driving a heavy motor vehicle/truck. He was appropriately licensed and had extensive experience in driving similar vehicles.

The semi trailer driver had no known prior convictions or traffic offences that would indicate an increased risk for this type of accident. Similarly, his driving record gave no indication of factors likely to have contributed to the accident.

1.1.3 Key witness information

A long time colleague of the semi trailer driver involved in the collision, who had lived in the area for many years, was able to provide valuable insights regarding the Tallabung-Back Creek Road, the level crossing and the semi trailer driver involved in the accident. He worked and, to an extent, socialised with the semi trailer driver on a regular basis and, similarly, had extensive experience in heavy vehicle and machinery operation. This person was on the scene of the accident almost immediately following the collision.

1.1.4 Train information

Train 3835 was owned and operated by Pacific National Pty Ltd (PN) and was travelling from Cootamundra to Gilgandra to load grain. Train 3835 consisted of locomotives 8147, 48106 & 48155 and 20 empty grain hoppers of the NGPF and NGKF classifications. The gross weight was 420 tonnes and the length 337 m. Although the speed of the track was 100 km/h (reducing to 40 km/h at the bridge over the Back Creek watercourse), PN had limited the maximum speed of train 3835 to 60 km/h.

Train crew

The train was operated by two drivers both of whom were employed by PN and based at the Cootamundra depot. Both drivers had considerable experience on the section of line where the collision occurred.

Both drivers were appropriately trained, qualified, and medically fit at the time of the accident.

1.1.5 Environmental conditions

The accident occurred shortly before 1832. The temperature was around 32 degrees Celsius with a light south-westerly breeze. Witnesses reported the weather was fine and that the air was clear with good visibility (although the area was in drought, there were no reports of dust clouds).

1.2 The occurrence

At 1400 on 10 March 2007, both train drivers signed on for duty at the Junee depot where they were randomly breath tested. Both returned zero readings. The drivers were then transferred by road to Cootamundra Yard to take charge of train 3835.

Train 3835 left Cootamundra at 1505, 5 minutes after the scheduled departure time. At Caragabal (about half way between Cootamundra and Parkes) the train drivers swapped the driving duties. After an uneventful run, train 3835 arrived at the Wirrinya crossing loop at 1800 in order to cross an opposing south-bound freight train (8932). Wirrinya station is about 10 km south of the Back Creek Road level crossing. The southbound train passed through Wirrinya at about 1810. As the trains crossed, the crews of both trains performed roll-by examinations on the opposing trains. No defects of train 3835 (stationary) were observed by the train crew of 8932 (moving). Train 3835 then departed Wirrinya loop 10 minutes later at 1820.

The semi trailer driver involved in the collision had worked all day on the family property located about 4 km to the east of the accident site. He had partly loaded the low loader trailer with wheaten hay bales and the hay bale loader. He intended to top up the load with more hay from a property located about 150 m west of the Back Creek Road level crossing before delivering it to a property in Cowra, about a 30 minute drive. He left the family property at about 1825.

A second truck, driven by the colleague of the semi trailer driver (referred to in section 1.1.3) also left the semi trailer driver's family property shortly after and followed at a distance of about 500 to 1000 m behind the first vehicle to avoid its dust. He was also travelling to the same property to load wheaten hay bales. The driver had spoken to the driver of the first semi trailer several times during the day, in person and by phone, including immediately prior to departing from the property. He said that on each occasion his colleague seemed alert and in his normal jovial mood. His distinct recollection was that the driver's cab windows were closed and the air conditioner was on when the first semi trailer left the property.

As train 3835 approached the Back Creek Road level crossing, the train driver said that he was using dynamic brake to slow the train from about 55 km/h to 40 km/h for the speed restriction on the bridge over the Back Creek watercourse. As the train passed the Back Creek grain silos (about 200 m before the Back Creek Road level crossing) both drivers noticed a semi trailer approaching from an easterly direction. The semi trailer had already passed through the creek by-pass before the level crossing and appeared to be slowing. The locomotive horn was sounded continuously as the level crossing was approached, although both train drivers said that they believed the speed of the semi trailer was such that it could have stopped at the level crossing. However, the semi trailer continued its slow approach and, in the last moments as the train was about to traverse the level crossing, appeared to 'lurch' onto the level crossing into the path of the train. The train driver said he then applied the train brake but was unable to recall whether he had made a service or emergency application. He also said that in the seconds before impact, he observed the semi trailer driver moving within the prime mover cabin, but was unable to determine what he was doing. Both drivers also said they saw that the passenger side window was closed.

Train 3835 collided with the semi trailer shortly before 1832; the impact was centred at the rear of the prime mover's cabin. At impact, the front windows of the lead locomotive burst inwards followed by large amounts of hay from the semi trailer. Feeling that the locomotive had derailed, both drivers threw themselves to the floor and braced themselves, fearing that it would topple off the bridge over the Back Creek watercourse. The lead locomotive crossed the bridge with the truck prime mover and trailer still wedged under it and all its wheels progressively derailed. As the leading locomotive passed over the bridge, it slowed and moved to the left, striking the tops of the last two concrete piers. At this point, the prime mover cabin separated from the wreckage and was crushed against the bridge piers. The lead locomotive then slewed down the ballast shoulder, coming to rest about 144 m past the point of impact at an angle of about 60°. The prime mover chassis and trailer remained trapped under the leading locomotive.

By this time, the train stopped and the locomotive cabin had filled with smoke, dust, and hay. Both drivers said that they saw flames around the side of the locomotive near the driver's (left) window and that there was a strong smell of diesel fuel. They immediately evacuated the locomotive cabin. The two drivers, both of whom had been injured during the accident sequence, did not have time to

reach for any radio, telephone, or belongings. Within seconds of the drivers evacuating the cabin, the locomotive was engulfed in flames.

When the second truck driver approached the creek deviation, he noticed a train coming to a stop engulfed in flames. He attempted to call the driver of the semi trailer that he was following by CB radio but there was no response. When he exited the creek by-pass, he realised that the semi trailer had been struck by the train. At 1832 he placed a call to the emergency services '000' operator.

After evacuating the locomotive, both train drivers walked back towards the level crossing when they saw the second truck stopped near the crossing. The driver from the second truck told them that he had already telephoned '000'. The train drivers asked to borrow his telephone to contact train control but the telephone was unable to call undesignated telephone numbers.

One of the train drivers was, by this time, beginning to feel pain. He stayed at the level crossing with the second truck driver. The other train driver (the co-driver) then walked back to the front of the train trying to locate the semi trailer driver. Unable to inspect the wreckage at the front of the train because of the intensity of the spreading fire, the co-driver then returned to the level crossing. In the meantime, a car had stopped on the other (western) side of the crossing. The co-driver then spoke with the car driver and established that the semi trailer driver involved in the collision had been found adjacent to the track on the western side of the rail line about 50 m from the Back Creek Road level crossing and that he appeared to be deceased.

The co-driver then used the mobile telephone of the car driver to alert the Pacific National train crew supervisor at Cootamundra. The train crew supervisor then notified Junee train control. By this time, train control had already been advised (at 1854) by the Tamworth Police communications centre of the accident.

A short time later, the co-driver noticed a police car arrive on site near the front of the train. After speaking with the police officer and confirming the type of train and cargo being carried, the co-driver returned to the level crossing to seek medical attention from ambulance officers. Both train drivers were later taken to Forbes hospital for further treatment.

Surprisingly, the hay bale loader, which had been on the semi trailer unsecured, had been thrown clear of the train and had landed on the roadway on its wheels (in an upright position) adjacent to the level crossing.

1.3 Post occurrence

Emergency services were notified and mobilised to attend the accident site. Police arrived on site at about 1850, followed shortly by the NSW Ambulance Service, NSW Rural Fire Service and the NSW Fire Brigade. The site was declared a crime scene by the attending police.

A 500 m exclusion zone was placed on the site by fire brigade personnel who feared, due to the increasing intensity of the fire, that an explosion could occur. By this time the timber-topped rail bridge, which the two trailing locomotives and a portion of the leading wagon were standing on, was alight. Also, the fire had spread to the adjacent land and caused grass fires. At the time of the collision the diesel fuel tanks on each locomotive were estimated to be near full capacity. (The total

diesel fuel capacity of the three locomotives was 11,240 L with a total lubricating oil capacity of 1,980 L.)

By early evening (about 2000) fire brigade personnel estimated that it would take at least six to 7 hours to control the fire. Due to the intensity of the fire, a containment policy was adopted aimed at controlling the spread of grass and 'small timber' fires. The locomotives and timber top bearers of the railway bridge were left to burn out as it was deemed to be unsafe to approach the seat of the fire because of the amount of fuel/oil that was feeding the fire and the potential of the wooden members of the bridge to burn out and collapse (with two locomotives standing on it).

Figure 4: Locomotives engulfed in flames, some hours after collision

Three site meetings were held during the night and following morning. At each of those meetings (at 2350, 0834 and 0920) the site was judged to be too dangerous to release as the fire was still burning fiercely. During daylight hours a plume of black smoke was visible for several kilometres.

At about 1610, the site was declared safe by the fire brigade and released to the ARTC. The two derailed locomotives on the bridge had remained nearly upright throughout the fire and, by first light on Sunday 11 March 2007, were being supported by the rail lines only.

Figure 5: Aerial photograph of the locomotives and semi trailer later the following day, fire extinguished

Figure 6: View of burnt out locomotives and bridge, note timber bearers of the bridge burnt from beneath locomotives

1.4 Loss and damage

The semi trailer prime mover and trailer were destroyed by the collision. All three locomotives were destroyed by the subsequent fire. The leading grain wagon suffered considerable heat damage, including some buckling.

All timber components of the Back Creek railway bridge were completely destroyed by fire, about 180 m of track needed replacement, and the aerial wires associated with the safeworking arrangements of the rail corridor (electric staff) were also damaged by fire.

The track at Back Creek was repaired sufficiently to be re-opened to rail traffic by 1600 on Wednesday 14 March 2007, some 4 days after the accident.

2 ANALYSIS

On 10 March 2007, an investigation team from the Australian Transport Safety Bureau (ATSB) was dispatched to investigate the accident at the Back Creek level crossing in central NSW.

Evidence was sourced from witnesses, the semi trailer driver's family, the NSW Police Service, the ARTC, PN, Forbes Shire Council, various telephone communication providers[2], and Central West Diesel Pty Ltd.

A post-mortem examination was conducted on the semi trailer driver. The examination did not detect any illicit or prescription drugs or other substances that may have impaired his performance or judgement at the time of the accident. Similarly, there were no medical issues found that would have impaired his performance or judgement. Though it was considered unlikely, the post-mortem examination was unable to rule out the possibility that he had suffered from some form of fit or seizure immediately prior to the collision.

The following analysis examines whether the train was being operated in accordance with the relevant rules and procedures and whether the Back Creek Road level crossing was compliant with the applicable standards. The analysis also examines the factors that may have led to the semi trailer driver's failure to stop at the crossing and factors that may have led to his failure to detect the presence of the train.

The collision and subsequent fire destroyed all of the sources of recorded data from the train's locomotives[3]. As a result, data in relation to key factors such as train speed and braking were unavailable. Therefore, the investigation relied largely on statements from the train drivers and motorists who arrived at the scene within minutes of the collision to ascertain and analyse critical aspects of the train's operation.

2.1 Sequence of events analysis

2.1.1 Passage of train 3835

Train 3835 had an electric staff for the Wirrinya to Forbes section as well as verbal permission from the Junee Train Controller to travel from Wirrinya to Forbes. This constituted an authority to occupy this section of track.

Both drivers of train 3835 said the lead locomotive's headlight and ditch lights were switched on at departure from Wirrinya and remained on until the time of the collision. With respect to the train's speed immediately prior to the collision, both drivers also stated that on the approach to the Back Creek Road level crossing, the train was in the process of being slowed to 40 km/h. They also said the locomotive horn was sounded continuously from when they first sighted the semi trailer almost

2 No outgoing or incoming calls on the semi trailer driver's mobile phone were recorded in the time leading to the collision.

3 Hasler wax paper drum recorders. Hasler recorders do not record headlight or horn operation.

until impact. There were no witnesses to corroborate the train divers' accounts that the headlight and ditch lights were on but several people in the vicinity at the time said they heard the locomotive horn sounding and then the noise of the collision.

Both train drivers said that the semi trailer approached the level crossing at a speed at which a stop could have been made and that the passenger side window of the semi trailer cabin was closed. In addition, the driver at the controls of the train said he saw the semi trailer driver moving about inside the prime mover cab in the moments before the collision.

2.1.2 Passage of the semi trailer

The trip from the property where the semi trailer had been partially loaded with hay to the property where the load was going to be topped up, is about 4 km. Although the Tallabung - Back Creek (gravel) road speed limit is 100 km/h, the evidence indicates that it is unlikely the semi trailer reached this speed.

The second semi trailer driver said that the maximum speed attained by heavy vehicles on the 4 km portion of the road that they travelled is about 60 to 70 km/h because anything in excess of this causes problems with dust and rocks being thrown about. Likewise, the second semi trailer driver said that the speed of a semi trailer approaching the Back Creek Road level crossing via the creek bed deviation has to be reduced to no more than about 40 km/h due to the curvature and grade of the road. He also said that it was usual to use the brakes of a semi trailer/heavy vehicle to slow the vehicle before the creek bed deviation and to allow the vehicle to coast up to the Back Creek level crossing. He said that usually 'you are four/fifths stopped before you get there' (the level crossing).

2.1.3 Summary

There is no evidence that contradicts the account of the train drivers in regard to the events leading to the collision. Independent witnesses corroborated the sounding of the horn before the collision and the distance the train travelled following the impact appears consistent with the train drivers' recollections of the train speed. Based on this evidence, it is reasonable to conclude that the train was being driven in accordance with the applicable rules and regulations in terms of headlight illumination, horn activation and speed of the train. It seems very unlikely that there was anything that could have been done to prevent or lessen the impact of the collision with the semi trailer.

As detailed at 1.1.3, the second (following) semi trailer driver had, like the semi trailer driver involved in the collision, lived and had driven heavy vehicles in the Forbes area for much of his life. He was very familiar with how heavy vehicles are driven on the Tallabung – Back Creek Road, having travelled the route many times. His description of the normal manner in which a heavy vehicle is driven on the approach to the Back Creek Road level crossing is consistent with the train driver's description of the approaching semi trailer; that it was travelling slowly 'as if it was going to stop'.

2.2 Level crossing compliance

Signs and devices used to control road traffic at level crossings must be in accordance with Australian Standard 1742.7 *Manual of uniform traffic control devices, Part 7: Railway crossings*. The latest version of this standard was released on 20 February 2007, only 19 days before the accident. The signage at the Back Creek Road level crossing before 20 February 2007 would have been in accordance with the previous standard, AS 1742.7-1993 *Manual of uniform traffic control devices, Part 7: Railway crossings.* The key amendments to the new standard in relation to the Back Creek Road level crossing includes a minor amendment to the RX2 stop sign assembly (see note 1 Figure 7), and the provision of sight distance calculations in lieu of State based level crossing sighting warrants. The new standard is only applied when level crossing devices and signs are initially installed or refurbished. The investigation assessed the level crossing's compliance against the new (2007) standard with this in mind.

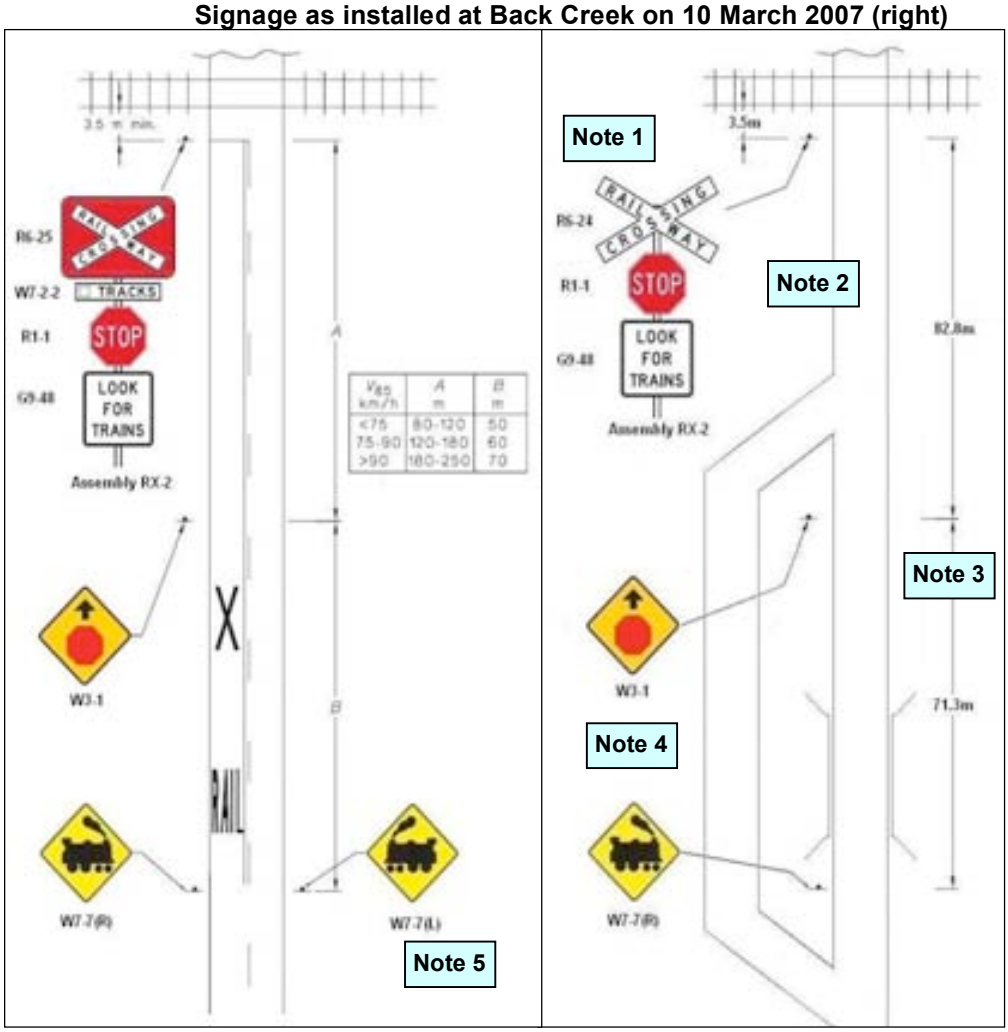
Road traffic at the Back Creek level crossing is controlled by a passive Stop sign assembly. AS 1742.7-2007 and AS 1742.7-1993 both define 'Passive control' as;

> Control of the movement of vehicular or pedestrian traffic across a railway crossing by signs and devices, none of which are activated during the approach or passage of a train, and which rely on the road user including pedestrians detecting the approach or presence of a train by direct observation.

Passive traffic control is usually provided by 'Give-way' signs or Stop signs and used where the volume of road traffic is relatively low. If the driver of a vehicle approaching a crossing has sufficient visibility to sight an approaching train and make an informed decision whether to stop or proceed across the level crossing, Give-way signs may be appropriate. If visibility is restricted such that a motorist could only sight an approaching train from the stopped position before making an informed decision whether to proceed, Stop signs may be more appropriate. In both cases, it is important that road signage can effectively warn motorists that they are approaching a level crossing, and critical that motorists can sight an approaching train, albeit with slightly different design criteria between Stop and Give-way sign controls.

Australian Standard 1742.7-2007 requires a passive level crossing with Stop sign control to have a specific configuration of approach warning signs. The Back Creek Road level crossing and road/rail approaches were surveyed using a 3D laser survey system and assessed against the requirements specified in AS 1742.7-2007. The illustrations in Figure 7 show the minimum traffic control requirements as specified in the Australian Standard and the actual traffic control installation at the Back Creek level crossing on 10 March 2007.

Figure 7: Signage as required by AS1742.7-2007 (left)
Signage as installed at Back Creek on 10 March 2007 (right)



Note 1: The railway crossing stop assembly (RX-2) was compliant, but not of the preferred design specified in the current standard (AS 1742.7-2007) for new or refurbished level crossing installations. The preferred design incorporates the 'Railway crossing position sign' (R6-25) with a large red target board.

Note 2: Pavement markings are not required on unsealed roads.

Note 3: The placement of the 'Stop sign ahead' sign (W3-1), 82.8 m from the stop sign assembly was consistent with a level crossing approach design based on 85 per cent of road vehicles travelling at less than 75 km/h (V85). The position of the 'Railway crossing ahead – Passive control' sign (W7-7(R)), 71.3 m from sign W3-1 is relevant for a level crossing approach design based on 85 per cent of road vehicles travelling at greater than 90 km/h (V85).

Note 4: The 'Stop sign ahead' (W3-1) and 'Railway crossing ahead – Passive control' (W7-7(R)) signs were placed with respect to the main road over the bridge. The by-pass road through the creek bed had no such signage.

Note 5: Sign W7-7(L) (right hand side of road) is for optional for use on busy roads at level crossing that have more than one rail track.

The eastern approach to the Back Creek level crossing consisted of a main road passing over a bridge (rated at 24 tonnes) and a by-pass road through the creek bed (for heavier vehicles). The evidence is that the majority of road vehicles used the by-pass road in preference to the bridge, as did the vehicle that drove into the path

of train 3835. However, the by-pass road did not conform to AS 1742.7-2007 since there was no advance or intermediate signage positioned on the left of the carriageway (clearly shown in Figure 8).

Figure 8: Photograph of main and by-pass roads on eastern approach

There also appeared to be minor non-compliances with respect to the placement of the 'Railway crossing ahead – Passive control' (W7-7(R)) sign on the main road approach passing over the bridge. It was evident that the crossing design was based on 85 per cent of road vehicles travelling at less than 75 km/h[4]. However, the distance between the W7-7(R) sign and the 'Stop sign ahead' (W3-1) sign on the eastern approach was 21.3 m further than defined by the standard. The lateral placement (about 0.8 m less than required) and height (about 0.5 m lower than required) of the sign was also non-compliant.

The correct location for the W7-7(R) sign is part way across the road bridge, between 2.0 m and 5.0 m from the edge of the bridge and at least 1.5 m above the bridge surface which, in this case, is not possible. The standard states that a sign may be placed outside the required location '… if a satisfactory site for the sign cannot otherwise be found'. Consequently the W7-7(R) sign has been positioned on the bridge abutment.

4 Although the road speed limit was 100 km/h, the standard specifies the location of signs based on the speed that 85 per cent of vehicles have been observed to travel under free flowing conditions. A design speed of less than 75 km/h is consistent with a witness statement that estimated the speed for a semi trailer approaching the Back Creek Road level crossing via the creek bed deviation to be no more than 40 km/h.

Crossing sight distances – Stop signs

Once beyond the Back Creek watercourse, the sighting distance along the rail line to the south was hindered to a moderate extent by several small trees and some equipment huts associated with the Back Creek grain silo. However, if rail wagons are occupying the northern end of the grain siding that is located to the east of the main line (as shown in Figure 9 below), then sighting along the track is significantly restricted. As a consequence, there was insufficient sighting for give-way control so Stop sign traffic control was installed at the level crossing.

Figure 9: Sight distance beyond the Back Creek watercourse

When positioned at the Stop sign, a road vehicle driver needs to be able to see far enough along the railway to be able to start off, cross and clear the crossing safely before the arrival of any previously unseen train. The required sighting distance to achieve this is calculated from the formula contained in AS1742.7-2007[5]. Based on this formula, the minimum sighting distance, in either direction, for a 19 m road vehicle and a track speed of 100 km/h, is 421.5 m. If the same formula and parameters are applied to a 26 m long B-double truck[6] the minimum sighting distance requirement is 460.4 m. The actual sighting distances along the rail lines from the Stop sign at the Back Creek Road level crossing exceeded 690 m in both directions.

The photograph in Figure 10 was taken at 1851 the day following the collision. Note the position of the sun and that the 81 class locomotive, stationary awaiting recovery duties, has no headlight or ditch lights illuminated.

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5 Formula used is AS1742.7 Appendix D formula (3). Key parameters used for this level crossing assume a level gradient, a road width of 5.0 m and a road/rail intersection angle of 104°.

6 B-double trucks operate on the Tallabung – Back Creek Road by permit.

Figure 10: Sight distance to the south from the Stop sign.

Maintenance of the Back Creek Road level crossing

The ARTC, as the manager of the rail corridor, has responsibility for the maintenance of the level crossing and the RX-2 Stop sign assembly at the level crossing. The Forbes Shire Council has responsibility for the maintenance of the advance warning signage.

The Forbes Shire Council was unable to produce any records relating to the signage at the Back Creek railway level crossing. As a result, the investigation was unable to determine when the last compliance inspection was conducted, if any. It is therefore unclear how long the eastern bridge by-pass approach was without any form of advance warning signs and thus not in compliance with the Australian Standard.

Of note is that an investigation conducted by the NSW Office of Transport Safety Investigations into a fatal level crossing accident that occurred at Grawlin Plains on 31 May 2005, also in the Forbes Shire, made a similar finding with respect to the lack of level crossing signage records.

Level crossing interface agreements

Australian Standard 4292 part 6 *Railway interface with other infrastructure*, requires a manager of a railway to have an interface coordination plan with the owner of any infrastructure that interfaces with the railway. To date, there has been no reciprocal requirement on the part of road managers.

In order to ensure that processes aimed at creating a consistent framework and approach to risk management at level crossings exists, the Model Rail Safety Bill 2006 contains some new mandatory provisions for road authorities and/or road

managers concerning interface agreements at level crossings. The Model Rail Safety Bill 2006 proposes that the road authority/manager be obliged to:

- identify and assess risks arising from the existence of the road or rail crossing;
- identify measures to manage, so far as is reasonably practicable, those risks; and
- seek to enter into an interface agreement with the rail infrastructure manager to jointly manage the risks.

There are similar obligations on the rail infrastructure manager.

States and Territories are expected to implement the amended laws by 2008. A 3-year transitional period after the commencement of the legislation will apply. Level crossings are to be jointly assessed during this time with priority to be given to those assessed as being the highest risk.

The investigation noted that at the time of the accident, there was no interface agreement between the ARTC and the Forbes Shire Council in relation to the Back Creek Road level crossing. It is anticipated that ARTC (the rail infrastructure manager) and the Forbes Shire Council, will implement an interface agreement when the model legislation is implemented in NSW.

Summary

The by-pass road through the creek bed, the route for heavy vehicles more than 24 tonnes, did not have any advance or intermediate level crossing warning signage. This was a significant non conformance with AS 1742.7-2007.

There were some other minor non conformances in regard to the longitudinal and lateral placement of the 'Railway crossing ahead – Passive control' sign W7-7(R) on the eastern approach to the level crossing. However, the standard does allow for alternative positioning of the sign where absolute compliance may not be possible (in this case due to the location of the road bridge).

Signage that was present was in good condition and, by in large, complied with AS1742.7-2007 in regard to type and size. Importantly, sighting distances along the rail line (in either direction) at the Stop sign, were well in excess of the requirements of AS 1742.7-2007.

2.3 Failure to stop

It appears from the train drivers' statements that the semi-trailer slowed on approach but then 'lurched' across the Back Creek Road level crossing in the moments before the collision. It is probable that the semi trailer driver was not intending to stop at the crossing's Stop sign and had either failed to look for, or failed to see, the train approaching the crossing in time to prevent the collision.

2.3.1 Expectation

The semi trailer driver had lived all his life in the Forbes - Back Creek area. His family property was only about 4 km from the back Creek Road level crossing. There is no doubt that he was extremely familiar with the Tallabung – Back Creek Road and the Back Creek Road level crossing and that he would have been well aware of the requirement to stop at the crossing. Given his familiarity with the road

and the crossing, it is highly unlikely that the non conformances of the level crossing approach warning signage (identified in section 2.2) contributed to the semi trailer driver's actions in failing to stop.

Although the semi trailer driver regularly used the Back Creek Road and level crossing, he did not have a set routine in terms of frequency or particular times during the day when he used the road. There are on average four freight trains that pass through the Back Creek Road level crossing each day, two in either direction. If running to time, they normally traverse the level crossing at about 0420 and 2115 (northbound) and 0950 and 1225 (southbound). However, it is not uncommon for these freight trains to run hours either side of their scheduled times. In addition to the freight trains, grain trains run when required during the wheat season. The grain trains do not run to a regular timetable.

The semi trailer driver's irregular routine combined with the infrequent and irregular passage of trains probably meant that it had been rare for him to encounter a train at the level crossing. Therefore, it is likely that he did not expect to see a train on the day of the collision. Of note is that the semi trailer driver's colleague said that he had only occasionally encountered trains at the level crossing.

Familiarity with a level crossing combined with an expectation that a train won't be present, may lead to motorist complacency or the development of poor looking habits[7]. In short, a road user's expectation that a train is unlikely to be encountered at the level crossing is reinforced every time that road user traverses the level crossing without seeing a train.

Operational constraints, heavy road vehicles

Stresses on driveline components (engine, transmission etc) are generally highest on large vehicles when starting from rest, increasing the risk of a failure under some conditions (inappropriate driving or clutch operation). Consequently, heavy road vehicle drivers will, at times, attempt to avoid a complete stop and execute what is commonly referred to as a 'rolling stop'. A rolling stop is where a driver slows their vehicle such that they can make the decision to proceed without coming to a complete stop, that is, without having to depress and release the clutch.

The semi trailer driver's colleague said that his usual practice at the Back Creek Road level crossing was to slow right down, look both ways and then traverse the level crossing without stopping. He expressed the opinion that 'Nine out of ten motorists did likewise'.

The observed actions of the semi trailer driver in the moments before the collision also support the views of the witness that the driver did not intend to come to a complete stop at the level crossing if no train was seen; he intended to perform a rolling stop.

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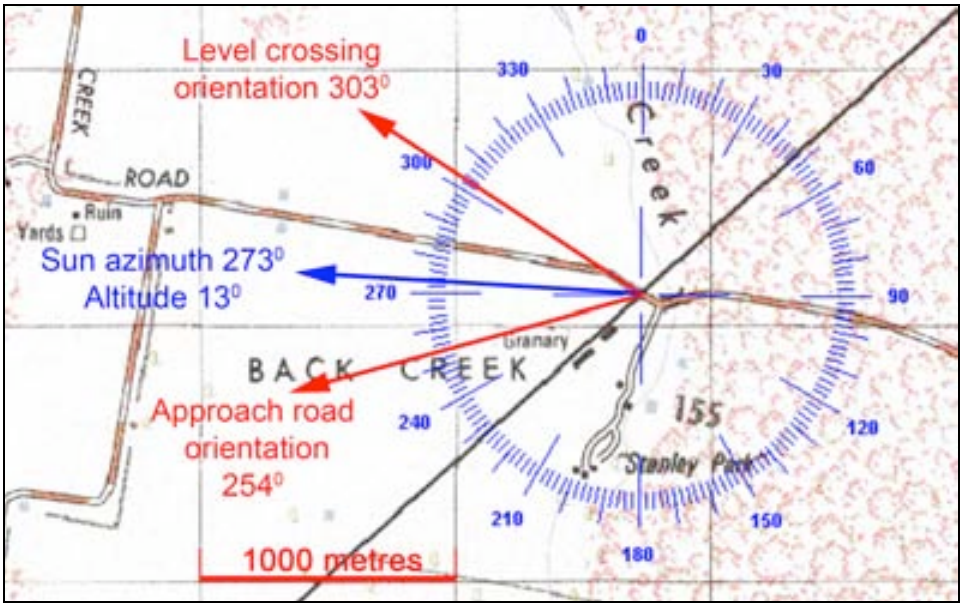
7 Caird, Creaser, Edwards, and Dewar (2002) *A human factors analysis of highway-railway grade crossing accidents in Canada*

2.3.2 Failure to detect the train

Orientation of the sun

At the time of the accident, the sky was clear of cloud and the sun was at an azimuth of about 273 degrees, and an altitude of about 13 degrees with a flat horizon. Bureau of Meteorology (BoM) records indicate that sunset was at 1934 hours (about 1 hour after the collision). As the semi trailer was heading towards the level crossing, the road was on a bearing of 254° at the Back Creek watercourse deviation and a bearing of 303° at the level crossing.

Figure 11: Diagram of sun azimuth and road/level crossing orientation



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Apart from the change in direction at the Back Creek watercourse deviation, the semi trailer driver was driving in a westerly direction as he approached the Back Creek Road level crossing. Based on the BoM records, the sun would have been shining directly into the prime mover cab during the approach to the level crossing. At the Back Creek watercourse deviation, the sun would have moved across the driver's field of view from left to right and then, as the semi trailer exited the deviation, from right back to the left again.

Figure 12 shows a composite photograph taken on the following afternoon at about 1855 and is considered representative of what the semi trailer driver would have seen approaching the crossing.

Figure: 12 Photograph of the approach to the level crossing

Note: this is a compilation of four photographs to form a panorama.

The angle and altitude of the sun was such that the side of the train facing the semi trailer driver would have been in shadow and would probably have tended to blend with the background. The semi trailer driver's task of visually identifying the train would have included discriminating a moving object in a cluttered visual environment. With the sun directly in the semi trailer driver's field of vision, the glare[8] would have been considerable. Glare can cause a reduction of visual performance (due to light scattering in the eye) and/or discomfort to the point where pain is felt and the eyes squint. In an overall sense, glare can lead to a decreased ability to detect visual cues from the surrounding environment.

It is also possible that the semi trailer driver's visual performance would have been further degraded as a result of looking through the prime mover's windscreen or passenger side window. Although the condition of the windscreen and side window were unknown, even minor 'defects' such as dust, grit blasting, chips and general cleanliness can become significant impediments because they have greater luminosity in direct sunlight. This reduces the contrast between the glass and the external landscape (perfectly clear glass gives zero contrast).

Locomotive livery / operation of headlight

According to the train drivers, the train headlight and ditch lights were on as the Back Creek Road level crossing was approached. These lights, and indeed the locomotive itself, should have been clearly visible to the semi trailer driver if the vehicle was in a stationary position at the Stop sign at the level crossing. There has been some conjecture that the navy blue and yellow livery of the locomotives may have blended into the surrounding landscape features and the horizon at that time of the day. However, the lead locomotive had an area painted bright yellow at the top of the cab and the headstock, and large white numerals (8147) on the front.

A number of colour schemes have been applied to locomotives across Australia over many years in an endeavour to improve train conspicuity. Regardless of the colour chosen, factors such as paint wear and cleanliness always have the potential to lessen the intended visual impact of the locomotive's colour scheme.

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8 Glare occurs when the visual field brightness is greater than the luminance to which the eyes are adapted (Mace, 2001)

Given the proximity of the locomotive to the Back Creek Road level crossing in the seconds before the collision, the locomotive would have been the dominant feature in the landscape and it would have been easy to see in the clear conditions regardless of its colour, had the semi trailer driver been looking in its direction.

Figure 13: 'Sister' locomotive 8173 painted in same livery as 8147

Figure14: Locomotive 8147 after fire extinguished

Locomotive horn effectiveness

The drivers of train 3835 said that the locomotive horn was sounded continuously from the first sighting of the approaching semi trailer almost until the point of impact. Although the sounding of the horn was heard by other persons nearby, it appears not to have alerted the semi trailer driver to the presence of the approaching train until the last moment, if at all.

The likelihood of a road user hearing a train horn is determined by a number of factors. These include the acoustic properties of the horn itself, the environment in which it is used, the auditory function of the road user, and the road user's level of attentiveness (Rapoza, Raslear & Rickley, 1999; Raslear, 1996; cited in Dolan and Rainey 2005). The factors influencing an individual's attentiveness at level crossings include demands of the driving task, driver motivation, the perceived likelihood of a train being present and the influence of other potentially competing visual and auditory cues (Dolan & Rainey, 2005).

In 1996, the US National Transport Safety Board (NTSB), in cooperation with several Oklahoma-based companies[9], conducted train horn audibility tests within 13 different passenger and emergency vehicles. A three-chime Leslie horn was used with a sound level of 96 dB(A) at 100 feet (30.48 m), as required by FRA regulations[10]. This project measured, firstly, the insertion loss of each road vehicle[11], secondly, the audibility of the train horn when the vehicle's engine was at idle and, thirdly, the audibility of the train horn when the vehicle's engine was at idle and the air-conditioning set on high.

The tests revealed a maximum insertion loss of 33 dB in a 1986 Chevrolet Corvette, compared with a minimum insertion loss of 17 dB in a 1986 Freightliner cab-over tractor[12] (for full details see NTSB, 1998 report number PB98-917004). Under the condition of engine at idle (air-conditioning fan off) the sound level of the train horn in a 1997 Thomas/Ford school bus was not audible (a dB level of -2 was obtained). In seven of the 13 vehicles, the train horn was not audible above the idling engine and fan noise. Furthermore, when the engine was at idle and the fan on high, the train horn did not meet the 10 dB difference needed above ambient noise levels necessary to alert the motorist in any of the vehicles. For example, the sound level in the 1986 Freightliner cab-over tractor reached 8 dB, whereas the 1997 Thomas/Ford school bus sound level was -11 dB.

The NTSB also concluded that the tests underestimated the level of interior noise that would occur in normal driving conditions as they didn't account for additional sources of ambient noise such as road surface texture, radio/music players and conversations.

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9 Oklahoma Operation Lifesaver, Oklahoma Department of Transportation, and Burlington Northern Santa Fe Railroad.

10 The relevant section of the Australian DRAFT Code of Practice for the DIRN stipulates that a locomotive horn must achieve a minimum of 88 dB(A), for a steady tone, at 200 m from the front of the vehicle when it is in the 'country' setting.

11 Insertion loss refers to the difference between the measured sound values from an exterior sound source taken outside the highway vehicle and inside the vehicle (NTSB, 1998).

12 Similar to a B-double truck.

Nevertheless, the NTSB noted that sounding train horns is an important element of grade (level) crossing safety, and should be done unless effective substitutes are in place[13].

The truck driver's colleague had observed that the prime mover air-conditioner was on and that the windows were closed on departure from the property several minutes before the collision[14]. It is very likely that ambient noise associated with the air-conditioner, the gravel road and engine noise/gear changes on the approach to the level crossing was such that the semi trailer driver's ability to hear the locomotive horn was severely compromised. If the radio was on, then a further impediment would have existed.

The effectiveness of locomotive horns at level crossings has been analysed at length in other ATSB reports (in particular, *Rail Safety Investigation Report - Final - Level Crossing Collision between The Ghan Passenger Train (1AD8) and a Road-Train Truck, Ban Ban Springs, NT, 12 December 2006*, ATSB 2008).

Fatigue

The log book entries of the semi trailer driver revealed no non-conformances in relation to driving hours over the previous 7 days. Indeed, the actual hours 'behind the wheel' where well under those prescribed by the National Driving Regulations. In addition, the driving hours were basically all day-work with no all-night shifts.

However, there is evidence that the driver had a late night, including consuming alcohol, on the evening before the accident and that this activity continued into the early morning on the day of the collision. At about 1000 the same morning, the semi trailer driver picked up his colleague (the second semi trailer driver) and started the day's work. During the day, they performed separate tasks such as loading barley and hay in and around the Forbes area but remained in contact by phone. Late in the afternoon, it was decided that they would meet at the semi trailer driver's family property to load some wheaten hay and take it to another property that was 4 km away on the western side of the Back Creek Road level crossing. During the time at the semi trailer driver's family property, further loading was undertaken.

While the semi trailer driver's log book indicated that he had taken regular rest breaks and driven within the relevant regulations, in terms of fatigue, this cannot be considered in isolation. The physical work conducted during the day (albeit with mechanical loaders) in conjunction with the late night and reported alcohol consumption the previous evening/early morning means that it is possible that he was experiencing some degree of fatigue in the time leading up to the collision.

A number of studies have been conducted on the effect of fatigue on a person's performance, to the extent that it is a known hazard in the road transport industry. Fatigue can reduce attention, increase reaction time and affect memory. When fatigued, a person can take longer to perceive and interpret information and longer

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13 Mark V. Rosenker, Acting Chairman, National Transportation Safety Board, Testimony before the Subcommittee on Railroads, Committee on Transport and Infrastructure, United States House of Representatives, July 21, 2005, p. 2-3.

14 The train drivers also said that they saw the passenger window of the semi trailer was closed before the collision.

to decide on an appropriate course of action. Importantly, individuals are often unaware of the effects of fatigue on their performance.

Although the semi-trailer driver's colleague said he saw no signs of fatigue when the driver was leaving the family property, it is possible, due to the factors discussed, that the semi trailer driver may have been experiencing a degree of fatigue in the time leading to the accident.

2.3.3 Summary

Based on the available evidence, the semi trailer driver was aware of the presence of the Tallabung – Back Creek level crossing and the requirement to stop at the Stop sign. It is probable that he had little expectation of encountering a train.

Anecdotal evidence also suggested that the failure to come to a complete stop at the Back Creek Road level crossing level crossing stop sign was not an isolated instance for either the semi trailer driver or other motorists using the crossing. Had the semi trailer driver stopped as required at the Stop sign and then visually searched the track it is probable that he would have seen the train, even though the existence of the sun glare would have affected his ability to sight the train while he was approaching the crossing.

At passively controlled level crossings the primary sense for detecting a train, whether it be at a crossing controlled by Give-way or Stop sign, is sight. The secondary sense is hearing. In terms of audible cues, the failure to come to a complete stop at the level crossing also decreased the ability of the semi trailer driver to hear the locomotive horn. The insertion loss within the driver's cabin while in motion would have been exacerbated by the increased ambient noise of the engine, gear box and road (gravel) when compared to when the vehicle was stationary with the engine idling.

In addition, it is possible that the driver was experiencing some effects of fatigue following a late night and a full day's work which may have contributed to his failure to detect the train in the time before the collision.

2.4 Heat and flame resistance, Hasler recorders

Standard Hasler wax paper drum recorders were the mainstay recording devices fitted to locomotives until the late 1980's, having given valuable service to the rail industry in Australia for many years. Later generation locomotives are fitted with electronic data loggers/event recorders that record a greater number of the locomotive's operating parameters.

Early recorders fitted to locomotives (such as the Hasler recorders) have little resistance to fire. Later generation event recorders are progressively being manufactured with a somewhat higher resistance to heat and flame.

Notwithstanding how unlikely it was for all four recorders fitted to the three locomotives of train 3835 to be destroyed as in this instance, some advances in heat and flame resistance are noteworthy in the context of this investigation.

The United Kingdom standard for data recorders on trains (2002)[15] specifies that all recorders should have 5 minutes heat resistance to a temperature of 700ºC. The more recent United States standard for locomotive event recorders (2005)[16] specifies fire resistance criteria for new locomotive event recorders, including 60 minutes resistance to heat at 750ºC heat or 1000ºC flame.

The evidence is that the Hasler recorder in the rear of Loco 8147 probably survived for some hours before the flames reached it. However, access to it was considered unacceptably hazardous. If the event recorders on the locomotives of train 3835 had greater heat and flame resistance than those fitted, it is possible that data may have been recoverable.

Standards for onboard recording devices fitted to locomotives are planned for development by the Rail Industry Safety & Standards Board (RISSB).

15 UK Rail Safety and Standards Board, Railway Group Standard GM/RT3472, Data Recorders on Trains – Design Requirements Issue One, June 2002.

16 US Federal Register Part III Department of Transportation Federal Railroad Administration 49 CFR Part 229 Locomotive Event Recorders; Final Rule, June 30, 2005.

3 FINDINGS

3.1 Context

The following findings are made with respect to the level crossing collision between train 3835 and a semi-trailer at the Back Creek level crossing on 10 March 2007 and should not be read as apportioning blame or liability to any particular organisation or individual.

3.2 Contributing safety factors

- The driver of the semi trailer slowed but did not stop at the level crossing Stop sign and was probably intending to perform a rolling stop at the crossing.
- The semi trailer driver probably had a low expectation that a train would be encountered at the crossing and probably did not hear the locomotive horn until immediately before the collision, if at all.
- The semi trailer driver's ability to see the train was probably impeded by glare from the sun as he approached the crossing.

3.3 Other safety factors

- The semi trailer driver was possibly experiencing a degree of fatigue after a late night and a full day's work.
- The by-pass road through Back Creek on the eastern approach to the Tallabung – Back Creek Road level crossing did not have any advance warning signs installed. *[Safety issue]*
- No recorded data was available to the investigation because the recording devices were destroyed in the fire which resulted from the collision. *[Safety issue]*

3.4 Other key findings

- Based on the evidence it is almost certain that there was nothing that the drivers of train 3835 could have done to prevent or avoid the collision with the semi trailer.
- The post mortem medical examination of the semi trailer driver detected no illicit or prescription drugs, other substances or medical issues that may have impaired his performance.
- Sighting distances from the stop signs, along the railway line, exceeded the requirements of AS 1742.7-2007.
- There was no evidence to suggest that the lack of level crossing warning signage on the Back Creek watercourse (creek bed) deviation contributed to the semi trailer driver's failure to stop at the level crossing.

4 SAFETY ACTIONS

The safety issues identified during this investigation are listed in the *Findings* and *Safety Actions* sections of this report. The Australian Transport Safety Bureau (ATSB) expects that all safety issues identified by the investigation should be addressed by the relevant organisation(s). In addressing those issues, the ATSB prefers to encourage relevant organisation(s) to proactively initiate safety action, rather than to issue formal safety recommendations or safety advisory notices.

All of the responsible organisations for the safety issues identified during this investigation were given a draft report and invited to provide submissions. As part of that process, each organisation was asked to communicate what safety actions, if any, they had carried out or were planning to carry out in relation to each safety issue relevant to their organisation.

Depending on the level of risk of the safety issue, the extent of corrective action taken by the relevant organisation, or the desirability of directing a broad safety message to the rail and road industries, the ATSB may issue safety recommendations or safety advisory notices as part of the final report.

4.1 Forbes Shire Council

4.1.1 Level crossing signage

Safety Issue

The by-pass road through Back Creek on the eastern approach to the Tallabung – Back Creek Road level crossing did not have any advance warning signs installed.

Action taken by/response from the Forbes Shire Council

Forbes Shire Council has advised that level crossing advance warning signs have been erected on the creek bed deviation approach to the Back Creek Road level crossing.

4.2 Pacific National

4.2.1 Data recording

Safety Issue

No recorded data was available to the investigation because the recording devices were destroyed in the fire which resulted from the collision.

ATSB Safety recommendation RR20080031

The Australian Transport safety Bureau recommends that Pacific National take action to address this safety issue.

APPENDIX A: SOURCES AND SUBMISSIONS

Sources of information

Australian Rail Track Corporation

Bureau of Meteorology

Central West Diesel Pty Ltd

Crew of train 3835

Family and friends of the semi trailer driver

Forbes Shire Council

Local land users

Mobile phone providers

New South Wales Coroner

New South Wales Fire Brigade

New South Wales Police Force

New South Wales Roads and Traffic Authority

New South Wales Rural Fire Service

Pacific National Pty Ltd

Telstra '000' emergency operator services

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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 the Australian Rail Track Corporation, Pacific National, the Independent Transport Safety and Reliability Regulator of New South Wales, the Office of Transport Safety Investigations New South Wales, Forbes Shire Council, the family of the semi trailer driver, and both train drivers.

Submissions in response to the draft report were received from the Independent Transport Safety and Reliability Regulator of New South Wales, the Office of Transport Safety Investigations New South Wales, Forbes Shire Council, Pacific National and the Australian Rail Track Corporation. These submissions were reviewed and, where considered appropriate, the text of the report was amended accordingly.

APPENDIX B : MEDIA RELEASE

Derailment investigation report

An Australian Transport Safety Bureau (ATSB) investigation has found that a fatal level crossing accident at Back Creek in central western NSW at about 1830 on 10 March 2007 occurred when the semi trailer driver drove into the path of an empty grain train. The driver sustained fatal injuries in the collision.

The ATSB today released a report regarding the collision. The semi trailer was trapped under the leading locomotive and dragged onto the rail bridge over a watercourse adjacent to the level crossing. During the collision sequence, the leading locomotive and semi trailer prime mover caught fire. The fire subsequently destroyed both vehicles and the other two locomotives that were hauling the train, and the timber members of the railway bridge over the watercourse.

The ATSB's investigation found that the semi trailer driver was probably intending to perform a 'rolling stop', where the vehicle is slowed but not stopped at the level crossing Stop sign, and he may have only heard the locomotive horn at the last moment, if at all. The driver lived in the area and was very familiar with the crossing and probably did not expect to see a train given the low volume of rail traffic on the line.

The investigation also found that the semi trailer driver's ability to see the train was probably impeded by glare from the sun given the time of day and the westerly direction he was driving as he approached the crossing.

The ATSB's investigation report also notes that there were no advance level crossing warning signs on an alternate road approach to the level crossing for heavy vehicles. However, given the semi trailer driver's extensive local knowledge, the lack of this signage was not considered to have contributed to the collision.